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This research was a field-based investigation into the impact of written feedback on students' perceptions, motivation, and academic performance. Seventy-nine fourth grade students, from five elementary classrooms participated in two studies. Study 1 (n=15) was an *ABAB*-type, reversal design, intended to provide support for a cause-and-effect relationship between feedback scores (i.e., a rubric-based evaluation of teacher's written feedback) and feedback effectiveness (i.e., a survey-based measure of students' views on the value of written feedback). Study 2 (n=64) was a quasi-experimental study intended to demonstrate: a) the relationship between feedback scores and feedback effectiveness, b) an association between feedback effectiveness and academic motivation, c) an association between feedback effectiveness and academic performance, and d) a curvilinear relationship between assignment grade and feedback scores.

An analysis of covariance (ANCOVA) confirmed that the experimental group reported a significantly higher level of Learning Goal Orientation, one aspect of academic motivation (p<.05). A General Linear Model Repeated Measures procedure found support for relationships between feedback scores and feedback effectiveness, and between assignment grade and feedback scores. The research was unable to demonstrate a relationship between feedback effectiveness and academic performance. The potential motivational and educational benefits of enhanced written feedback are discussed, and recommendations for implementation are offered.

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Chapter 1. Introduction

When students complete college, high school, some elementary schools, and even the occasional kindergarten their accomplishments are celebrated with graduation ceremonies. This recognition is also called commencement, signifying that the watershed event is both the end of one journey and the beginning of another. Evidently, the knowledge, wisdom, and understanding acquired at each juncture provides the skills for future educational endeavors and, ultimately, for life. Therefore, the purpose of an education is to prepare individuals for their future roles; academics are future oriented.

Unfortunately, educators, administrators, and politicians too often lose sight of this prime directive. In our quest for accountability and what ostensibly qualifies as academic improvement, we overlook the real purpose of education. When we concentrate on improving standardized test scores, we devalue creative thinking, trivialize in-depth understanding, discount individual interests, and diminish the long-term significance of learning (Bloom, Madaus, & Hastings, 1981; Paris, 1998). The quality of education should not be judged by how high one scores on a test; effective learning pays future dividends by virtue of its personal relevance and value to the individual. Knowledge that is neither employed nor enjoyed is inert. Insipid education is of little value if students subsequently discard or disregard the lessons, regardless of how they play on the standardized tests.

Effective schooling is *learner-centered* (McCombs, 1991): Educators provide support systems that encourage, promote, and facilitate learning that is intriguing, practical, or, ideally, both. The challenge is to create an environment where children focus on subject matter due to personal interest and investment in their own development

rather than for external rewards or to avoid sanctions. Gottfried (1996) labeled this scholastics-embracing attitude *academic intrinsic motivation*, or the extent to which students want to learn and are genuinely interested in subjects. If students value the lessons being presented, they are more likely to focus their attention, exert effort, remember concepts, recall information, and subsequently apply acquired knowledge. Conversely, if the audience is not academically motivated, students may exert moderate effort to perform well on tests, but they will not internalize these lessons, and their mental development will suffer. In a learner-centered environment, motivation is the key to effective development.

Learner-centered education is a philosophy, not an instructional template. In principle, learner-centered instruction consists of providing a nurturing environment that promotes individual growth and development, captivating students and scaffolding their learning attempts. Bandura (1977) contends that there are three interrelated components of the learning environment: the student (person), his or her behavior, and the environment. Further, he referred to the bi-directional interplay between these components as *triadic reciprocity*. So, construction of a learner-centered model becomes a challenge of optimizing the interplay between these three components: the individual student, his or her behavior, and the environment (e.g., teachers, peers, and subject matter).

One of the pitfalls of educational interventions is that practitioners frequently approach psychological and physiological components as separate and distinct. For example, cognition (thoughts) and emotions are considered independently (cf. Serna, Schumaker, & Sheldon, 1992), mind and body are treated as distinct, teaching techniques

are disconnected from cultural considerations (cf. Noels, Clément, & Pelletier, 1999), and personality and practice are divorced. Learning is enhanced by holistic approaches; every intervention needs to be evaluated within an ecological context (Ames, 1990; Jerram, Glynn, & Tuck, 1988).

One of the key ingredients of any educational environment is motivation, defined by Graham and Weiner (1996) as "the study of why people think and behave as they do" (p. 63). If we hope to improve the effectiveness of education, we must attend to student motivation. One of the tenets of learner-centered education is that it taps and promotes students' academic motivation. Therefore, a learner-centered approach may provide teachers an avenue to promoting student motivation.

Graham (1994) contends "classroom motivational life is complex. No single word or principle such as reinforcement or intrinsic motivation can possibly capture this complexity" (p. 47). Motivation is intricately tied to learning. Extricating and analyzing motivation in isolation is problematic. Motivational theories are intriguing, but applying them to practice poses a daunting challenge. How can motivation be infused into an educational environment?

Ford (1992) proposed a Motivation Systems Theory that can be superimposed on Bandura's social learning theory to produce a contextualized view of motivation within education (Figure 1). Ford contends that motivation is a product of goals, emotions, and personal agency beliefs. In other words, individuals are moved to action based on what they want or need to accomplish (goals), their subjective commitment to a course of action (emotions), and their evaluation of the likelihood of success (personal agency beliefs). Therefore, the challenge for educators is to construct learning environments

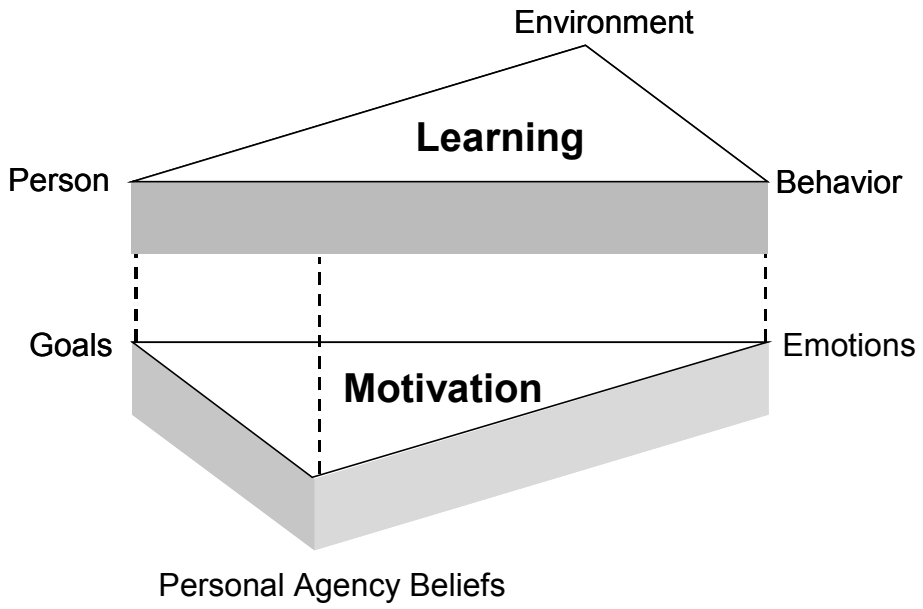


Figure 1. Bandura's Social Learning Theory Combined With Ford's Motivational Systems Theory

where the person, behaviors, and the environment maximize goal construction, goal adoption, and legitimate competency assessments. Teachers need to facilitate an atmosphere where students are vested in their own development, where students have both the will and the skill to acquire academic expertise.

If one adopts Ford's (1992) position that motivation consists of goals, emotions, and personal agency beliefs, then a corollary is that motivation will increase if one or more of these components is enhanced, while the others at least remain constant. Intuitively, these psychological components can be affected in countless ways. For example, goals can be affected by strategic planning, emotional commitment can be enhanced by making activities personally relevant, and personal agency beliefs can be improved by tracking incremental growth and progress. There are myriad approaches to affecting motivation, for better or for worse.

One aspect of the social learning environment that has pervasive effects on motivation is feedback. The reactions and elicited actions of significant others can affect goal commitment, emotional dedication, and personal agency beliefs. Unless we know how we are doing—in relation to established goals, personal desires, and assessed abilities—we cannot monitor and maintain motivation. Consider how we would feel if we were on a long trip yet never saw informative road signs or mile markers. Would we "push" ourselves if we didn't know the distance to the next town or next rest stop? Would we maintain optimism without knowing how far we had come, how far we had to go, or even whether we were headed in the right direction? Efforts must yield assessable results. Lack of feedback extinguishes motivation. However, feedback cannot be considered in isolation; it is synergistic with other aspects of motivation. For example,

knowing how many miles we have traveled is of limited value if we are not interested in either the journey or the destination.

Feedback is key to educational development. Students must know how they are progressing, through classroom discussion, student-teacher conferences, portfolios, quizzes, exams, standardized tests, report cards, or some other acknowledgement. Without feedback, pupils cannot assess their progress.

Researchers distinguish between two general forms of feedback, formative assessment and summative evaluation (Bloom, 1976; Bloom et al., 1981; Wiggins, 1993, 1998). Summative evaluation, as its name implies, is intended to gauge a student's level of expertise or accomplishment. It serves as a measure of attainment, or an evaluation of the product of instruction. However, it serves no educative purpose; it appraises but it does not instruct. Formative assessment, on the other hand, is specifically intended to teach; it guides the instructional process. Errors students make during formative assessment serve as guides for subsequent study, they help students revise and refine their thinking, and they help clarify misconceptions. Feedback from formative assessments need to *feed forward* into subsequent study (Ford, 1992; Ford & Nicholls, 1991). Motivation can be enhanced through effective feedback during formative assessment.

One challenge is how to make feedback effective. If, as previously claimed, motivation is based on a subjective set of goals, emotions, and personal beliefs, then feedback must be tailored to suit the individual's motivational structure. For example, congratulating a student for a job well done is counterproductive if the student does not feel that the work was praiseworthy, criticizing work as inferior is equally detrimental if the author thinks that the product was of high quality or that valiant effort was exerted

(McMillan, 1977), and marking a sentence as *passive* is ineffective if the student does not understand the distinction between passive and active voice. Effective feedback, then, must convey a message that the teacher wishes to express, must be interpreted as intended, and must produce the desired response. The quantity and quality of feedback provided by the instructor will have some degree of effectiveness on student motivation.

It is perilous to assume that a message is interpreted as intended; teachers must ensure that their feedback is properly deciphered and that it has the intended impact. A student may cry in frustration, relief, or gratitude. The teacher must not assume that behavior reflects a particular underlying belief or emotion. The meaning of feedback must be *negotiated*; a dialogue must occur for the teacher to understand the impact of the commentary on the student's psyche (Higgins, Hartley, & Skelton, 2001; Schunk, 1995). Students must provide reciprocal feedback so that a teacher can evaluate the effectiveness of his or her feedback.

Feedback occurs frequently within classrooms. Virtually every lecture, discussion, project, and assignment has a feedback component. But how effective is this feedback? What did the teacher say, what did he or she intend, and how did the student react to the message? Is feedback motivating or de-motivating? Does it inform students and promote learning or is it judgmental and manipulative? Little empirical research has been done concerning the nature and effectiveness of feedback.

One challenge in studying feedback is its relatively dynamic nature. Teachers seldom "plan" verbal feedback; student comments are often unanticipated, so teachers cannot hold preconceived responses at the ready. Verbal feedback is reactionary; it is constructed in response to unscripted conversations, impromptu queries, erroneous

answers, and student behavior. The extemporaneous nature of spoken feedback makes it difficult to control, and the fluidity of the situation makes it equally difficult to assess the communicative quality of the dialogue.

Written feedback is another story. Although teachers are under time constraints to grade and return written assignments, they do have the opportunity to consider, compose, and refine written comments. Depending on the circumstances, a teacher may provide written feedback consisting of anything from *X*'s and smiley faces to in-depth comments and analyses of student work. Several issues arise from this written feedback:

1. To what extent do teachers provide written information?
2. How is the feedback that is provided by the teacher interpreted by each student? In other words, are the teacher's intended messages conveyed, or do the students misappropriate the messages?
3. When teachers provide enlightening feedback, does it enhance students' understanding, subsequent performance, and academic motivation?

Answering such seemingly succinct questions is deceptively difficult for a variety of reasons. First, we need empirical measures for feedback. Then, there is the issue of determining whether the recipient properly interpreted the author's intent. This can be quite challenging. Consider the quote, "I know you think you understand what you thought I said, but I'm not sure you realize that what you heard is not what I meant" (author unknown). It may take several dialogic interchanges before an author has a reasonably accurate understanding of the effect of the feedback; author and reader need to negotiate the meaning of the dialogue. Finally, there is the rather complicated issue of assessing the impact of feedback on motivation. Exacerbating this issue is the possibility

that feedback's effects may vary by academic subject area, grade level, cognitive developmental level, and social structure. Intuitively, feedback is very important, but it can be quite difficult to decipher its effects on motivation.

Purpose of the Study

Educators provide frequent feedback to students, in a variety of forms, formats, depths, and scenarios. It has been argued that this feedback is an elemental ingredient in the academic motivation of children; it influences goals, emotions, and personal agency beliefs. A proper understanding of feedback is needed to guide teachers toward educationally sound practices for facilitating student motivation.

Written feedback affords an opportunity for researchers to study the nuances of feedback on formative assessment, student motivation, and academic performance. By consciously and deliberately focusing on the form, substance, and interpretation of written feedback, this study examined the impact that written feedback has on academic motivation.

However, the efficacy of written feedback depends on several factors. Students must be old enough to read and comprehend teacher commentary (e.g., second grade and beyond); they must be sufficiently advanced to understand the causal relationship between effort, ability, and outcome (e.g., at least nine years old) (Nicholls, 1978); they must be young enough to have reasonably malleable academic motivation (e.g., prior to high school) (Gottfried, Fleming, & Gottfried, 2001); the academic topic must provide sufficient opportunities for teacher responses; and feedback must be extensive enough to have a chance of making a noticeable impact. Based on the preceding discussion and these considerations, the following research question was posed:

- What are the effects of negotiated written feedback within formative assessment on fourth grade students' motivation and goal orientations?

Research in the area of written feedback for younger children is needed to further the application of motivation theory to the elementary school setting. Currently, many of the tenets for the use of feedback are either intuitive or speculative; little evidence exists on the empirical utility of this resource. In particular, there was no prior research on the effectiveness of feedback from the recipient's subjective perspective. If one subscribes to the belief that motivation involves personal subjective evaluations, feedback's effectiveness must be viewed from the recipient's lens.

Hypotheses

The research described above was intended to provide support for the following propositions:

1. Within a learner-centered educational environment, a negotiated written feedback component of formative assessment increases academic motivation.
2. There is a positive correlation between the quality of written feedback as gauged by the researcher and as gauged by the students (or recipients).
3. The quality of the written feedback, as gauged by the recipients, positively affects the level of academic motivation.
4. There is a positive correlation between students' levels of academic motivation and their levels of academic performance; an increase in academic motivation is accompanied by an increase in academic performance.
5. There is a discernable, possibly non-linear, relationship between assignment grade and the amount of teacher-provided feedback.

This study focused on written feedback provided within the framework of formative assessment. For purposes of manageability, the research was confined to a single academic subject area. Mathematics was selected because it provided many opportunities for the teacher to convey both objective correctives and subjective commentary. The participants were the consenting members of intact, fourth-grade classrooms that were selected based on their geographic and logistical convenience, not through randomization or a purposeful sampling method.

Delimitations

The implemented intervention may be problematic outside of third through eight grades. Minimally, recipients of written feedback must be able to read, comprehend, and react to this medium. In light of this requirement, young students may not be capable of digesting extensive written feedback. Conversely, prior research suggests that students' academic intrinsic motivation becomes increasingly stable as children mature (Gottfried & Gottfried, 1996); children's academic motivation at age nine predicts academic motivation at age sixteen (Gottfried et al., 2001). Therefore, the intervention instituted in this research may be less effective beyond middle school.

Limitations

One characteristic of written feedback is the variety of messages that can be conveyed. Some subjects, such as elementary geography, are primarily knowledge-based and tend to have objective, straightforward response sets. As such, they may provide limited opportunity for teacher elaboration in the form of written feedback. At the other opportunistic extreme are subjects such as creative writing and fine arts, which may be highly subjective. These subject areas afford ample opportunity for commentary but may

elude objective feedback measurements. Academic subjects such as math and science provide a compromise; there are many opportunities for teacher commentary and guidance, and although there can be opportunities for a wide range of responses, the feedback necessarily contains objective components. Since this research focused on a specific subject area, caution must be exercised in extrapolating the results to other academic subjects.

The relatively short intervention period that was measured (i.e., eight weeks) may have limited the range of the shift in academic motivation and performance. However, a longer time period would have introduced other extraneous variables (e.g., student attrition as a result of interschool transfer, developmental maturity, pedagogic amendments, and environmental changes) that could have confounded the results.

The researcher contends that the effectiveness of written feedback is a function of the environment within which the commentary is provided. Unless students are participating members of a nurturing community, feedback will receive a cool reception. Therefore, a precondition for effective written feedback is an educational atmosphere that is learner-centered and engaging.

Finally, this research was conducted on a fairly small convenience sample (i.e., n=15 for study 1 and n=64 for study 2). The small sample sizes may have exacerbated obtaining statistically significant results. In addition, idiosyncrasies of these groups may limit the applicability of the study to other populations.

Significance of the Study

In an optimal school setting, teachers should serve as facilitators who provide students with the fuel, atmosphere, and catalyst needed to spark their interests and ignite their passion for academic understanding. According to McCombs (1991), "students have a natural inclination to learn…in the right motivational atmosphere" (p. 118). Educators should leverage students' natural curiosity and innate enthusiasm by providing them with captivating topics and a nurturing environment. One form of nourishment is formative assessment, and one ingredient of this guidance is written feedback.

Written feedback offers teachers many unique opportunities for deliberate, individualized attention and instruction. Unlike other aspects of a teacher's hectic, hustle-and-bustle day, written feedback permits focused, reflective contributions to the students' comprehension and affect. Furthermore, negotiated written feedback constitutes a dialogue whereby the teacher becomes cognizant of the effects of his or her commentary. The purpose of this research was to demonstrate that written feedback within a nurturing environment enhances academic motivation, offering an avenue for teachers to use to promote student adoption of learning goals. If teachers can encourage students to <u>want</u> to learn, by providing them with timely, constructive, goal-oriented feedback, the result will be one small step toward transforming education from a process of force-feeding to one of voluntary consumption. Motivational feedback can help students become free-willed, lifelong learners.

Chapter 2. Review of the Literature

Introduction

The literature review that follows is divided into two main sections: an examination of the key theoretical arguments that support research into the efficacy of feedback, and an analysis of prior research relevant to teacher-provided feedback. Within scientific arenas, observations, intuitions, hypotheses and theories generally precede investigations. In a similar vein, this chapter begins with an examination of some of the key educational philosophies that bear on motivational feedback, and then moves to consider supporting research and practice. The first section, *Theoretical Foundations*, progresses from the broad issue of motivation, and systematically narrows the focus to center on the motivational potential of written feedback. In contrast, the second section, *Relevant Research*, concentrates on experiments, interventions, and investigations into the effectiveness of feedback in school settings. Here, the focus begins with the general issue of academic motivation and narrows in scope to that of written feedback's effect on academic motivation.

The overarching goal of this literature review is to highlight the importance of feedback in facilitating motivation. Ample evidence will be presented in support of this stance. In addition, a theory will be developed contending that feedback's effectiveness depends on the subjective interpretations of the recipients; "good" feedback is feedback that gets the job done. Effective feedback, as gauged by the recipient, fuels motivation. Motivation, in turn, influences academic engagement and performance. An approach to measuring effective feedback will be proposed, along with a research proposal for assessing the impact of effective feedback on academic performance and motivation.

Theoretical Foundations

Motivation theories.

The fundamental goal of this research project was to evaluate written feedback as one possible approach to enhancing students' motivation toward academic pursuits. In order to assess motives, we need a clear understanding of what constitutes motivation. According to Graham and Weiner (1996), motivation governs "why people think and behave as they do" (p. 63). The key feature of this definition is that motivation reflects the *why* of behavior, not the *what*; motivation cannot be measured simply based on outcomes. This distinction is clearly delineated by Ames (1992):

> In considering approaches to motivation enhancement, it is important to note that motivation is too often equated with quantitative changes in behavior (e.g., higher achievement, more time on task) rather than qualitative changes in the ways students view themselves in relation to the task, engage in the process of learning, and then respond to the learning activities and situation. (p. 268)

As noted above, motivation is a latent variable; it is influential on some behaviors and imperceptible on others. There is a saying that "you can't tell which way the train went by looking at the tracks." Similarly, an individual's outward appearance and superficial behavior provide specious gauges of motivation. Measures such as academic performance, cooperativeness, and compliance do not reveal motives. So what <u>is</u> motivation and how can it be measured?

Deci, Ryan and their colleagues (Deci & Ryan, 1985; Deci, Vallerand, Pelletier, & Ryan, 1991) have demonstrated that one facet of motivation is a feeling of *self-determination*, or the belief that one is in control of one's own actions, competent in

one's abilities, and working on personally-relevant activities. These researchers provided evidence that students were more engaged in activities when they had feelings of autonomy and control. Conversely, students showed less dedication to mandated tasks and inflexible directives. So, one aspect of motivation is a perception of autonomy, or self-determinism.

However, autonomy alone cannot account for motivation. Individuals have wide latitude in the ventures they can pursue, yet some courses are completely neglected while others are undertaken in earnest. For example, one may choose to play golf over tennis, watch television rather than read, and study physics instead of weaving baskets. Ostensibly, all of these are equally autonomous choices. What additional factors influence motivational decisions?

According to Weiner (1992), motivation depends on three attributes: locus of causality, stability, and controllability. *Locus of causality* is an individual's assessment of who or what controls events. This attribute meshes with Deci and Ryan's (1985) theory. The additional attributes, stability and controllability, offer a deeper understanding of motives. *Stability* reflects the extent to which an individual believes that influential factors are fixed. For example, if a young girl fails on her first attempt to ride a bicycle, her motivation will be diminished if she believes that bicycle riding ability is a stable factor. If, however, she believes that balance is a skill that can be honed with practice, her determination and motivation will endure. Weiner's third causal attribute is *controllability*. Whereas stability reflects the mutability of a determinant, controllability reflects its manageability. Some factors can be unstable and controllable (e.g., skill), others can be stable and uncontrollable (e.g., gender), and still others can be unstable and

uncontrollable (e.g., luck). Motivation depends on all three circumstantial attributes: causality, stability, and controllability. So, not only must a person feel personally responsible (i.e., have a feeling of autonomy or internal locus of causality) but must also feel empowered by situations that are unstable yet controllable.

Locus of causality, stability, and controllability are subjective. From Weiner's (1992) perspective, motivation depends on how an individual characterizes events. One student may attribute success on a test to being smart. Further, this student may view intelligence as innate (i.e., a stable, uncontrollable feature with an internal locus of causality). A different student may view the identical experience as a quirk or sheer luck (i.e., an unstable, uncontrollable feature with an external locus of causality). The key point here is that attributions, whether rational or irrational, founded or unfounded, are established by the individual.

Attributions are cognitive evaluations that individuals make, either consciously or subconsciously, to account for their beliefs. Returning to Graham and Weiner's (1996) definition of motivation as "why people think and behave as they do" (p. 63), it appears that attribution theory can provide a partial account for motives: attributions account for why people *think* as they do. However, two key aspects of motivation have yet to be addressed: individual *behavior*, and the context within which thinking and behaving occurs. With regard to context, it seems unlikely that cognitive evaluations occur in a vacuum; other persons and situational factors probably influence our assessments. For example, a student may evaluate a grade on a homework assignment in light of how others perform: An *A* may be more meaningful if all other students receive *B*'s and *C*'s. Further, cognitive evaluations are retrospective; they are assessments of past events, not

stimuli for future ones. So, although attribution theory may account for how people view their capacities, it does not fully explain why people behave as they do.

Pintrich and Schunk (2002) provide a different perspective on motivation, which may elucidate the issues of context and behavior. They define motivation as "the process whereby goal-directed activity is instigated and sustained" (p. 5). This definition provides three key contributions. First, motivation is a process, not an outcome. According to Schunk (1996), "motivation is not observed directly but rather inferred from such behavioral indexes as people's verbalizations, task choices, effort expenditure, and persistence" (p. 284). Motivation is the mental activity that impels behavior; it is a decision process that precedes any observable result.

Second, motivation has goals. Motivation is not simply a decision to act, it is a decision to act purposefully. Therefore, goals are an essential ingredient in motivation. Finally, motivation instigates and sustains activity; motivation must endure throughout the life of an activity. What factors contribute to the initiation and maintenance of the "process" of motivation?

According to Ford (1992), motivation is "the organized patterning of an individual's personal goals, emotions, and personal agency beliefs" (p. 78). This definition incorporates the theories of Deci and Ryan (1985), Weiner (1992), and Pintrich and Schunk (2002). *Personal agency beliefs* are an individual's views of competence, capacity, and control. As such, these beliefs subsume Deci and Ryan's Self-determination Theory and Weiner's Attribution Theory. *Personal goals* are an individual's volitional aspirations, similar to Pintrich and Schunk's (2002) goal-directed

activity. So, Ford's definition of motivation supports the views of other theorists and posits an additional causal factor: emotions.

What emotions affect motivation? Feelings such as fear and compulsion can induce behavior, but these emotions do not elicit willful actions. Emotions are only motivating if they produce voluntary behavior directed toward personal goals. Lepper and Hodell (1989) contend that there are four types of activities that promote emotional commitment: tasks that are challenging, those that spark curiosity, those that promote feelings of control or governance, and those that engage personal fantasy.

Pekrun (1992) contends that a much broader array of emotions bear on motivation, for better or for worse. He proposes a taxonomy of emotions that affect cognitive functioning, achievement, and motivation. These emotions are divided into two broad categories, task-related emotions and social emotions. The task-related category consists of *prospective* emotions (hope, anticipatory joy, anxiety, and hopelessness (a.k.a., resignation and despair)); *process-related* emotions (enjoyment and boredom); and *retrospective* emotions (relief, outcome-related joy, sadness, disappointment, and shame and guilt). The social category of emotions includes gratitude, empathy, admiration, sympathy, love, anger, jealousy, envy, contempt, antipathy, and hate. Intuitively, it seems reasonable that all of the preceding emotions could, circumstantially, either promote or retard engagement and influence motivation. Pursuits and environs that elicit emotions can directly affect motivation. In addition, emotions can have an indirect influence on motivation if the feelings affect either personal goals or personal agency beliefs.

The triadic representation of motivation as a product of personal goals, emotions, and personal agency beliefs provides a parsimonious yet robust definition that will be adopted here. However, it is important to note that many perspectives on motivation are compatible. As Ford (1992) contends, "because the conceptual and terminological idiosyncrasies of different motivation theories are so salient, they tend to obscure the impressive degree of underlying convergence among these theories" (p. 155). The conceptual framework of Ford's Motivational Systems Theory meshes well with the theoretical perspectives on learning theory and feedback that will be described subsequently, but other theories of motivation may be similarly compatible.

Ford's (1992) theory provides a general explanation for motivated behavior, without regard to any specific context. Conversely, learning theories provide insight into how individuals acquire and assimilate knowledge, in both formal and informal educational contexts, with little regard to motivation. The next topic to be considered is how motivated learning is incorporated into educational environments.

Learning theories.

The previous section adopted Ford's (1992) definition of motivation as "the organized patterning of an individual's personal goals, emotions, and personal agency beliefs" (p. 78). This dissertation considers how motivation theory can be leveraged in an academic setting. Consequently, theories on motivation must dovetail with learning theories. Fortunately, Ames (1990) espouses a perspective on motivation within education that strongly resembles Ford's generic theory: "At a very general level, [students'] thought patterns include goals, beliefs, and attitudes that are involved in how students approach learning situations, engage in the process of learning, and respond to

learning experiences" (p. 411). The question, then, becomes one of how to integrate motivation theory into the process of learning.

Learning within educational institutions is fundamentally a social activity. Therefore, it is essential that motivation be considered within a social environment. Albert Bandura (1977) presents a Social Learning Theory that addresses this issue. In his conceptualization, three components interact to influence learning: the person, his or her behavior, and the environment. Each component exerts a bi-directional influence on the other two, producing a *reciprocal interaction*. For example, a person responds to environmental influences, producing certain behaviors, which result in environmental reactions, which affect the person. To use a concrete example, consider a situation where a student (i.e., the person) participates (i.e., the behavior) during a class discussion, causing the teacher to demonstrate approval (i.e., the environment), which reinforces the student (i.e., the person), so that he or she participates (i.e., the behavior) more often under these circumstances (i.e., the environment). The interplay between a person and the environment mandates that learning theories consider the student within a social context.

Bandura's Social Learning Theory and Martin Ford's Motivational Systems Theory provide an ideally matched set of theories for dealing with motivation within a learning environment. Both theories posit a triumvirate of causal factors that appear quite similar and compatible. Chapter 1 presented a conceptual view of how the two theories might interrelate. The goal here is to juxtapose motivating factors with a social learning environment.

Bandura's social learning theory provides an abstract view of the learning environment. In order to make tangible changes, the person, behavior, and environment need to be transformed into a concrete model for learning. Many models of classroom teaching could be considered, from a militaristic, regimented structure to a Socratic, egalitarian one. Arguably, motivation and learning can exist in most environments. What structure best suits the purpose of this research? Several authors have contributed greatly to the philosophical approach that will be employed here.

Carl Rogers (as cited in Pintrich & Schunk, 2002) commented that "I become very irritated with the notion that students must be 'motivated'" (p. 42). An instructional environment should not be designed to "motivate" the student; it should provide a setting that is facilitative, that engages, that entices, and that encourages academic pursuits. Motivation arises from events that spark personal goals, elicit productive emotions, and tap personal agency beliefs. "In brief, in humane relationships, people choose to change because WE change OUR behaviors (which is part of their environment) when we INTERACT with them, such that it is worth their effort to change" (Kozloff, 1988, p. 45). Academic motivation is a matter of orchestrating circumstances such that students <u>want</u> to learn.

McClelland (1971) refers to four types of information that influence motivation: demands, incentives, motive dispositions, and intents. Demands are external, compulsory forces. They are manipulative rather than volitional. Incentives are external inducements that individuals are free to choose to pursue. Motive dispositions are "habitual orientations toward certain goals" (p. 3); they are personal tendencies and aspirations. Finally, intents are transient, internal processes that direct and sustain actions. If we

adopt what Kozloff (1988) referred to as a humane approach to changing individuals, then motivational interventions must focus on motive dispositions, intents, and incentives, respectively. Motivation should derive either from the individual (preferably) or from inducements that the individual voluntarily seeks.

McCombs (1991) provides a template for a learning environment that promotes academic motivation. Her learner-centered approach to education targets six aspects of the educational environment: self, metacognitive structures, cognitive development, affective aspects of personality, behaviors, and the social structure. Table 1 shows how these dimensions can be superimposed on Bandura's social learning theory and Ford's motivation systems theory.

McCombs' (1991; 1998; 2001) prescription for lifelong learning is an ideal blend of principles applicable to Bandura's and Ford's theories. Note how her specific recommendations for student involvement address these theoretical underpinnings:

Specifically, students must:

1. See schooling/education as personally relevant to interests/goals.
2. Believe in their competence and ability to succeed.
3. Feel personally responsible for their success.
4. Understand higher level thinking and self-regulation skills.
5. Employ effective and efficient encoding, processing and recall strategies.
6. Control counterproductive emotions and moods.
7. Produce the outcomes that signal success and goal attainment.

Table 1. McComb's Individual Dimensions with Bandura's and Ford's Theories

<table>
<tr><td>McCombs</td><td>Self</td><td>Metacognitive</td><td>Cognitive</td><td>Affective</td><td>Behavior</td><td>Social</td></tr>
<tr><td>Bandura</td><td colspan="4">Person</td><td>Behavior</td><td>Environment</td></tr>
<tr><td rowspan="2">Ford</td><td colspan="3">Personal Agency Beliefs</td><td>Emotions</td><td colspan="2"></td></tr>
<tr><td colspan="6">Personal Goals</td></tr>
</table>

If one subscribes to McCombs' (1991; 1998; 2001) principles, the issue now evolves into one of translating philosophy into actions. In particular, how does a teacher compose an environment that is personally relevant to all students, taps individual interests, meets disparate goals, allows for various competencies, delegates responsibilities, elicits emotional commitments, and produces noteworthy outcomes? These objectives are too ambitious for any single teacher to accomplish individually. The key to this learner-centered approach is what McCombs (1994) calls *reciprocal empowerment*, or "promoting the development of higher order self-processes and self-regulated learning skills through addressing will, skill, and social support components of motivation" (p. 54). How can educators enhance *will*, *skill*, and *social support*? Or, using McClelland's (1971) characterization of motivational determinants, how can teachers affect motive dispositions, intents, and incentives?

McCombs (1991) contends that "students have a natural inclination to learn…in the right motivational atmosphere" (p. 118). What is the "right" atmosphere and how can teachers facilitate it? Interestingly, deCharms (1972) addressed this precise topic almost two decades earlier, with his theory of Personal Causation:

> Briefly stated…you must help the person, (a) to determine realistic goals for himself; (b) to know his own strengths and weaknesses; (c) to determine concrete action that he can take now that will help him reach his goals; and (d) to consider how he can tell whether he is approaching his goal, that is whether his action is having the desired effect. (p. 97)

All of the theorists cited have a common core of beliefs regarding motivation within education. Specifically, they contend that teachers need to act as mentors and facilitators who engage, inform, guide, and gauge. Teachers should maximize opportunities for students to acquire and internalize knowledge and understanding. Students must avail themselves of these opportunities and assume the responsibility for learning. How does this transition from teacher-centered to learner-centered education occur? Research on Academic Motivation provides some guidance.

Enhancement of academic motivation.

If, as Ford (1992) contends, motivation is a product of personal goals, emotions, and personal agency beliefs, then academic motivation can be enhanced by inflating any one of these three factors without deflating either of the other two. For example, if a teacher can entice a student to increase personal goals for academic comprehension then academic motivation will increase. Or, if a student becomes more emotionally committed to a school subject, motivation will rise proportionally. How, then, can an educator affect these factors? Let us begin with emotions.

One emotion that should, ideally, pervade the educational milieu is interest. If a student is interested in learning, for whatever reason, attentive focus will be sharpened, efforts will be amplified, and persistence will be increased. Interest is a powerful

motivating force that affects both personal goals and emotions. Krapp, Hidi, and Renninger (1992) contend that there are three aspects of interest: a relatively-stable individual interest or disposition, a situational interest that is task or activity related, and an actualized interest that is the combination of individual and situational interest in context. For example, a student may enjoy science (individual interest) and enjoy science lab in school (situational interest) but may balk at a dissection activity (actualized interest). The three aspects of interest vary in strength and duration, from individual interest being the strongest and most enduring aspect, to actualized interest being the most malleable. Instructors need to focus immediate efforts on actualized interest, in the hopes of affecting individual interest over the long term.

One way to make education more interesting is to make it more personally relevant to the student (Vygotsky, 1978). Often, assignments are imposed without any rationale as to their utility. For example, why does a student need to know how to perform long division when calculators are readily available; what good does it do to know the state capitols; and when will the average citizen have occasion to employ the biological classification system of genus and phyla? If an academic task is not inherently relevant or captivating, the challenge for teachers is to find a way of making it so.

However, it is naïve to suppose that all academic tasks can be made interesting or otherwise emotionally rewarding. Every occupation, pursuit, and life has ebbs and flows, mundane, boring phases and exciting, interesting ones. In fact, highpoints are impossible without corresponding low points; peaks cannot exist without valleys. In those cases where tasks are not inherently interesting, participants need to understand the task's necessity or utility. Here, again, the teacher can help the student appreciate the

importance of the task in achieving distal goals. In addition, even boring tasks can become self-regulated if the teacher adopts a non-controlling, coaching style (Deci et al., 1991), or if the student subscribes to the task's necessity (Sansone, Weir, Harpster, & Morgan, 1992).

Teacher-provided support and feedback are key to establishing and maintaining academic interest. The teacher needs to help students subscribe to the importance of education, and the teacher must provide ongoing feedback and guidance so that the student can detect learning gains. Support and feedback sustain interest.

But interest does not exist in isolation; enduring interest, like motivation, is related to goals. Idioms like *passing fancy* and *idle curiosity* refer to capricious, ill-defined interest. For example, the question "What makes a traffic signal turn green when a car pulls up to the intersection?" may reflect curiosity but it exists in isolation. Practical interest has a purpose or goal. So, another approach to enhancing motivation is to develop or promote goal-directed activity.

Goal theory has been preeminent during the past decade (e.g., Ames, 1992; Ford, 1992; Ford & Nicholls, 1991; Graham & Weiner, 1996; Harackiewicz & Sansone, 1991; Schunk, 1991). Topics that have received extensive attention include the establishment of proximal (i.e., short-term) and distal (i.e., long-term) goals; goal types (e.g., Ames, 1992); goal adoption and acceptance (e.g., Woolfolk, 2001); and goal assessment (e.g., Ford & Nicholls, 1991). The common thread in all of this research is that goals are an essential motivational determinant. Therefore, teachers can boost motivation by helping students adopt, maintain, and assess progress toward goals.

However, there is a crucial divergence of opinions within goal theory. A number of highly respected theorists seem to contend that dichotomous goal types exist, and that internally-directed goals are preferable to external ones (Ames, 1992; McCombs, 1991). For example, Ames (1992) concludes that mastery goal orientation "promotes a motivational pattern likely to promote long-term and high-quality involvement in learning" (p. 263). In contrast, Köller (2000) contends that goal orientations are only moderately associated with academic performance. So, mastery goal orientations may produce deeper, more enduring learning than performance goals, but this is not reflected in the traditional testing that gauges academic progress.

Ford (1992) contends that a taxonomy of two dozen goal types exists, and that "the most motivating activities and experiences in life will be those that involve the simultaneous pursuit and attainment of many different kinds of goals" (p. 100). This is a critically important principle: If educators confine themselves to promoting intrinsic motivation in the guise of "learning goals" (Dweck, 1986; McCombs, 1998) or "mastery goals" (Ames, 1992), motivation expires when personal interest disappears; academic motivation becomes totally dependent on hedonistic desires. This is a perilous stance. Consider how many adults would persevere in their daily jobs solely for the enjoyment that it provides. How many people would willingly continue employment in a position that was devoid of salary, benefits, social status, social relationships, and societal value? Intrinsic interest should be the premier goal, but it should not be the sole goal.

Feedback facilitates goal assessment and maintenance. When students exert effort, they need some means of judging whether their trials have been successful or unsuccessful, on-target or misguided. Teacher-provided feedback serves this purpose.

As an analogy, archery and marksmanship require both a target and feedback. The archer and marksman need to know whether the shot was true or missed the mark. If it missed, how far afield did it go and in which direction? Was the aim off, or was the firing technique flawed? Similarly, academic goals cannot be achieved without specific feedback and explicit guidance.

A final motivational determinant to be considered is personal agency beliefs. Students will not be motivated if they feel inept. Students will not persevere, regardless of how interested they are, if they have defeatist attitudes (Dweck, 1986). They will not persist, irrespective of goal relevance, if they believe they are doomed to failure. It is incumbent on teachers to provide students with accurate, realistic evaluations of their current abilities and capabilities. Feedback satisfies this need.

Feedback is present, to some degree, in virtually every aspect of daily classroom life. However, while it may be incidental to many activities, it is fundamental to assessment; the primary output of teacher evaluations is feedback. So, assessment is a logical route to pursue when considering the motivational ramifications of feedback.

Academic motivation through assessment.

Assessment is a fact of life in conventional school systems. Indeed, it is difficult to conceive of a classroom that is devoid of quizzes, oral exams, written tests, homework, graded projects, group projects, writing assignments, and standardized tests. If there were no assessments, there would be no bases for evaluating student abilities, deficiencies, or academic progress. Ames (1992) contends that "the ways in which students are evaluated is one of the most salient classroom factors that can affect student

motivation" (p. 264). A classroom without assessments lacks an educational compass for directing student motivation and learning.

However, classroom assessment can serve two, distinct purposes, as enunciated by Bransford et al. (2000):

> The first, formative assessment, involves the use of assessments (usually administered in the context of the classroom) as sources of feedback to improve teaching and learning. The second, summative assessment, measures what students have learned at the end of some set of learning activities. (p. 140)

Educational administrators and legislators generally focus on summative assessment. These individuals are primarily interested in gauging the quality of education, and their basis for evaluation is students' ostensible level of academic achievement and competency, reflected by scores on standardized (i.e., summative) tests. Classroom teachers have divided allegiances toward assessment: They are obliged to evaluate students' performance via summative assessments, but they also employ feedback from formative assessments to gauge and guide instruction. For teachers, summative assessment serves their administrative responsibilities and formative assessment serves their didactic ones.

But the real beneficiaries of assessment are supposed to be the students. For them, summative assessments serve an evaluative purpose, not an educative one. A letter grade or standardized test score may be aggrandizing or demoralizing, reinforcing or disparaging, motivating or demotivating. Regardless of the affective outcome, summative assessments are not educative; they do not guide the student and they do not promote learning. Summative assessments document achievement and they expose

individuals to judgment, but they do not facilitate learning, and their effects on motivation are ancillary.

Conversely, formative assessment is student-centered; its purpose is to further student development and learning. Bloom (1976) claims that "where mastery learning has been effective, it has made use of relatively explicit formative evaluation procedures" (p. 126). Black and Wiliam (1998) contend that formative assessment "is at the heart of effective teaching" (p. 140). Wiggins (1998) asserts that this type of assessment "is a major, essential, and integrated part of teaching and learning" (p. 8). Where summative assessments advise observers of educational outcomes, effective formative assessments empower its participants. What, specifically, is formative assessment and what makes it effective?

Formative assessments can take a variety of forms including projects, performances, practice tests, informal question-and-answer sessions, and homework assignments. Regardless of form, there are three essential characteristics of formative assessment: It is timely, it focuses on key concepts and skills, and it offers students specific information on the learning process (Guskey, 1997). These rather prosaic characteristics may be deceptively difficult to implement.

Formative assessments must be timely. More specifically, "the recipient must have opportunities to employ it, if it is to be effective" (Wiggins, 1993, p. 194). Feedback that occurs in close chronological proximity to lessons is only timely if it can be applied to subsequent lessons. Ford (1992) refers to this as a *feedforward* process; output from assessments must further achievement of short-term goals. Formative assessments are, by definition, generative.

Formative assessments must be geared toward the significant portions of the lesson and the proficiencies needed to accomplish them. Teachers must guard against *abusing* rather than *using* feedback and corrective procedures (Bloom, 1976). For example, teachers should overlook or minimize penmanship and spelling errors on a creative writing assignment, and the accuracy of mathematical calculations, though important, is secondary to solving logistical problems. If teachers focus on trivialities to the detriment of fundamental concepts, so will their students.

Finally, formative assessment needs to be *in-formative*; it must provide information about what portion of the student's response is right, what is wrong, and how to remedy the discrepancy (Guskey, 1997; Wiggins, 1993). Both Wiggins (1993; 1996; 1998) and Guskey (1990; 1997) distinguish between *feedback* and *guidance*. According to Wiggins (1993), feedback tells whether the student is on course whereas guidance gives direction. For simplicity, the term feedback will generally be used within this discussion to refer to both constructs. Regardless of terminology, formative assessment must let students know how they are doing, and give them explicit direction on how to further progress toward their cognitive, affective, and social goals.

Formative assessments affect both educational growth and psychological development. By providing feedback and guidance, formative evaluations further cognitive and metacognitive ends. In addition, teacher-provided responses can affect personal evaluations of autonomy, competency, capacity, self-worth, and self-esteem. From the student's perspective, feedback is the fundamental output of formative assessments. Therefore, any academic motivation that results from assessment is motivation derived from feedback.

Academic motivation through feedback.

In 1976, Benjamin Bloom concluded, "while it is possible to analyze the literature for the relation between student achievement and cues, reinforcement, or participation, there is almost no evidence in the research literature which deals directly with feedback and correctives" (p. 125). While some research on feedback and correctives has been conducted in the ensuing years, guidelines for teacher-provided feedback are still rather generic. One of the recurring themes in feedback-related literature is that teachers should adhere to certain *principles* of interaction (Ames, 1990; Anderson, 1990; Ford, 1992; Graham & Weiner, 1996; McCombs, 1998, 2001; Pervin, 1991; Ryan & Stiller, 1991; Stipek, 1988; Wiggins, 1998). The most salient of these guidelines are subsets of McCombs' (2001) *Learner-Centered Psychological Principles*, Ford's *Principles for Motivating Humans*, and Wiggins' (1998) "elements of a learning-centered assessment system" (p. 12).

McCombs' (2001) recommendations revolve around the educational environment, in general, rather than feedback, specifically. For example, she discusses motivational and emotional influences on learning (Principle 7), intrinsic motivation (Principle 8), and social influences (Principle 11). Feedback has the potential for supporting these principles by providing information and cues that students use to evaluate themselves, their performance, and their potential. Indeed, feedback is crucial for learner-centered education.

McComb's (2001) principles for learner-centered education are inferentially linked to feedback. In contrast, one of Ford's (1992) seventeen principles deals directly with feedback and several others bear strong connections to feedback. His *Feedback Principle*

states, "people cannot make progress toward their personal goals in the absence of relevant feedback information" (p. 210). Therefore, feedback is an essential ingredient to motivation. In his *Principle of Direct Evidence*, Ford contends that experiences must relate directly to the goals and beliefs that affect motivation. Teacher-provided feedback can provide such direct evidence. In Ford's *Reality Principle*, the contention is made that feedback must be consistent with "actual skills" to be credible and of long-term utility. Finally, several other principles (e.g., the *Principle of Emotional Activation*, the *Principle of Incremental Versus Transformational Change*, and the *Principle of Human Respect*), while not feedback-specific guidelines, are applicable to feedback. Academic motivation can be enhanced through appropriately constructed feedback (Elawar & Corno, 1985).

Wiggins (1998) provides the most explicit, extensive treatment of feedback. His elements of learner-centered assessment contain two primary components, authentic instruction and feedback. Wiggins contends that "educative assessment" must:

> Provide data and commentary [i.e., feedback] that are rich, clear, and direct enough to enable students and teachers to self-assess accurately and self-correct their own performances increasingly over time, and provide ample opportunities to get and use timely and ongoing feedback. (pp. 12-13)

Wiggins (1998) makes a strong argument for the crucial role of feedback in enhancing learning, empowering students, and spurring children to accept responsibility for their own academic development. In his chapter devoted to feedback, Wiggins explains that effective feedback has the following attributes: Provides concrete evidence to confirm or disconfirm the effectiveness of the student's work relative to desired outcomes, compares current performance and trends against goals, is timely, is frequent

and ongoing, is descriptive and prescriptive, references exemplars, and promotes self-assessment and self-adjustment. The goal of educative assessment and feedback is to enlist students' participation in "performances that matter to them and to others around them" (Wiggins, 1998, p. 5). This objective can only be achieved if students are motivated to learn by virtue of their personal goals, emotions, and personal agency beliefs.

Relevant Research

The previous section dealt with various scholars' reflective, pragmatic views on motivation, learning, and assessment. Now, it is time to consider how these perspectives are supported by research, and how research has honed understanding in these areas.

A key premise of this investigative focus is that academic motivation is an individualized construct. Ames (1992) contends that "subjective experience and meaning has important implications for examining the effects of classroom environments or structures on student motivation outcomes" (p. 268). Indeed, a prime challenge is to concoct environments that students find motivationally conducive, based on their personal perspectives. More recently, Higgins, Hartley, and Skeleton (2001) reiterated this conclusion, with respect to feedback:

> Feedback may need to be more dialogical and ongoing. Discussion, clarification, and negotiation between student and tutor [or teacher] can equip students with a better appreciation of what is expected of them. (p. 274)

Indeed, two challenges of providing effective feedback are that individuals refract information through their personal lenses, and feedback itself is a multifaceted form of

communication. This section begins with research on the nuances of feedback and then proceeds to examine how feedback can be customized to adapt to individualized needs.

Feedback dimensions.

Recall that Wiggins (1998) indicated that feedback should "provide data and commentary [i.e., feedback] that are rich, clear, and direct enough to enable students and teachers to self-assess accurately and self-correct their own performances increasingly over time" (p. 12). Wiggins proposes objectives of feedback, but what environmental characteristics yield these outcomes?

Cohen, Perkins, & Newmark (1985) surveyed ninety-nine active special education teachers who enrolled in graduate special education courses. The researchers' goal was to understand better the types of feedback that teachers employed. The participants were provided with hypothetical "student-completed" worksheets in math, spelling, and writing, and asked to mark them as they would for their own special education students. The researchers then analyzed the graded papers, looking for distinguishing features and patterns in the teacher-provided written feedback.

Cohen et al. (1985) found two main categories of feedback, *non-corrective* and *corrective*. *Non-corrective* feedback is simply a reflection of the satisfactoriness of the students' responses. It includes four types of markings: marking the correct answer, marking the incorrect response, marking both the right (e.g., √) and the wrong (e.g., *X*) answers, and simply indicating that the student should *re-do* the assignment. Conversely, *corrective* feedback provides guidance. It, too, includes four types of markings: marking incorrect responses and providing the correct answer; indicating accuracy and requesting that the student come see the teacher; providing some written analysis of student-

committed errors; and simply instructing the student to come see the teacher for feedback.

This research provided three pieces of insight. First, it demonstrated that content-related feedback falls on a continuum from non-prescriptive (non-corrective) to diagnostic and prescriptive. Second, it showed that the frequency of feedback type varied by subject area. Finally, it reflected a disturbing pattern in the instructional quality of feedback: Sixty percent of the feedback was non-corrective, and diagnostic feedback was provided only 8.6% of the time. Even more disappointingly, diagnostic feedback was only provided about 2% of the time on the division, subtraction, and addition worksheets. Based on this study, it would appear that much teacher-provided written feedback fails to provide guidance to students.

In the preceding research, Cohen et al. (1985), investigated the prescriptive dimension of written feedback. They sought to determine the extent to which teachers provide guidance. More recently, Bardine (1999) investigated the functional dimension of feedback; he was interested in the purpose or intent of the teacher-provided feedback. Based on his analysis of teacher comments on a dozen high school students' essays, Bardine identified six functional categories of teacher commentary: to *instruct* (i.e., to impart specific information), to *praise*, to *direct* (i.e., to provide general direction), to *question*, to *call attention to*, and to *answer*. His conclusions were based on his own analysis, augmented by student input extrapolated from questionnaires and interviews. Since Bardine employed such a small, select sample, his findings should be viewed cautiously. However, he provided several concrete recommendations for constructing teacher feedback and comments that have practical appeal:

1. Feedback must be as specific and detailed as possible.
2. Students like to see praise that is earned.
3. We need to learn how to respond to students' writing
4. "A final implication can be that we begin using questionnaires…. Early in the semester use them to determine how well students understand the comments on their papers and if they feel the responses are helpful for future writing" (p. 246).

Bardine's (1999) last point is particularly relevant to the current discussion. Feedback is a dialogical process. Teachers cannot assume that students interpret written messages as intended, or that the communiqué has the desired impact. Students must reciprocate for teachers to understand the effects of their feedback.

But is there any potential educative value to written feedback beyond appraising students of their current level of achievement? Specifically, can feedback promote motivation and future learning? Research by Block and Tierney (1974) would seem to indicate that it can. These researchers recruited 44 upper division college students to participate in an experiment that included a control group and two experimental groups. The control group underwent a traditional lecture-type course. One of the experimental groups received periodic assessments and specific direction on which topics required further study. The second experimental group received periodic assessments and supplemental materials targeted toward the topics where they were deficient. This latter experimental group performed better than either of the other two groups did on the end-of-semester assessment test. Block and Tierney concluded that, if done properly, assessment and correctives can improve student learning.

There is also some evidence that students desire teacher-provided feedback. In an experiment conducted by Dwyer and Sullivan (1993), 97 high school students were allowed to select either teacher-performed grammar checking of their essays or computerized grammar checking. Despite the fact that the computer program was as accurate as the teachers' scoring, 88% of the students elected to have their teacher mark the papers. Upon subsequent probing, the researchers found that the most frequent rationale for this preference was that the teacher provided personalized assistance. An analysis of teacher markings revealed that the teachers individualized their comments, provided corrective advice, elaborated on the writing, and personalized the commentary. Since students are not disinterested in the source of written feedback, it seems reasonable to conclude that it has some value to them.

One final consequence of feedback that is worth considering is its potentially detrimental effect. Obviously, teachers can compose deliberately caustic and hurtful comments. However, no ethical educator would consciously act in such a manner. But the possibility exists that an instructor's well-intentioned comments would be misconstrued or misinterpreted, thereby unintentionally inflicting damage.

Fortunately, research by Booth-Butterfield (1989) suggests that students apply liberal interpretations of feedback, tending to view even negative commentary in a favorable light. Booth-Butterfield presented 78 college students with fabricated teacher feedback on hypothetical scenarios of classroom presentations. The research participants attempted to interpret the teacher's feedback from a third person perspective. Based on an analysis of these interpretations, Booth-Butterfield concluded that students "exhibit self-serving effects (SSE) by attributing positive comments to their own traits, efforts, or

ability and negative comments to the current situation or context" (p. 129). So, while feedback can be abused, there is reason for optimism that a conscientious, well-meaning teacher's comments will be graciously accepted, and will promote cognitive and affective development.

Academic feedback is a multifaceted construct. Through it, the teacher can judge, inform, instruct, question, direct, praise, criticize, encourage, or discourage. Feedback can promote learning, retard learning, or be vacuous. It can also enhance, sustain, or diminish students' motivation toward schooling. Let us review some of the specific effects that feedback produces.

The research described in this section provided insight into the possible dimensions of feedback, including quantitative attributes (e.g., frequency and intensity), qualitative attributes (e.g., the non-corrective-to-diagnostic continuum), cognitive attributes (e.g., to *inform*, to *question*, and to *answer*), and affective attributes (e.g., to *praise*, and to *encourage*). However, the analyses of feedback were retrospective; the researchers qualitatively analyzed surveys and interviews to determine feedback's components. To date, no research had been performed to measure proactively the feedback construct. If we subscribe to the premise that feedback affects motivation, then we must have a means of measuring the independent variable, feedback, if we are to assess its effects on the dependent variable, motivation. There are two key characteristics of feedback: what it <u>is</u> (i.e., its attributes or dimensions), and what it <u>does</u> (i.e., its effects). Feedback effects must be understood in order to develop a feedback measurement instrument. Issues of feedback effects and feedback measures will be addressed next.

Feedback effects.

One risk with any type of intervention is that the intended assistance may distract from the recipient's personal goals. For example, deCharms (1972) found that manipulative assistance decreased the subject's feeling of *personal causation* and correspondingly reduced motivation. Similarly, Deci and Ryan (1985) determined that lower levels of self-determinism constricted motivation. So, teachers need to be discreet when providing assistance via feedback, to insure that students do not feel manipulated, thereby decreasing their motivation.

Research on the attitudinal effects of written feedback dates back at least a quarter of a century. In 1977, McMillan conducted an experiment with 120-140 students in an undergraduate educational psychology course. In a 3 x 2 factorial experiment, McMillan provided no praise, low praise, or high praise on both low effort and high effort assignments. He found that students who completed low effort assignments did not seem to be affected by the subsequent amount of praise. As one might expect, students who exerted high effort formed more positive attitudes if the effort was followed by high praise. In an interesting twist, students who exerted low effort and received no praise developed more positive attitudes than their counterparts who received high praise. The important message here is that effective feedback is commensurate with the level of effort expended by the student (based on their subjective evaluations). Furthermore, feedback is only effective if the associated assignment is sufficiently challenging.

Students' objectives also mediate the efficacy of feedback. Sansone and her colleagues (Sansone, Sachau, & Weir, 1989; Sansone et al., 1992) performed a series of studies to assess various affective effects of teacher-provided feedback. One set of

experiments (two studies) was geared toward gauging the impact of feedback on participants' goal orientations. The researchers provided approximately 120 college students with "hints" during a computer text adventure game called Zork. At the conclusion of game play, participants were given a questionnaire assessing their level of enjoyment, perceived competence, and feelings of self-determinism. Sansone et al. (1992) found that teacher-provided feedback (i.e., "hints") is embraced when it meshes with the individual's goals. For example, if the individual was focused on improving game skill, performance-related hints were appreciated; if the goal was exploration, discovery-related hints were valued. The researchers concluded that the psychological impact of feedback "depends on the [individual's] long-term goals" (p. 828).

In a second set of experiments, Sansone et al. (1992) sought to determine whether students could make a necessary, but intrinsically tedious task more palatable. Based on responses from 211 college students across two studies, the researchers found that these adult learners usually possessed, and conditionally employed, strategies to enhance task interest in mundane tasks. Students will self-regulate uninteresting tasks if there is a reason to persist, and they can devise a way of making it more interesting. Taken together, the Sansone et al. (1989; 1992) studies indicate that educators need to either organize feedback to be compatible with individuals' goals or to modify students' goal orientations. Further, if tasks are consistent with goals, students will implement self-regulating strategies to maintain interest and perseverance.

All of the research studies described in the preceding portion of this section involved relatively mature participants: high school students, college students, or teachers. This is because, as other researchers have noted, "most research on written feedback has focused

on college students" (Matsumura, Patthey-Chavez, & Valdes, 2002, p. 6). However, the ultimate goal of this dissertation was to affect academic motivation in elementary school. So, it was important to understand the extent to which research with developmentally more mature participants applies to younger students.

In a seminal study, Nicholls (1978) investigated children's development of the concepts of effort and ability. These conceptualizations play a vital role in the interpretation of feedback since success and failure are attributed to underlying aspects of self within contexts. For example, a student may interpret a substandard grade as either a reflection of low ability or a consequence of insufficient effort. Effective feedback is predicated on students' ability to correlate academic outcomes with contextual and personal precursors.

Nicholls (1978) recruited 144 children, ranging in age from five through thirteen. Each age level was represented by eight boys and eight girls. The children were shown filmstrips and administered questionnaires to assess their development of the causal schemes of effort and ability. Based on the results of this research, Nicholls concluded that there was "an invariant sequence of qualitatively different, hierarchically integrated, levels of reasoning [about ability and effort]" (p. 805). These levels can be summarized as follows:

1. Level 1 – (Ages 5-6) Effort and outcome are not distinguished as cause and effect. Children generally consider effort and outcome as synonymous; high effort yields superior dividends, and substandard results are solely the result of insufficient effort.

2. Level 2 – (Ages 7-9) Effort and outcome are distinguished as cause and effect. However, equal effort across individuals is expected to lead to equal outcomes. Ability is not a factor.
3. Level 3 – (Ages 10-11) The concept of ability is used intermittently. Children at this level recognize that effort is not the sole cause of outcomes, but they do not systematically evaluate the dual influences of effort and ability in achieving outcomes.
4. Level 4 – (Ages 12 and up) Effort and ability are used to systematically explain behaviors and predict outcomes.

Nicholls concludes that the causal schemes for effort and ability evolve along lines similar to Piaget's (1997) theory of cognitive development. There are two key implications from this research:

1. Before the association between task difficulty and incentive value of success develops, success appears likely to be generally pleasing and failure displeasing, and normative difficulty appears less likely to affect those emotional responses. (p. 809)
2. Preferences for easy tasks decrease when subjects believe that difficult tasks have greater incentive value for success, and this belief develops with the ability to infer greater personal responsibility for success on more difficult tasks. (p. 809)

If these contentions are accurate, than teachers of young students (i.e., those less than ten years old) will be hard-pressed to provide feedback that emphasizes high effort to attain academic excellence. Young students are more interested in *performing well*, under the misconception that this is equivalent to *learning well*. Conversely, errors are

viewed as deficits rather than as a normal course of discovery learning. Further, academic motivation is predicated on children's ability to differentiate between effort and ability. Students must perceive a higher incentive value in more difficult tasks before they will commit greater effort and accept greater risks of failure in the hopes of achieving higher levels of academic success.

Schunk (1982; 1983) published a pair of studies that appear to support Nicholls' (1978) theory on the developmental nature of attributions of ability and effort. In his first study, he questioned whether attributing past accomplishments to effort would promote perceptions of self-efficacy and enhance subsequent achievement. Schunk enlisted low-achievers in mathematics, children ranging in age from 7 years, 5 months to 10 years, 7 months. The forty children were administered three forty-minute treatment sessions over three consecutive days. Intermittently throughout the sessions, proctors would comment on either past effort (e.g., "You've been working hard") or on the necessity for future effort (e.g., "You need to work hard"). Two control groups were also present, one that was monitored but did not receive any comments, and one that was not monitored. Out of the four groups, the students who received feedback regarding past efforts performed significantly better than the other three groups. Schunk concluded, "linking past achievement with effort promotes task involvement, skill development, and perceived self-efficacy" (p. 553). Consistent with Nicholls' (1978) theory, these young children worked harder and performed better when they perceived a connection between effort and outcome. However, Schunk's conclusions included two important caveats:

1. "The impact of imploring a child to try harder not only relies on the credibility of the persuader but may actually undermine percepts of efficacy; since this type of

feedback is more ambiguous it may imply that effort is necessary because the child lacks ability" (p. 553).

2. "Capability inferences derived from one's performances vary depending on the weight placed on personal and situational factors that affect how one performs" (pp. 554-5).

Effort attributions can be effective for young children if they are compatible with the students' own perceptions; attributing success to hard work is effective if the student believes that he or she has been working hard. Likewise, attributing poor performance to lackadaisical behavior is effective if the student concurs with the assessment. However, it is counterproductive to criticize concerted effort or to praise lax behavior. The challenge is for teachers to provide guidance that is consistent with the students' subjective beliefs regarding their efforts.

Schunk's (1982) first study investigated the effects of effort-related feedback on performance. The following year, Schunk (1983) introduced an "ability" variable into his experiment, and attenuated his selection of participants to include only traditional third graders. This time, students received one of three types of feedback: effort-related (e.g., "You've been working hard"), ability-related (e.g., "You're good at this"), or both effort- and ability-related (e.g., "You've been working hard. You're good at this."). His measures included a self-efficacy component, where students were asked to predict the likelihood of success in solving specific problems, and an arithmetic skills test. Results showed that "children who received only ability feedback judged themselves the most efficacious and solved correctly the highest number of posttest problems" (p. 853).

Schunk's (1983) experimental results are intriguing. Intuitively, one would have expected that the combination of effort-related and ability-related feedback to have been most effective. However, when considered in conjunction with Nicholls' (1978) research, it reiterates the muddled nature of young students' ability, effort, and outcome schemata. Consistent with Nicholls' research, Schunk speculates that "ability feedback should exert stronger effects on third graders than younger children" (p. 854), and "we might expect a further shift in the importance of ability information relative to effort beyond the third grade" (p. 855). Finally, Schunk acknowledges the importance of the confluence of feedback and attributional development:

> Knowing how children's interpretation of attributional feedback progressively changes with development would allow teachers to structure their feedback accordingly, including over the course of a school year, to enhance children's achievement and sense of efficacy" (p. 855).

Schunk's (1982; 1983) experiments evaluated the influence that effort and ability attributions had on performance and self-efficacy. A decade later, McLaughlin (1992) conducted research into the potential academic benefits of contingently-issued "positive comments" on the academic performance of five behaviorally disordered children. The comments were "pretty much descriptive praise like good work, good job, good reading, etc." (personal communication, May 9, 2003). These students, ages 10 years, 3 months through 11 years, 6 months, received accolades when: their performance improved, they maintained high outcomes, or the teacher felt that they had otherwise earned recognition. Based on a multiple baseline analysis of the performance versus feedback condition, results showed that students' scoring on the Sullivan Reading Skills tests and/or SRA

reading materials were positively affected by affirming written comments. Further, McLaughlin found sustained improvements a year later. McLaughlin's research provides a demonstration of the effectiveness of written feedback on young students' academic performance.

Most of the preceding studies in this subsection have dealt with the effects of feedback on academic performance. Two final feedback-related topics will be discussed: The interplay between feedback and goals, and the attitudinal effects of written feedback in the elementary grades. The topic of goals will be addressed first.

One of the preeminent goal theorists is Dweck (1986). Her theory on achievement motivation and goals posits two distinct types of academic orientations, learning goals (i.e., a desire for competence), and performance goals (i.e., a desire to gain positive judgments and/or avoid negative judgments from others). In one experimental evaluation of this theory, Miller, Behrens, Greene, and Newman (1993) sought to determine whether college students would demonstrate motivational patterns and self-regulatory activities that aligned with Dweck's posited goal orientations. Approximately 120 college students in an introductory statistics course responded to a questionnaire that ostensibly assessed their goal orientations, perceived ability, value judgment of statistics, and persistence in dealing with difficult problems. The researchers found that persistence and valuing were positively correlated. They also found that learning goals were positively correlated with persistence, but performance goals were not.

However, the research by Miller et al. (1993) revealed an interesting inconsistency. Dweck's (1986) theory posits two distinct types of academic goals, learning goals and performance goals. The researchers' instrument obtained scores on both types of goals,

and the scores were not mutually exclusive. In other words, participants could possess both some degree of learning goal orientation and some degree of performance goal orientation. The researchers compensated for the dual goal orientations by dichotomizing the relationship: If the score on the learning goal measure exceeded that on the performance goal one, the subject was classified as learning goal oriented, and vice versa. The implication here is that individuals possess simultaneous goal orientations, which is contradictory to Dweck's theory but is consistent with Ford's (1992) advocacy of multiple goal simultaneity. Miller et al. addressed this discrepancy best when they speculated, "perhaps the relationships among these variables is more dynamic and reciprocal than the unidirectional relationships implied by the questions" (p. 13).

In contrast to the research done by Miller et al. (1993), Pintrich and DeGroot (1990) conducted research in which they viewed learning goals as falling along a continuum, and they treated performance goals as an ancillary issue. Their research on 173 seventh-graders entailed a self-report measure of student self-efficacy, intrinsic value, test anxiety, self-regulation, and learning strategy employment. Survey results indicated several correlations, and allowed the researchers to suggest additional hypotheses. First, they found that intrinsic valuing of academics was positively correlated with the use of cognitive strategies and self-regulation. Importantly, the correlation between these three variables was independent of levels of self-efficacy and test anxiety. The implication here is that when students find value in their studies they will exert effort even if they are short on self-confidence; student embracement of academic values will compensate for low self-efficacy.

Pintrich and DeGroot (1990) made a second important discovery: "intrinsic value did not have a direct relation to student performance in any of the regressions that included cognitive strategy use or self-regulation" (p. 37). The message here is that intrinsic value—a contributor to academic motivation—does not directly relate to academic performance. However, their data "suggest that intrinsic value is an important component for students' 'choice' about becoming cognitively engaged in their classroom academic work" (p. 37). So, academic motivation directly influences cognitive engagement and indirectly affects academic performance. The challenge in academic motivation research is devising an assessment tool that relies on cognitive and affective attributes other than simple scholastic performance.

Butler and Nisan (1986) attempted to differentiate between the performance-related outcome of motivation and the attitudinal one. They exposed their participants—261 sixth grade students from 9 Israeli classes—to two test conditions, anagrams, and a "uses" test that was intended to activate divergent thinking (e.g., creativity). Three sets of tests were administered during a three-day timeframe; one test occurred on Day 1, and two tests occurred on Day 3. Each test lasted about ten minutes, five minutes per section. The three-group experiment employed a control group, which received no feedback, and two feedback groups: one that received numerical grades on each section of Test 1 and Test 2, and one where each student received a one-sentence, performance-related written comment on each section of Test 1 and Test 2. The comments included one positive phrase and one critical phrase. Two measures were used to assess the effects on the research participants: test scores, and scores on an attitudinal questionnaire.

The researchers (Butler & Nisan, 1986) found that both of the groups that received written feedback (i.e., numerical grades or comments) fared better on the anagrams task than the no-feedback group did. Further, the group that received comments demonstrated enhanced performance on the divergent thinking exercise. But this only reflects the relationship between written comments and performance. The results from the attitudinal questionnaire indicated that the written-comments group exhibited a significantly higher level of interest than did the other two groups. So, written comments conditionally resulted in performance gains, and had a consistently measurable impact on interest. In addition, the written-comments group "tended to attribute success to internal, motivational factors such as effort and interest" (p. 214). The authors speculated that the task-related comments fostered "a climate characterized by high interest and personal causation" (p. 215). This research provides evidence for affects from written feedback outside the sphere of immediate academic performance gains.

One other finding from the Butler and Nisan (1986) study is noteworthy. Students were asked which form of feedback they preferred. Nearly 79% of those who received grades would have opted for written comments, while over 86% of those who received feedback were satisfied with this form of assessment. Most students would rather have feedback—even feedback that includes critical comments—than straight numerical grades.

Around the same time that the Butler and Nisan (1986) study was occurring, another group of researchers, halfway around the world, was conducting a similar, more extensive experiment. Elawar and Corno (1985) trained eighteen sixth-grade Venezuelan teachers on procedures for providing written feedback on mathematics homework. These

teachers subsequently taught 504 students across three public elementary schools in Guayana City, for a period of ten weeks. Changes in student attitudes were gauged based on four standardized assessment tools: The Coopersmith Self-Esteem Inventory (Coopersmith, 1967), a Quality of School Life Questionnaire (Epstein & McPartland, 1976), a Children's School Questionnaire (Phillips, 1966), and Atkin's (1974) Scales E. and V., which measure attitudes toward mathematics. Based on ANOVAs, the researchers concluded that the feedback intervention accounted for 57% of the variance in student attitudes toward mathematics. Feedback also improved student achievement. The authors contend that written feedback should "become an important focus of teacher effort whenever cognitive and affective objectives such as these are valued educational goals." (pp. 172-3).

One final study deserves attention in this subsection. In 1988, Jerram, Glynn and Tuck instituted written feedback in a fifth grade classroom in an Auckland, New Zealand suburban primary school. Over a 29-week period, the teacher established a baseline of behavior without feedback, instituted written feedback, withdrew feedback, and, finally, re-introduced the intervention. This *ABAB*-type research design permitted the class of 24 students to serve as their own control group. By plotting the quantity and quality of students' journal writings, the study's authors were able to demonstrate a dramatic cause-and-effect relationship between teacher's written commentary and student performance. The most intriguing aspect of this study was its single-group design.

Unfortunately, there is a significant empirical gap in the research cited in this section: The instructors' written comments were not clearly defined; the researchers made vague statements about the structure and content of their feedback. Dependent variable

measures such as performance and attitude were measured with established instruments, but the independent variable, written feedback, was a murkily-defined categorical variable. In truth, feedback is not a dichotomous construct, and to treat it as such weakens its explanatory power.

If written feedback is to be measured, a tool is needed that assesses both the observable aspects of feedback and the intangible, student-perceived utility of teacher-provided feedback. This latter component of feedback is an elusive characteristic because the latent variable is students' endorsement of feedback, which includes both a general component and context-specific beliefs. To be effective, feedback must assist students in reaching their educational goals. Attitudes and effectiveness may vary by course, teacher, or subject area. While several authors have reflected on the importance of feedback in learning, no research was found that dealt directly with this pedagogical construct. Several researchers implemented studies with a feedback component, but the feedback content and construction were ill-defined. Therefore, an instrument to measure feedback was constructed for this research.

Fortunately, previously described research provided some guidance in the area of feedback's dimensions. Feedback can be classified along a "guidance" continuum, from non-corrective (i.e., simply differentiating between right and wrong answers), to simple correction (i.e., providing correct answers), to varying levels of analyses of errors (e.g., pointing out specific calculation mistakes) (Cohen et al., 1985). Feedback can also be categorized based on depth of analysis, from surface edits, to clarification edits, to content edits (Matsumura et al., 2002). Feedback can be further classified on a "functional" scale, based on its cognitive and affective intents: to instruct (i.e., to depart

specific information), to praise, to direct (i.e., to provide general direction), to question, to call attention to, and to answer (Bardine, 1999). At a more simplistic level, feedback may be designed to guide students toward making attributions of either effort or ability (Schunk, 1982, 1983). Likewise, teachers may provide either positive or negative comments concerning effort, ability, conduct, and general performance (Foote, 1999). At a much more complex level, feedback may be structured to be compatible with student's educational goals (Dweck, 1986; Miller et al., 1993).

No research was located that tackled the multidimensional complexity of feedback. But Wiggins (1998) provided the most comprehensive treatment of the subject. His writings, augmented by others, were used to construct a tool to measure feedback. It is important to recognize that written feedback was treated as a continuous variable that was measured as an incremental increase over "normal" feedback. In other words, since no classroom environment is devoid of teacher-provided feedback, written feedback was viewed as both a quantitative change to existing instructional activities, and a qualitative change to teaching techniques.

As mentioned previously, feedback was investigated to determine its effects on academic performance and motivation. A prerequisite for this research was a tool to measure academic motivation. The next topic considers prior research on academic motivation and associated measurement tools.

Academic motivation.

Educational research is replete with measures of academic performance, at all grade levels, in every subject area, and in a variety of mediums. However, only a handful of researchers have undertaken the challenges of measuring and manipulating academic

motivation and goal orientations. Connell (1985) developed a scale to measure the locus of control component of motivation. His measurement tool consisted of 48 self-report, four-point Likert items to assess third- through ninth-grader's perceptions of control along three dimensions: cognitive, social, and physical. The underlying assumption is that individuals will tend more toward intrinsic motivation (along the continuum) if they perceive higher levels of control. Unfortunately, in light of the preceding discussion on the composition of motivation, locus of control does not sufficiently reflect motive. Connell's work is informative, but his survey was inadequate for this dissertation.

Haladyna (1980) constructed a survey that took a much broader view of influences on school-related attitudes. The Inventory of Affective Aspects of Schooling (IAAS) measured teacher, student, and environmental characteristics that reflected school attitudes. This instrument was administered to 601 fourth grade students, yielding measures on 34 latent variables across four subject areas (English, mathematics, social science, and science) and school in general. Although the survey provided useful information, there were a couple of concerns. First, it was too generic: specific teacher characteristics, parental behaviors, and environmental conditions may affect motivation, but some of the questions were rather broad. For example, it is unclear how the question "Do your parents spend a lot of time talking with you?" directly relates to academic motivation. Second, the measurement scale was too coarse. Most responses were measured on a three-point scale (e.g., yes/no/maybe; often/sometimes/hardly ever). The resultant scores had low variance.

The following year, Estes, Estes, Richards, and Roettger (1981) collaborated to produce the Estes Attitude Scales: Measures of Attitudes Toward School Subjects.

There were two forms of this survey, one for early elementary grades, K-3, and one for grades 4-12. The latter instrument contained 75 questions, evenly spread across five subject areas: English, math, reading, science, and social studies. The five sub-scores and the overall score supposedly reflected dispositions toward individual subjects and toward school in general. Again, intuitively, some of these questions would appear to assess academic motivation. For example, "The study of English is a waste of time," "reading is a good way to spend time," and "people who like math are often weird" would seem to reflect academic attitudes.

One of the premier advocates of academic motivation is Adele Gottfried (Gottfried, 1983; Gottfried et al., 2001; Gottfried & Gottfried, 1996). Gottfried originally proposed the construct of academic intrinsic motivation. She and her colleagues created a survey instrument called Children's Academic Intrinsic Motivation Inventory (CAIMI) to measure this psychological construct. The CAIMI is intended for children in grades 4-8. It is designed to measure academic motivation across four subject areas (reading, math, social studies, and science) and school in general. The subject-specific scales are each based on 24 Likert-type questions and a pair of forced-choice items. Students provide four responses to each question, one per subject area. The general scale is based on an additional 18 items. This survey looks like a good measure of academic motivation. However, the instrument is designed to assess multiple subject areas concurrently. As such, it would have required modification to focus strictly on mathematics. In addition, this survey is seventeen years old (1986), raising the possibility that it may be somewhat dated.

More recent surveys provided additional guidance in measuring academic motivation. Renown researchers Pintrich and DeGroot (1991) developed a Motivated Strategies for Learning Questionnaire "to assess college students' motivational orientations and their use of different learning strategies for a college course" (p. 3). They subdivided strategies into two categories, those geared toward motivation and those aimed at learning. They employed an expectancy/value paradigm in assessing motivation. Examples of motivationally directed questions include, "In a class like this, I prefer course material that really challenges me so I can learn new things," and "I think I will be able to use what I learn in this course in other courses." Unfortunately, this instrument is confined to college students, and it focuses on a single course rather than general academic attitudes.

Majoribanks (1992) provided a parsimonious twenty-item, 5-point Likert-type questionnaire to assess attitudes toward school. While there is overlap between school attitudes and academic motivation, the two constructs are different. For example, the prompt "I get on well with my teachers" reflects an attitude toward the school environment, but it may only weakly correlate with academic aspirations. Similarly, the prompt "overall, I like school quite a lot" may reflect a social attitude rather than an academic one. However, intuitively, many items may relate to academic motivation (e.g., "I like fooling about during my lessons," and "I work and try very hard at my schoolwork"). Care must be exercised in distinguishing between attitudes toward a particular school environmental characteristic (e.g., a relationship with a particular teacher, or level of interest in a specific class) and overarching motivational attitudes. While these situational interests and intents are important, they are fleeting (Krapp et al.,

1992; McClelland, 1971). True motivational inroads need to affect enduring actualized interests, personal interests and motive dispositions.

Finally, Midgley et al. (2000) constructed a *Patterns of Adaptive Learning Scales* (PALS) "to examine the relation between the learning environment and students' motivation, affect, and behavior" (p. 2). The student-directed portion of the PALS self-report consists of 94 Likert-type questions on a 5-point scale. Originally published in 1997, this scale has undergone several field tests and refinements. It is predicated on the assumption that students' motives and behaviors revolve around "mastery" and "performance" goal orientations. This survey instrument held promise: It is age-appropriate; relevant to the question at hand; customizable for the specific issues being investigated; and easy to administer and score. The survey's authors granted permission to use the instrument, in either its original form or a modified form.

The final personality construct that was measured is students' goal orientations. Several authors focus on two categories of academically-related goals (e.g., learning goals and performance goals) (Ames, 1992; Dweck, 1986; McCombs, 2001). In contrast, Ford (1992) presents a taxonomy of two dozen goals distributed across six categories (i.e., affective goals, cognitive goals, subjective organization goals, self-assertive social relationship goals, integrative social relationship goals, and task goals). Neither of these two extremes addressed the question under study. The issue was not what goals did the student possess, but, rather, how much personal or instrumental interest did this goal hold? How committed was the student to learning, regardless of the underlying reason(s)?

Deci and Ryan (1985) provided additional insight into this issue. They posit that motivation lies on a spectrum from amotivation (i.e., complete lack of motivation), to extrinsic motivation, to intrinsic motivation. This progression is reflected by its increasing level of internalization. Extrinsic motivation is further subdivided into four regulatory types: External regulation, introjected regulation, identified regulation, and integrated regulation. The distinguishing feature of these categories is the degree of "ownership" that the individual feels. Many discussions of Deci and Ryan's work focus on the extrinsic/intrinsic dichotomy. However, for the purposes of academic motivation, an external/internal regulation dichotomy is more relevant. The issue was whether students would self-regulate their learning, regardless of ulterior motive. From this perspective, amotivation, external regulation, and introjected regulation are undesirable attributes, whereas identified regulation, integrated regulation, and intrinsic motivation are favorable.

Goal orientations and strengths needed to be measured. The *Patterns of Adaptive Learning Scales* (PALS) survey (Midgley et al., 2000) met this requirement. PALS contains a number of questions that assess goals, and the Likert scale reflects the intensity of these feelings.

Summary of the Literature

Throughout this chapter, the argument was made that written feedback affects academic motivation, academic performance and student goals. It was proposed that the effectiveness of feedback is dependent on how the recipient attends to, interprets, and reacts to the information presented. A substantial body of theory and research revolves around motivation and academic performance, while considerably less progress has been

made toward measuring academic motivation, and no empirical measures of written feedback were located. As educators, one of our goals is to maximize academic performance. Academic motivation provides one path toward this goal, and feedback is an essential ingredient of motivation.

Once the feedback construct was adequately identified, the next step was to assess how effectively teachers were employing this tool, and how feedback influenced academic performance and motivation. The research described in the ensuing chapters investigated several aspects of this topic. Specifically, the following issues were addressed:

1. Instruments for empirically measuring feedback were constructed, employed, and evaluated.
2. A causal relationship was investigated, between empirically measured feedback and feedback's perceived effectiveness (as subjectively interpreted by the recipient).
3. Perceptions of feedback effectiveness on motivation and academic performance were explored.
4. The relationship between the caliber of written feedback and the quality of the graded assignment was investigated.

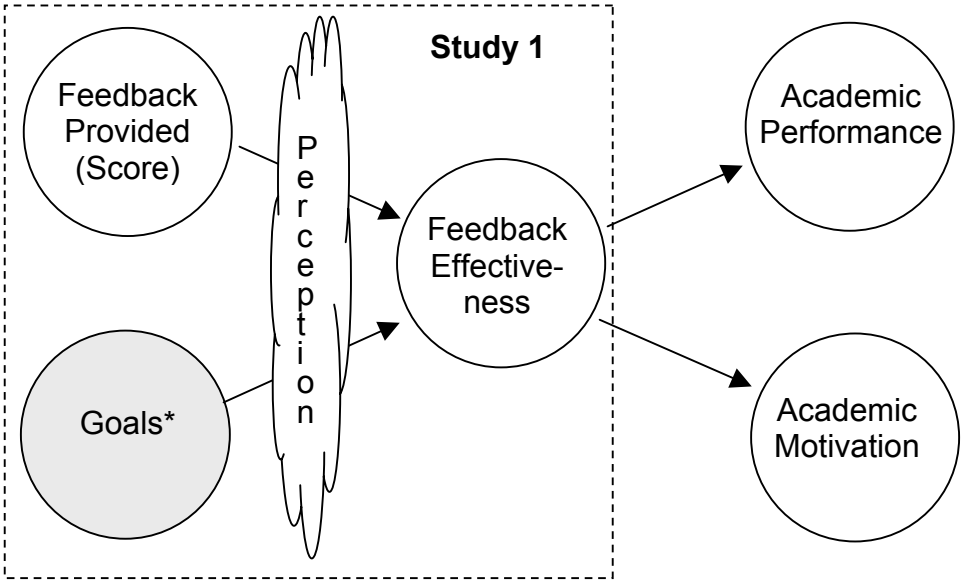
A thorough understanding of the utility of written feedback should improve educators' abilities to facilitate motivation and enhance academic performance. To gain this understanding, educators must be cognizant of the dimensions of feedback, and attuned to how feedback is appropriated by its recipients. These issues are explored more fully in the next three chapters.

Chapter 3 Study 1 – Feedback Dimensions

Chapter 2 synthesized prior research on the effects of feedback on academic motivation and student learning. The argument was made that motivation occurs within a social context, through the interaction of an individual's goals, emotions, and personal agency beliefs. With respect to academics, feedback from the teacher serves as a key contributor to motivation. However, the attributes of this feedback had neither been fully documented nor empirically measured, and the link between feedback, academic motivation, and learning had not been established. This study analyzed the relationship between the objective measure of written feedback and the students' subjective interpretations of feedback effectiveness. Measurement instruments were developed to assess both of these perspectives on feedback.

As shown in Figure 2, the fundamental hypothesis of this research was that student perceptions of the effectiveness of feedback influenced both academic motivation and academic performance. Feedback effectiveness was, in turn, a derivative of the feedback provided in conjunction with the individual's goals, mediated by the individual's perception of this information.

There are two key points worth noting in this conceptualization. First, the primary foci of this investigation were the relationships between the student perceptions of feedback effectiveness and their impact on academic motivation and performance. However, feedback effectiveness is formed by blending the teacher's feedback with goals, refracted by the recipient's psychological perceptions. The ultimate goal of this research was the study of the impact of student perceptions of feedback on their academic motivation and performance.



* Not Measured

Figure 2. Hypothesized Relationships Investigated

Second, in the current research, students established short-term and long-term goals, and periodically reviewed their long-term goals. While it is believed that goal establishment and maintenance contributed to feedback effectiveness, goals were not directly measured (as indicated by the shading). However, the research was designed to demonstrate the effects of feedback over and above the isolated impact of goals. Study 1, described in this chapter, deals with the left-hand portion of Figure 2, the causal relationship between the caliber of the teacher's feedback and student interpretations of feedback effectiveness.

Written feedback was too pervasive of an activity to be studied in its entirety. Prior research was used to triangulate this study toward fourth grade students. Gottfried and colleagues (Gottfried et al., 2001; Gottfried & Gottfried, 1996) provided evidence that academic motivation becomes increasingly stable as children mature, and that motivation at age 9 (approximately fourth grade) predicts motivation at age sixteen. Based on this research, academic motivation should be addressed in the early elementary years. Conversely, research by Nicholls (1978) indicated that young children cannot make accurate causal ascriptions for the outcomes of their labors; it is not until around the age of twelve that children fully understand that outcomes are achieved through a combination of effort and ability. This evolving comprehension of the interrelationship between effort, ability, and outcome suggests that causal feedback would be more effective in the later elementary grades. Fortunately, the cause-and-effect relationship between effort and outcome becomes ingrained around age nine, so younger children should accrue some benefits from written feedback. A fourth grade intervention struck a

balance between addressing the issue of academic motivation in a timely manner and providing effort/ability/outcome-related feedback prematurely.

A single subject area was selected to limit further the scope and manageability of this research. The targeted area was one that provided ample opportunities for elaborative feedback that was somewhat objective. Mathematics was selected because faults in these written assignments readily lend themselves to extemporaneous teacher commentary. The researcher believes that effective written feedback has motivational benefits in all subject areas, but the math curriculum was most accessible for the purposes of this research. Therefore, this research was confined to written feedback within the field of mathematics, at the fourth grade level.

As mentioned earlier, the fundamental question under study was whether student perceptions of feedback effectiveness influenced academic motivation and academic performance. However, an appropriate foundation was needed upon which an answer could be built. Therefore, the following issues were addressed by Study 1:

1. A formal measure was developed to assess the written feedback that teachers provide.
2. Teachers and students have different perspectives on the efficacy of written feedback. While there is, hopefully, a significant commonality in perspectives, student interpretations of feedback ultimately influence their motivations. This research investigated the relationship between the two perspectives on feedback.

If motivation derives from a combination of the person, his or her behavior, and the environment, then motivation is best studied under authentic conditions. Therefore, this research was designed to occur within a regular classroom, employ conventional

instructional materials, and augment the teachers' regular practices. A reasonably non-intrusive intervention was designed to supplement traditional teaching approaches. The intent was for the added components to enhance motivation without unduly taxing either the teacher or the students.

Methodology

Overview

The purpose of this study was to establish a relationship between feedback scores (i.e., what the teacher wrote) and student impressions of feedback effectiveness (i.e., what the student thought of the commentary). At points during the study, unbeknownst to the students, the classroom teacher varied the intensity of the written feedback that she provided on assignments. Throughout the study, students completed Feedback Effectiveness Surveys, critiquing the teacher's written commentary. The expectation was that students would give more favorable reviews of the teacher commentary during the periods where it was more elaborate. This study also provided data that were used in a post hoc analysis aimed at identifying qualitative links between the teachers' written feedback and student impressions of feedback effectiveness.

This study employed an *ABAB*-type methodology, a form of single-subject design (Creswell, 2002). Under this approach, baseline measures are taken prior to the intervention (the initial period, A_1); educational components are added (i.e., the intervention is performed, B_1); the intervention is removed, returning to baseline (period, A_2); and, finally, the intervention is reinstated (the second intervention period, B_2). Figure 3 shows the graphical representation of a hypothetical *ABAB*-type study.

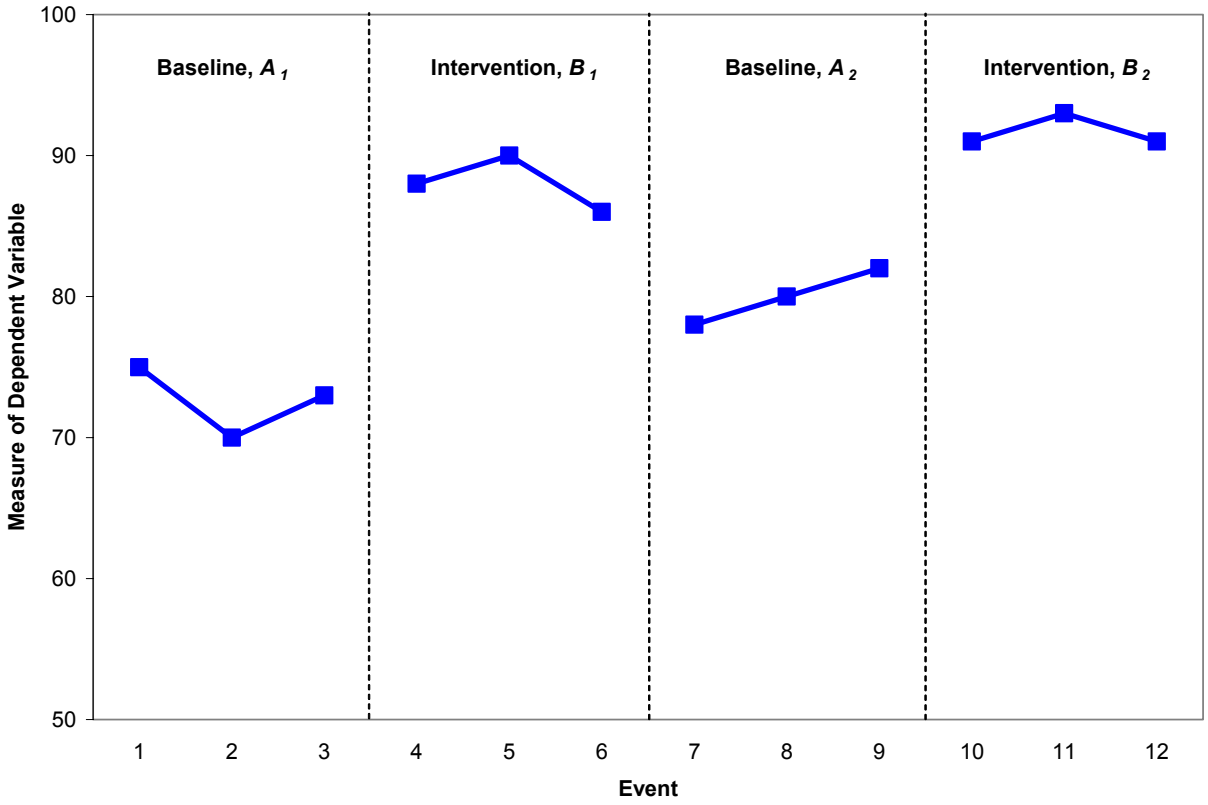


Figure 3. Hypothetical *ABAB*-type Study

The *ABAB*-type approach is one type of *reversal design* study where the intervention is withdrawn during the study (at period A_2). Schloss and Smith (1994) advise that the introduction of a second intervention phase (B_2) enhances the internal validity of the study by ruling out the potential effects of maturation and history; if there are discernable differences in the dependent variable between the baseline phases (A_1 and A_2) and the intervention phases (B_1 and B_2), the independent variable is the likely cause.

This research was a comparison among instructional techniques, in a commonly accepted educational setting (i.e., a regular classroom). Further, removal of the intervention, during period A_2, was considered ethical because this discontinuance provided the means of establishing whether the intervention was beneficial; there could have been alternate explanations for improvements noted during period B_1.

The moral, ethical, and professional quality of the intervention was enhanced through prerequisite reviews of this proposal by all of the following: The Institution Review Board of the University of Missouri-St. Louis (see Appendix A, page 162); the school district's administrative office; the principal of the participating school; and the teachers of the participating classrooms. In addition, consent was obtained from parents or guardians (see Appendix B, page 163).

Participants

This study involved fifteen students (five males and ten females), within a single classroom, and their female teacher. The participants were from a fully accredited, suburban school district with an enrollment of approximately 20,000. Students were generally middle class, with just under one-third of them eligible for free or reduced

meals. Average daily student attendance was around 95%, and the student-to-classroom teacher ratio was 17:1. Per-pupil spending was approximately $8,300 per year.

The school was selected based upon practical considerations, including geographic location, the teacher's general educational practices, and the teacher's and students' willingness to participate.

All students were invited to participate in the study. Some students declined to participate. Those who declined still performed all academic activities, but were exempted from completing any of the research-related measurement instruments. Students participated in the study during the second semester of fourth grade. This study involved twelve sampling points during eleven consecutive weeks, beginning January 19, 2004.

Variables and Measures

The study included one independent variable and one dependent variable. The independent variable was the intervention *period*, during which the teacher's oscillating level of feedback was expected to be reflected in the feedback score. The dependent variable was student perception of feedback effectiveness.

Feedback score.

Feedback score is a measure of the written commentary that a teacher provides on graded student assignments. For example, an assignment that is returned with just a grade, checkmarks, or a final score, lacks explicit feedback.

No preexisting measure was found for assessing the caliber of the teacher's feedback. However, as described in Chapter 2, there were a number of studies that provided insight in this area. Appendix C (page 167) shows the Feedback Assessment *Rubric* (i.e., an

analytical measure of feedback) that was created to assess both a feedback score and a feedback rate (described next). The categories used in the feedback rubric are those identified by several authors. Bardine's (1999) research resulted in the following categories: providing praise, performing instruction, directing the student elsewhere, asking probing questions, focusing the student's attention on something, and offering answers. Schunk (1983) furnished the rational for subdividing praise into accolades for ability and comments on effort. Foote's (1999) work suggested a *general* category (e.g., "that's very good" (p. 166) and "that's not what I'm looking for" (p. 166)). Cohen (personal communication) suggested an additional category, *digressions*, to reflect comments that did not relate directly to the assignment, but conveyed information and/or sentiment (e.g., "Thank you for helping *name* yesterday").

During the first two weeks of the study, an additional category was devised. The teacher frequently provided some general sign of happiness, with either the caliber of the assignment or with the student. Signs of happiness, or *pleasure*, were often signified by smiley faces (☺), stars (★) or stickers. The general sentiment was that the teacher was pleased, but the cause of the pleasure was unspecified.

Finally, two intensity levels, average and high, were assigned to the *effort* and *ability* comment categories based on an intuitive belief, by this researcher, that not all effort- and ability-oriented comments are equivalent. For example, teacher praise of "nice job" and "FANTASTIC!" are not equivalent amounts of praise. Therefore, the feedback score represents the number and intensity of informational clauses placed on the student's assignment.

Feedback score was measured on an open-ended ratio scale, reflecting the number of information-transmitting clauses, weighted by intensity (i.e., high-intensity clauses counted double). In theory, feedback score could have been zero (i.e., no teacher commentary) or any positive integer. In this study, feedback scores ranged from zero to eleven. The composite numbers used in calculating the final feedback score were saved to permit post hoc analysis of feedback determinants. Appendix D (page 168) contains several examples of comments and their associated feedback categories.

Since the researcher computed feedback scores and was aware of which *ABAB* period was in progress, there was the possibility that scores could have been marked artificially higher during the intervention periods, to favor the study's results. This bias was guarded against by consistently employing the *Examples of Feedback Categories* (Appendix D), and counting every teacher notation as an occurrence of feedback.

Feedback rate.

Feedback rate is the quotient of the feedback score divided by one plus the number of incorrect responses. This measure is meaningful because, intuitively, the feedback score should be inversely correlated with assignment quality. In other words, an assignment with few errors (i.e., high quality) would probably have a fairly low feedback score (i.e., few comments), whereas a poor assignment (i.e., low quality) might be peppered with comments, resulting in a high feedback score. The introduction of a feedback rate measure, reflecting comments per error, provided a means of compensating for differences in assignment quality. In theory, feedback rate can range from zero or any positive number. In this dissertation, the feedback rate ranged from 0 to 11.5.

Feedback effectiveness.

The two preceding variables considered feedback from the researcher's perspective; feedback score and feedback rate were based on an independent evaluation of the commentary by the researcher. However, the real utility of feedback depends on how the recipient assimilates this information. Feedback effectiveness is the student's view of the caliber of feedback.

The Feedback Effectiveness Survey (Appendix E, page 169) was developed for this study, using concepts derived from a variety of sources, including Pintrich and DeGroot's *Motivated Strategies for Learning Questionnaire* (1991), Majoribanks' *Attitudes-to-School* self-report survey (1992), and *The Estes Attitude Scales: Measures of Attitudes Toward School Subjects* survey (Estes et al., 1981). The resultant instrument contained twelve, 5-point, Likert-type questions and one open-ended question. These questions probed the students' views on several aspects of the commentary on the returned assignments. Feedback effectiveness measures could range from 12 to 60. However, in the current research the actual values were from 16 to 60.

The intent of the questionnaire was to determine whether the student understood the feedback, appreciated the comments, found them helpful, found them valuable, and characterized the teacher's tone as one of caring and concern. The questionnaire was brief because it needed to be employed numerous times throughout the study. Low scores reflected ineffective feedback (e.g., too few comments, the student still does not understand what he or she did wrong, and perceived teacher insensitivity). Conversely, high scores indicated that the student found the feedback to be useful, valuable, and emotionally gratifying.

Feedback effectiveness was the key dependent variable in this study. It was expected that an increase in the effectiveness of feedback would yield corresponding improvements in academic motivation and performance, a relationship that was explored in Study 2.

Goal-directed behavior: Proximal goals and effort expended.

Motivation is goal-directed behavior. Therefore, goals are a precondition for motivation. In order to help establish short-term (proximal) goals, students completed a simple two-question prelude to each assignment, using Part 1 of the Assignment Rating Slip (Appendix F, page 170). This goal-setting activity consisted of asking the student to indicate the number of questions on the assignment, and to specify a minimum number of problems that he or she would strive to complete correctly. This activity was based on research by Manderlink and Harackiewicz (1984) that revealed the contradictory nature of performance goals. The goal was intended to be autonomous rather than imposed, and personal rather than aloof. It was speculated that an explicit, self-set goal would increase academic commitment (cf. Ames, 1992).

Part 2 of the Assignment Rating Slip (Appendix F) was a four-question postscript to student homework assignments. The student was to rate the difficulty level of the assignment, to tell how much time was spent on the assignment, to rate the level of effort expended in completing the assignment, and to indicate whether the assignment was completed without assistance. This instrument was designed specifically for this dissertation. It was intended to provide the teacher with insight into the student's beliefs concerning assignment difficulty and effort expended. The purpose of this postscript was to help the teacher assess the level of investment that a student had in the assignment, so

that circumstantially appropriate feedback could be provided. For example, one student may believe that an assignment was overwhelming, while another may have felt it was facile; one student might have given it short shrift while another agonized over it. Teacher feedback would not be given legitimacy if its messages were in conflict with student beliefs. In keeping with this spirit, teachers should only compliment effort if the student feels that substantial energy was expended. Likewise, students should only be coaxed and cajoled to work harder if they believe that they had been lax. The assignment postscript provided the teacher with information to assist in making circumstantially appropriate ability and effort attributions.

Design

This study employed an *ABAB*-type, within-subjects, *reversal* design. The independent variable for this study was the *ABAB* "period." It was expected that the written feedback score of teacher commentary on mathematics assignments would vary by period, thus allowing the level of teacher commentary to be used as an independent variable, too. The dependent variable was the effectiveness of the written feedback, from the recipient's perspective (i.e., as gauged by the students).

All written feedback was provided by the students' regular classroom teacher. However, the caliber of the written feedback was measured by the researcher rather than by the teacher for three reasons. First, these measures were taken during both the baseline periods and the intervention periods. If the teacher was cognizant of the evaluation criteria during baseline, it could have influenced her approach to providing feedback, compromising the internal validity of the research through diffusion of treatments. Second, elementary school teachers are already heavily burdened with

responsibilities. Adding the enhanced written feedback component increased the teacher's duties. If she were then required to assess the feedback, she might have become overwhelmed. Finally, the primary focus of this study was the relationship between feedback scores, from an objective perspective, and the subjectively perceived effectiveness of the feedback, from the recipient's perspective. Therefore, it was appropriate that the researcher evaluate the feedback that the teacher provided.

Procedure

Conceptually, the intervention was straightforward: Students were to receive higher quality written comments on their assignments in the hopes that this feedback would be interpreted as more effective. However, the process of providing "high quality" written feedback was elusive. Therefore, the intervention was somewhat involved, to maintain quality control. The study lasted eleven weeks, subdivided into four periods. The first three periods lasted three weeks. All activities for the fourth period were compressed into two weeks to complete the study prior to the district's Spring Break. The periods were: An initial baseline period of observation and monitoring, A_1; an intervention period, B_1; a withdrawal and return to baseline period of observation and monitoring, A_2; and a second intervention period, B_2.

The researcher had no direct interaction with the students; he was introduced to the students but was not present during any classroom activities. The researcher scored various measurement instruments, and collaborated with the teacher, but was not directly involved in the instructional or feedback processes. The activities that occurred during this study are summarized in Table 2 and described below.

Table 2. Summary of Activities Performed During Study 1

Activity	Feedback Events											
	Period A_1			Period B_1			Period A_2			Period B_2		
	1	2	3	1	2	3	1	2	3	1	2	3
Goal-setting activity	♦											
Mathematics assignments	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Rate feedback dimensions	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Weekly updates to teachers					♦	♦	♦				♦	♦
Review goal statements		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Workshop on teacher feedback				♦								

Baseline Period, A_1.

1. The teacher assisted the students in establishing long-term (distal) academic goals for their work in mathematics during the upcoming 11 weeks (i.e., the investigation period). Appendix G (page 171) contains the script that was provided to the teacher for use in this Goal Setting Activity. The script was intended as a general guide, and the teacher was free to adapt it to her own personal style. However, she reported that she closely followed the script.

   The goal-setting activity was a 10- to 15-minute discussion of math in everyday life. At the conclusion of the discussion, students reflected upon and provided written, private responses to the following short-answer questions:

   a. There are many ways that someone my age might use math, including…

   b. Considering what I want to do when I grow up, math might be useful for…

   c. By the end of this semester, my goals in math are…

   Students were instructed to retain their private goal statements in a location where they could be accessed at future points throughout the semester. Individual goals were not seen by either the teacher or the researcher. Students reviewed their goal

statements weekly, throughout the study. The periodic review of distal goals is consistent with Manderlink and Harackiewicz's (1984) finding that "distal goals… provide some competence information, but in a less controlling context" (p. 920). The presence of distal goals was intended to provide additional salience to the "enhanced" written feedback given during the intervention phases.

Note that goals were established during the baseline period so that their effects, if any, would be present throughout the study. This was done because the issue under consideration was the combined effect of the teacher's feedback in conjunction with personal goals, mediated by student perceptions. By introducing goals at the outset, the differential effects of enhanced teacher feedback could be assessed during the intervention periods.

2. The class engaged in its normal learning activities. This may have included teacher-led activities, collaborative learning exercises, or any other educative approaches that the teacher chose to employ.
3. Throughout this period, students received intermittent written assignments, as part of the teacher's normal instructional practices. The assignments included both in-class, independent activities and take-home assignments.
4. Students set short-term (proximal) goals for one of the week's written assignments (Appendix F, Part 1, on page 170). This goal setting activity simply asked students to tell how many problems were on the written assignment, and to establish a target number of problems that they thought they were capable of solving correctly. Students were then to complete the assignment. For this study, the number of problems per assignment varied from 12 to 38.

5. As an epilogue to this assignment, students used the second half of the Assignment Rating Slip (Appendix F, Part 2, on page 170), to provide the teacher with some insight on the perceived difficulty of the assignment and the effort expended in completing the work.
6. The teacher graded all written assignments using her usual procedures; no special emphasis was placed on written feedback. It should be noted that some written feedback was inevitable during this baseline period, but the caliber of this feedback was expected to be lower than during the intervention period.
7. On one of the week's written assignments (the same assignment selected for steps 4 through 6), each student used the Feedback Effectiveness Survey (Appendix E, page 169) to rate their impressions of the efficacy of the teacher's written feedback on the corresponding assignment.
8. The researcher used the guidelines from the Feedback Assessment *Rubric* (i.e., an analytical measure of feedback, shown in Appendix C, page 167) to assess the written feedback provided on the assignment.
9. The teacher was to incorporate the skills that the students exercised in completing the aforementioned assignment into a subsequent lesson or assignment. For example, if an assignment dealt with adding fractions, a similar classroom activity (or unit test) was supposed to follow the return of the graded assignment. This step was necessary to insure that the feedback occurred during formative assessment.
10. For each "surveyed" assignment, the following data were collected: Assignment grade, the total number of problems, the number of errors made, the feedback score and its components, and feedback effectiveness ratings, by item.

11. Completed assignments and surveys were collected from the participating school's office each Friday afternoon. The following Monday morning, the student papers were returned to the school, along with blank forms to be used during the upcoming week. Also included in the Monday morning packet was a *Weekly Update* letter (refer to Appendix H, on page 175, for an example). The update—generally 1 or 2 pages long—included observations concerning fidelity to the research and suggestions for the ensuing week.
12. At the beginning of each subsequent week, students independently reviewed their distal goals. To maintain autonomy, neither the teacher nor the researcher saw students' goal statements.

First Intervention Period, B_1.

1. At the beginning of this period, the teacher participated in two, one-hour collaborative sessions on providing effective feedback. Details of these sessions are provided in Appendix I, *Constructing Negotiated Written Feedback*, on page 177. General teacher guidance was provided, iteratively augmented by lessons learned concerning what was "working" and what was not effective, based on the accumulated experience gained from the growing inventory of the students' Feedback Effectiveness surveys (see step 12).
2. At the beginning of each week, students independently reviewed their distal goals. To maintain autonomy, neither the teacher nor the researcher saw students' goal statements.

3. As in the baseline period, the class engaged in its normal learning activities. This may have included teacher-led activities, collaborative learning exercises, or any other educative approaches that the teacher chose to employ.
4. Throughout this period, students received intermittent written assignments, as part of the teachers' normal instructional practices. The assignments could have been either in-class, independent activities or take-home assignments. Both assignment types occurred during the intervention period.
5. Students set short-term (proximal) goals for one of the week's written assignments (Appendix F, Part 1, page 170). This goal setting activity simply asked students to establish a target number of problems that they thought they were capable of solving correctly. Students then completed the assignment.
6. As an epilogue to this assignment, students used the second half of the Assignment Rating Slip (Appendix F, Part 2, page 170), to provide the teacher with some insight on the perceived difficulty of the assignment and the effort expended in completing the work.
7. The teacher graded the written assignments. During this intervention period, the grading of the selected assignments (one assignment per week) included an emphasis on written feedback. This emphasis on commentary was the key feature of the intervention.
8. On one weekly written assignment (the same assignment selected for steps 5 through 7), each student rated the perceived efficacy of the teacher's written feedback, using the Feedback Effectiveness Survey (Appendix E, page 169).

9. On this written assignment (the same assignment selected for steps 5 through 8) the researcher used the guidelines shown on the Feedback Assessment *Rubric* (i.e., an analytical measure of feedback, shown in Appendix C, page 167) to measure the written feedback that was provided by the teacher on the assignment.
10. The teacher was to incorporate the skills that the students exercised in completing the assignment into a subsequent lesson or assignment. For example, if an assignment dealt with adding fractions, a similar classroom activity (or unit test) would follow the return of the graded assignment. This step was necessary to insure that the feedback occurred during formative assessment.
11. For each "surveyed" assignment, the following data were recorded: Assignment grade, the total number of problems, the number of errors made, the feedback score and its components, and feedback effectiveness ratings, by item. Descriptive statistics were run against each week's data to confirm that the feedback levels during the intervention period exceeded those of the baseline period.
12. Completed assignments and surveys were collected from the participating school's office each Friday afternoon. The following Monday morning, the student papers were returned to the school along with blank forms to be used during the upcoming week. Also included in the Monday morning packet was a *Weekly Update* letter (refer to Appendix H on page 175 for an example). The updates—generally 1 or 2 pages long—included observations concerning fidelity to the research; comments from students, excerpted from the surveys; general suggestions for the ensuing week; and recommendations for refining the feedback.

Withdrawal and Return to Baseline Period, A_2.

All of the activities described in the section *Baseline Period, A_1* (beginning on page 75) were repeated, with one exception: the first step, the establishment of distal goals, did not recur. During the withdrawal period, the enhanced written feedback that was introduced during the *First Intervention Period, B_1*, was removed, to confirm that feedback measures returned to their pre-intervention state. The teacher had been aware from the outset of the research that feedback should be withdrawn at this point. The periodic Feedback Assessment Rubrics were used to confirm that feedback rates returned to baseline. During some *Weekly Updates*, the teacher received reminders to return to the original feedback levels. Descriptive statistics were run against each week's data to confirm that feedback levels were appropriately amended.

Second Intervention Period, B_2.

All of the activities described in the section *First Intervention Period, B_1* (beginning on page 78) were repeated, with one exception: The teacher did not repeat training in providing feedback; she was simply instructed to resume enhanced feedback. During this period, the enhanced written feedback process was to be reinstated, to confirm that feedback effectiveness was positively affected by the intervention. Descriptive statistics were run against each week's data to confirm that feedback rates exceeded the baseline periods.

Summary of the Procedure

This experiment revolved around providing enhanced written feedback. During the intervention periods, the teacher was to provide high-caliber written feedback to the students. The periodic surveys revealed whether student perceptions of feedback

effectiveness changed throughout the study, and whether period-related variations existed.

The study began with a goal-setting activity. Then, students completed regular written assignments. Weekly, a written assignment was evaluated and returned, and the students subsequently rated their perceptions of the effectiveness of the teacher's feedback. Students reviewed their goal statements at the beginning of each subsequent week. At the beginning of period B_1, a teacher workshop was conducted to promote procedures for providing enhanced written feedback. Periods B_1, A_2, and B_2 proceeded similarly to period A_1. However, during periods B_1 and B_2, the teacher attended to the Assignment Rating Slips, increased the level of feedback that she provided to her students, and reflected on *Weekly Updates*, which included student comments.

Hypotheses

Research hypothesis 1.

The teacher's feedback scores on the Feedback Assessment Rubric (Appendix C, page 167) are significantly higher during the intervention periods, B_1 and B_2, than during the baseline periods, A_1 and A_2. A General Linear Model Repeated Measures procedure reflects temporal differences ($\alpha = .05$).

Research hypothesis 2.

The students' perceptions of feedback effectiveness, as reflected by their scores on the Feedback Effectiveness Survey (Appendix E, page 169)., are significantly higher during the intervention periods, B_1 and B_2, than during the baseline periods, A_1 and A_2. A General Linear Model Repeated Measures procedure reflects temporal differences ($\alpha = .05$).

Results

This study was an *ABAB*-type investigation into the potential causal relationship between the caliber of teacher's feedback and the students' interpretation of the feedback's effectiveness. The study involved one fourth grade classroom in a suburban school district. The class consisted of nineteen students, eight males and eleven females, ranging in age from 9 years, 7 months to 10 years, 7 months (at the beginning of the study). Fifteen students participated in the study, five males and ten females.

The study was comprised of four periods, with three data collection points during each period. The intervention occurred during periods 2 and 4, when the teacher increased the level of written feedback that each student received. The expectation was that the increased feedback would result in more favorable student perceptions of feedback effectiveness.

During the 11-week study, there was a total of twelve measured feedback events (one per week, except for week 10, which included two events, to complete the study prior to the district's Spring Break). Due to illness, resource room commitments, and other absences, only eight of the fifteen students participated in all twelve feedback events. Five students participated in eleven out of the twelve events, and two students participated in ten out of twelve. The actual number of participants considered in the data analysis will vary depending on the statistical test being performed. In each case, sample sizes will be clearly stated.

In this study, the participating students completed 173 Feedback Effectiveness surveys. Although the vast majority of the returned surveys were completed in their entirety, about 2% of the responses were omitted. In these cases, a default response of

"Not Sure," or a value of 3 on a 5-point Likert scale, was used. Use of this intermediate value is justified for two reasons. First, it seems intuitive that intentionally omitting a response is equivalent to being "not sure." Second, some value was needed because leaving the omission null would have caused overall Feedback Effectiveness evaluations to be artificially lowered. If a disproportionate number of omissions occurred during one of the *ABAB* periods, this could have resulted in misleading between-period comparisons. In this study, the data was fairly comprehensive.

Research hypothesis 1

The teacher's feedback scores on the Feedback Assessment Rubric (Appendix C, page 167) are significantly higher during the intervention periods, B_1 and B_2, than during the baseline periods, A_1 and A_2. A General Linear Model Repeated Measures procedure reflects temporal differences ($\alpha = .05$).

Data were analyzed using SPSS version 10.0.7 for the PC. Results of the general linear model considered only eight of the fifteen students since incomplete, insufficient data were available for the other seven participants.

Table 3 provides summary statistics for a test of differences in Feedback Scores, by period. This table shows means ($\overline{X}$) and standard errors (SE) for each of the four periods, and the results of the univariate, Huynh-Feldt Test for period-related differences on the dependent variable Feedback Score. The statistical test indicates that the null hypothesis of no mean differences should be rejected ($p<.01$), providing support for Hypothesis 1. The effect size (or partial eta squared, η_p^2) of .801 estimates that about 80% of the period-related differences in Feedback Scores are due to the intervention.

Table 3. Univariate (Huynh-Feldt) Test Results for Period-related Differences in Feedback Score

Means and Standard Errors, by Period								Univariate Test Results			
A_1		B_1		A_2		B_2					
$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	F	Sig.	η_p^2	Observed Power [a]
1.67	.19	3.98	.20	2.46	.29	4.60	.41	28.14	.000	.801	1.000

[a] Computed using alpha = .05

Research hypothesis 2

The students' perceptions of feedback effectiveness, as reflected by their scores on the Feedback Effectiveness Survey (Appendix E, page 169)., are significantly higher during the intervention periods, B_1 and B_2, than during the baseline periods, A_1 and A_2. A General Linear Model Repeated Measures procedure reflects temporal differences (α =.05).

The univariate test for period-related differences on the dependent variable Feedback Effect (Table 4) provided disconfirming results; contrary to Hypothesis 2, the means of the Feedback Effect did not significantly vary by period.

Table 4. Univariate (Huynh-Feldt) Test Results for Period-related Differences in Feedback Effect

Means and Standard Errors, by Period								Univariate Test Results			
A_1		B_1		A_2		B_2					
$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	F	Sig.	η_p^2	Observed Power [a]
50.2	1.6	49.2	2.4	47.7	2.9	49.3	2.3	.704	.560	.091	.173

[a] Computed using alpha = .05

There are at least five possible explanations for why the Feedback Effectiveness appeared not to vary by period:

1. The intervention was not implemented as intended.

2. Insufficient or incomplete data were available to assess the hypothesis using a General Linear Model Repeated Measures procedure.
3. The examined measures are not reflecting the actual differences between periods.
4. Although there were statistical differences in feedback scores between periods, the differences were not large enough the have a practical effect.
5. Hypothesis 2 is incorrect.

As will be shown, further analysis of the data revealed that feedback effectiveness did indeed increase during the two intervention periods. Figure 4 depicts the group means of the feedback scores and feedback effects, by period and feedback event number. The means were converted to *z*-scores to facilitate comparisons, since feedback scores and feedback effects had vastly different means and standard deviations.

The expectation was that all of the Feedback Scores during the intervention periods, B_1 and B_2, would be higher than all of the Feedback Scores during the baseline periods, A_1 and A_2. Furthermore, if there was a true, positive causal relationship between feedback score and feedback effect, the two sets of measures should be similar and should vary in concert. In actuality, the feedback scores (the blue lines) for the first feedback event of both B_1 and B_2 were considerably lower than during the other two events of these periods, closely resembling the A_1 and A_2 levels.

The unexpected pattern of feedback scores suggests that the intervention might not have proceeded as it was designed. A second set of data appears to support this contention. Table 5 on page 88 shows the Feedback Scores for the twelve feedback events of the *ABAB*-type study alongside those for the first six "weeks" of the quasi-experimental study (refer to Chapter 4). Inspection of this table reinforces the belief that

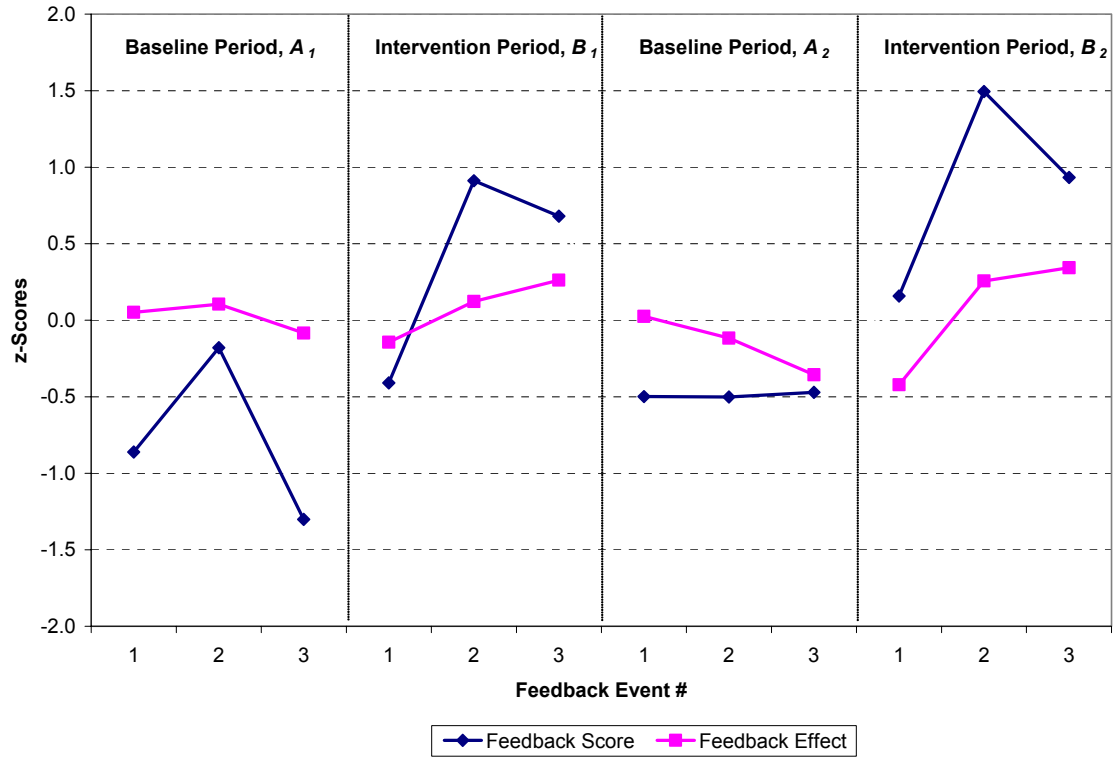


Figure 4. ***z*-scores for Feedback Score and Feedback Effect for the ABAB-type Study by Period and Week**

the feedback scores for the first feedback event of periods B_1 and B_2 (highlighted in yellow) are outside of expected boundaries (i.e., more closely resembling a "control group" than a feedback-enriched "experimental group"). It appears that an increase in feedback scores from A_1 to B_1 and from A_2 to B_2 was not immediate. The introduction of these two weeks into the data lowered mean feedback effectiveness scores and weakened the statistical results.

Table 5. Mean Feedback Scores by Participant Group and Week

Group	Class						
control	1	1.00	2.00	2.44	2.94	1.63	1.81
	2	3.39	2.50	2.64	1.75	0.23	2.56
	Avg.	2.20	2.25	2.54	2.34	0.93	2.18
ABAB	A_1, A_2	1.32	2.80	0.37	2.11	2.10	2.17
	B_1, B_2	2.30	5.17	4.67	3.53	6.43	5.21
experimental	3	3.62	4.12	4.14	7.12	3.54	5.05
	4	4.74	7.56	5.16	6.05	5.75	5.50
	Avg.	4.18	5.84	4.65	6.58	4.64	5.28

A second extenuating circumstance confounded a repeated measures analysis. Complete data existed for only eight of the fifteen study participants; only 53% of the cases were considered in the general linear model. Based on the data that was available to the original model, the Research Hypothesis is not supported. However, an alternate view of the data, while less robust, provides some evidence in favor of the hypothesis. A secondary analysis was performed, using the following approach:

1. Week 1 of each of the four periods was discounted. The first feedback event of B_1 and B_2 was discounted due to the low mean feedback scores, and the first

feedback event of A_1 and A_2 was eliminated to treat the data similarly across the four periods.

2. The calculation of Feedback Effect was amended. Originally, twelve questions were used to assess the effectiveness of the teacher's feedback. However, the following three questions were only peripherally associated with feedback effectiveness:

   - I **expect** to make these types of mistakes in the future.
   - This assignment will help me with future schoolwork.
   - This assignment was of value to me.

   The Feedback Effect was recomputed, using the remaining nine questions.

3. Periods A_1 and A_2 were combined, and periods B_1 and B_2 were combined. A single score was obtained for each student, during each period, to yield an average *Feedback Effect per period*. This was done for two reasons:

   a. To compensate for missing data. The General Linear Model Repeated Measures procedure only considered data from nine of the fifteen students since the other six students had not participated in all twelve feedback events.

   b. To permit a *t*-test to be performed; *t*-tests can only be performed on two groups or, in this case, two periods.

   There were a maximum of 120 possible data points (i.e., 15 students x 8 weeks) that were consolidated into 30 observations (i.e., 15 students x (1 average feedback effect for A_1 and A_2 + 1 intervention average feedback effect for B_1 and B_2)). Only 4 of the possible 120 data points were absent (3%), and every consolidated value was an average of at least three observations.

4. A *t*-test of paired samples was run to determine whether there was a statistically significant difference between the two sets of observations.

The results of this analysis, shown in Table 6, indicate that the null hypothesis of no difference in the means should be rejected ($p<.01$), providing support for the research hypothesis. Further, the effect size (i.e., $d=\frac{\overline{D}}{\hat{\sigma}_D}=\frac{37.21-34.35}{2.51}=\frac{2.86}{2.51}=1.14$) indicates that the means between the *A* periods and the *B* periods differ by 1.14 standard deviations, signifying a large effect.

Table 6. ***ABAB*-type Study Paired-samples *t*-test Results**

Period	Mean	Std. Dev	Std. Error	95% Confidence Interval of the Difference		*t*	df	Sig. (2-tailed)
				Lower	Upper			
Baseline	34.35	5.17	1.33					
Intervention	37.21	4.62	1.19					
Differences	2.86	2.51	.65	1.47	4.25	4.42	14	.001

A graphical representation of the data used in the preceding *t*-test adds further clarity to the differences in feedback effects between periods. As shown in Figure 5, 14 out of the 15 students exhibited at least minimally higher scores during the intervention phase as compared to their baseline scores; only student #9 showed a decline.

In conclusion, there appears to be qualified support for this research hypothesis.

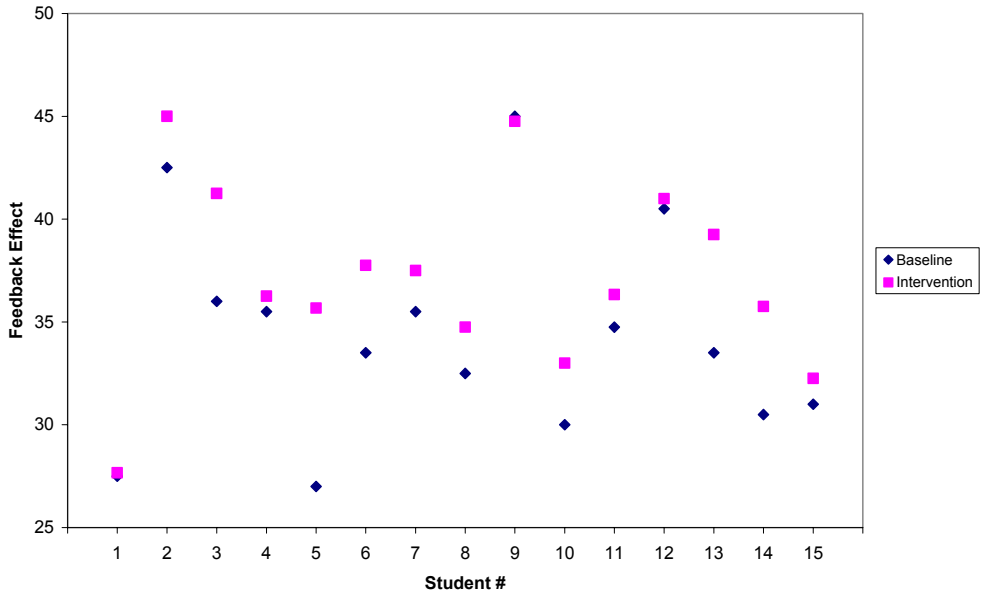


Figure 5. ***ABAB*-type Study Average *Baseline* Feedback Effect vs. *Intervention* Feedback Effect**

Summary of Study 1

This study was intended to demonstrate the causal relationship between the caliber of written feedback provided by the teacher (i.e., feedback scores) and its effect on students' impressions of the quality of the feedback (i.e., feedback effectiveness). A General Linear Model Repeated Measures procedure revealed fluctuations in feedback scores, by period, demonstrating that higher feedback levels occurred during the intervention periods. A paired-samples *t*-test of a judiciously selected subset of the data showed that student perceptions of feedback effectiveness were also higher during the intervention periods. This study provided support for cause-and-effect relationship between feedback scores and feedback effect.

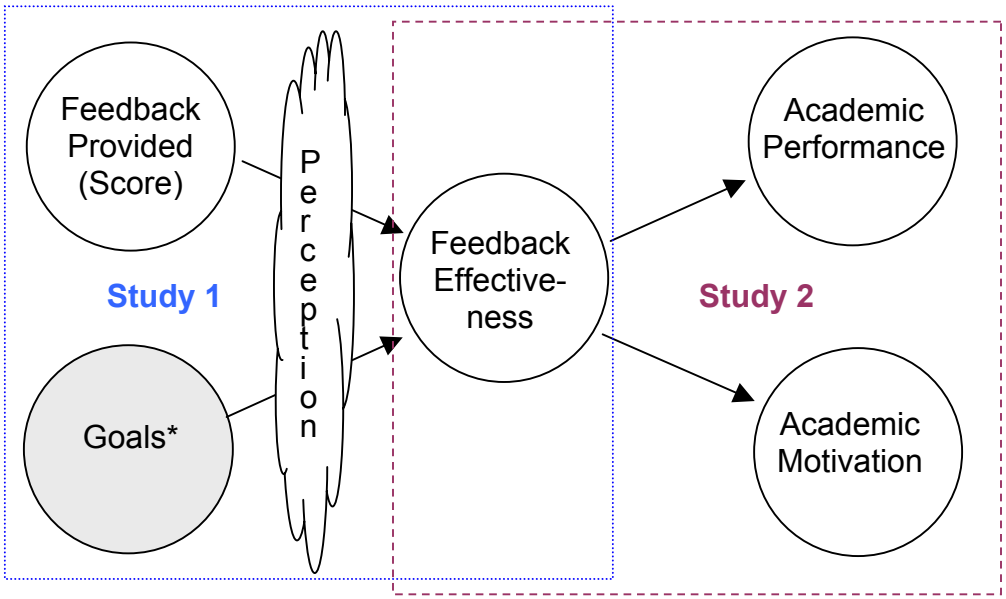
The study did not progress exactly as hoped, and the resultant data was consequently less robust than desired. The obstacles encountered during this study were a normal consequence of field-based research; classroom interventions are subject to the complexities and messiness of the educational milieu, and they tend to yield less pristine results. However, the challenges in data collection and interpretation are offset by the realization that positive results were achieved in an authentic context.

In Chapter 4, Study 2 builds upon the foundations established by Study 1. The relationship between the caliber of the teacher's feedback and student perceptions of feedback effectiveness is used as a springboard for demonstrating the ultimate relationship between feedback effectiveness and academic outcomes, performance and motivation. High quality written feedback empowers students, giving them the guidance and desire to succeed academically. Following the presentation of Study 2, the results of both studies will be discussed, in Chapter 5.

Chapter 4. Study 2 – Academic Motivation and Academic Performance

Chapter 3 began with a discussion of the hypothesized relationships under investigation in this dissertation, and presented Study 1, which examined the causal relationship between feedback scores and feedback effectiveness. Study 2 completed the investigation into the effects of written feedback by examining the impact of student perceptions of feedback effectiveness on academic motivation and performance (refer to Figure 6). The following relevant issues were addressed by Study 2:

1. A formal measure was needed to assess the written feedback that teachers provide. This research facilitated the development of such a measure.
2. Teachers and students have different perspectives on the efficacy of written feedback. While there is, hopefully, a significant commonality in perspectives, student interpretations of feedback ultimately affect their motivations. This research investigated the relationship between the teacher and student perspectives on written feedback.
3. Feedback, as viewed from the student's perspective, should affect academic motivation and performance. This research examined these relationships.
4. The caliber of feedback may vary based on the quality of the student's written assignment. The relationship between assignment quality and the caliber of the teacher's feedback was investigated.



* Not Measured

Figure 6. Hypothesized Relationships Investigated and the Focus of Each Study

Methodology

Overview

The purpose of this study was to investigate the impact of student perceptions of feedback effectiveness on academic motivation and academic performance. It was also intended to provide evidence to reinforce the hypothesized relationship between feedback scores and feedback effectiveness that was the primary focus of Study 1.

Participants

Participants in this study were the students and teachers from four intact, fourth grade classrooms within two suburban schools from a single district. The schools were selected based upon practical considerations, including geographic location, the teachers' general educational practices, and teachers' and students' willingness to participate. Students in the four classrooms served as comparison groups (i.e., two "control" classrooms and two "experimental" classrooms) in a quasi-experimental study, with the primary goals of investigating the relationships between feedback perspectives, and investigating the impact of "effective" feedback on academic motivation and performance.

All 75 students were invited to participate in the study. Informed consent was obtained from participants' parents or guardians (Appendix B, page 163). Ten students declined to participate, and one additional student was subsequently disqualified due to limited English proficiency. Those who were omitted from the study still participated in all academic activities but were exempted from completing any of the measurement instruments associated with the research.

Table 7 shows the number and gender of the student participants in each of the groups. Four female teachers and 64 students participated in this study. The students

were from a fully accredited, suburban school district with an enrollment of approximately 20,000. Students were generally middle class, with just under one-third of them eligible for free or reduced meals. Average daily attendance in both schools was around 95%, and the student-to-classroom teacher ratio was 17:1 in one school, and 18:1 in the other school. Per-pupil spending was approximately $8,300 per year.

Table 7. Study 2 Participants by Group and Gender

Group	Classroom	Participants	Male	Female
Control	1	16	7	9
	2	15	5	10
	Subtotal	31	12	19
Experimental	3	14	3	11
	4	19	9	10
	Subtotal	33	12	21
Total		64	24	40

Students and teachers participated in the study during the second semester of fourth grade. Those in classrooms 1 and 3 participated for seven weeks, beginning on January 19, 2004. Those from classrooms 2 and 4 were subsequently enlisted. They also participated for seven weeks, but their involvement began four weeks later, on February 16, 2004. All students were to complete two pre-tests (i.e., an academic motivation survey and an academic performance test), participate in eight feedback events, and then complete two post-tests.

Variables and Measures

This study included three independent variables and three dependent variables. The independent variables were the treatment group (i.e., the experimental and the control groups), the associated caliber of the teacher's feedback (i.e., feedback score), and the associated level of student perceptions of feedback effectiveness. The dependent

variables relate to students' academic outcomes. They were feedback effectiveness, academic motivation, and academic performance.

Feedback effectiveness.

Feedback effectiveness is the students' rating of the caliber of feedback. This is an attitudinal measure, which may or may not reflect the substantive content of the feedback. Feedback effectiveness was fully described in Chapter 3, in *Variables and Measures* section of Study 1, on page 71.

Goal-directed behavior: Proximal goals and effort expended.

Goal-directed behavior is action specifically aimed at achieving a personal goal. During this study, activities were performed that should have caused students to make explicit long-term (distal) and short-term (proximal) goals for mathematics study. Goal-directed behavior was fully described in Chapter 3 in the *Variables and Measures* section of Study 1, on page 72.

Academic motivation.

Academic motivation is the student's non-compulsory desire to master academic subjects. This desire for expertise may have diverse motives, such as self-actualization, some instrumental value, or ego enhancement. Regardless of the individual's personal goals or ulterior motives, various degrees of academic commitment exist. In the current study, academic motivation is a dependent variable, and is limited to the field of mathematics.

Academic motivation was measured using a slightly modified subset of the *Patterns of Adaptive Learning Scales* (PALS) (Midgley et al., 2000). This instrument was developed and refined by a team of thirteen researchers at the University of Michigan,

over the past six years. The researchers successfully tested the instrument on children in third through ninth grades. They caution against using it for students in third grade or below. The complete *Student Scale* consists of ninety-four items across five categories: Personal Achievement Goal Orientations; Perception of Teacher's Goals; Perception of Classroom Goal Structures; Academic-Related Perceptions, Beliefs, and Strategies; and Perceptions of Parents, Home Life, and Neighborhood.

The utility of the PALS scales is supported by Jagacinski and Dùda (2001). These researchers compared PALS with two other goal orientation scales. Based on surveys of 393 college students, they concluded that the PALS scale did the best job of assessing the psychometric properties of goal orientations. Further, the designers of the PALS report that the Cronbach Alpha measures of internal consistency for the subscales being used in this study range from .78 to .89 (Midgley et al., 2000).

The authors contend that "the different PALS scales can be used together or individually" (Midgley et al., 2000, p. 4). For the current study, the two categories *Personal Achievement Goal Orientations* and *Academic-Related Perceptions, Beliefs, and Strategies* are relevant since they include questions pertaining to feedback. From within these categories, those questions that tap the following personal attitudes and beliefs are germane: *Mastery Goal Orientation*, *Performance-Approach Goal Orientation*, *Academic Efficacy*, and *Avoiding Novelty*. Please note that for the purpose of this study these components of academic motivation are called *Learning Goals*, *Performance Goals*, and *Ability Self-Concept*. Finally, the questions that make generic references to academics were rephrased to apply specifically to mathematics. This adaptation is a commonly accepted practice, described on pages 2-3 of the *Manual for the*

Patterns of Adaptive Learning Scales (Midgley et al., 2000). Written permission to adapt and use the PALS scales was received from Michael J. Middleton on March 13, 2003. The adapted, 20-item Academic Motivation Survey is shown in Appendix J (page 179). For purposes of analysis, the Likert-type questions were subsequently converted to numeric scores, yielding values ranging from 1-5, on an interval scale. The total score on a completed survey could range from 20 to 100. In this research, students reported motivation scores between 50 and 100.

Academic performance.

Academic Performance is a measure of how effectively a student demonstrates knowledge of an academic subject. For the current study, academic performance was a dependent variable, and was considered only within the field of mathematics.

Academic performance gains were evaluated based on pre-tests and post-tests that were selected by the classroom teachers, from the Instructional Resources provided by the textbook's publisher, McGraw-Hill. The tests were designed to evaluate comprehension of the curriculum taught during the research period. Students were expected to perform relatively poorly on the pre-test and better on the post-test. Of particular interest was whether there would be noticeably higher gains by the experimental group as compared to the control group.

Unfortunately, a single measure of academic performance could not be used because not all classrooms were going to cover the same curriculum during the study period. Both of the classrooms in one school (one control classroom and one experimental classroom) employed the same test, a 21-item, multiple-choice quiz from a test bank provided by the textbook's publisher, McGraw-Hill. The two classrooms in the other

participating school also used multiple-choice, publisher-provided quizzes, but they differed in content, both from each other and from the other school. In addition, one quiz contained 17 items and the other contained 21 questions.

Design

This study employed a quasi-experimental, comparison groups design. Students and teachers from two classrooms (one per participating school) served as a control group, and those in the other two classrooms (one per school) served as an experimental group. Classrooms were combined into groups to obtain a larger sample size for comparison of pre-test/post-test scores. Since convenience (i.e., non-random) groups participated, this was not a true experimental design and results must be interpreted with caution.

The independent variable for this experiment was the treatment group (i.e., all students from a class were assigned to either the experimental group or to the control group). The expectation was that these groups of students would receive different amounts of written feedback, as reflected by the Feedback Score on the mathematics assignments. Therefore, feedback score was also considered to be an independent variable.

Feedback score was expected to influence feedback effectiveness (i.e., the quality of the feedback as gauged by the students). The causal relationship between feedback scores and feedback effectiveness was the subject of Study 1 (Chapter 3). The present study lends further support for this relationship. Further, since feedback effectiveness impacts academic outcomes, feedback effectiveness will also be used as an independent variable.

Two additional dependent measures were investigated, academic motivation and academic performance. Conceptually, academic motivation is the internal drive that students have toward success in academics, and academic performance is their demonstrated competence in a subject area. Both academic motivation and academic performance were measured on interval scales.

An additional relationship of interest was the relationship between feedback scores and the number of incorrect responses on the assignments. This was a tangential issue intended to help understand patterns of administration of written feedback.

All written feedback was provided by the students' regular classroom teachers. However, the score and the rate of the written feedback was measured by the researcher rather than by the teacher, for the reasons discussed in Study 1, on page 73.

Procedure

Conceptually, the intervention was straightforward: Students in the experimental group received superior written comments, from their teachers, on their assignments, with the expectation that they would interpret the feedback as more effective, resulting in improved academic motivation and performance.

Two comparison groups, each comprised of the students and teachers from two intact fourth grade classrooms from two separate schools were employed in this study. For statistical analysis, the individuals in two classrooms (one per participating school) served as a single control group, and those in the other two classrooms were treated as a single experimental group. The study consisted of eight feedback events spanning a seven-week period. Originally, the study was planned to last eight weeks, but the intervention period was compressed due to teacher commitments and Spring Break.

The activities that occurred during this study are summarized in Table 8 and described in the following steps:

Table 8. Summary of Activities Performed During Study 2

Activity	Cycle								
	0	1	2	3	4	5	6	7	8
Workshop on teacher feedback	• •								
Academic Motivation Survey		♦							♦
Academic Performance Quiz		♦							♦
Goal-setting activity		♦							
Mathematics assignments		♦	♦	♦	♦	♦	♦	♦	♦
Rate feedback dimensions		♦	♦	♦	♦	♦	♦	♦	♦
Weekly feedback to teachers			•	•	•	•	•	•	•
Review goal statements			♦	♦	♦	♦	♦	♦	♦

- • Experimental group activity
- ♦ Common activity (both groups)

1. Prior to student participation (week 0), the teachers of the students in the experimental group participated in two, one-hour collaborative sessions on *Effective Feedback*. Additional details of these interactive sessions are provided in Appendix I, *Constructing Negotiated Written Feedback,* which begins on page 177. General guidance was provided to the teacher, iteratively augmented by *Weekly Updates* (see example in Appendix H, beginning on page 175) that provided feedback on what was "working" and what was not effective, based on the accumulated experience gained from the growing inventory of the students' Feedback Effectiveness surveys (see step 14).
2. At the beginning of the study (week 1), both groups of students took the Academic Motivation Survey (Appendix J, page 179), and a teacher-constructed test of math competency. The competency tests—that differed in three of the four classrooms—consisted of 17-21 questions, representing the material to be taught during the study

period. As expected, students performed relatively poorly on this initial assessment since it tested somewhat unfamiliar math topics (i.e., those to be covered during the investigational period).

3. The teachers assisted their students in establishing long-term (distal) academic goals for their semester's work in mathematics. Appendix G (page 171) is the script provided to teachers for use in this Goal Setting Activity. For this activity, the classes discussed math in everyday life and then the students reflected on and responded to the following short-answer questions:
    a. There are many ways that someone my age might use math, including…
    b. Considering what I want to do when I grow up, math might be useful for…
    c. By the end of this semester, my goals in math are…
4. Students were instructed to retain their private goal statements in a location where they could be accessed at future points throughout the semester. Individual goals were not seen by either the teachers or the researcher. All students were to periodically review their goal statements (see step 15).
5. All students engaged in their normal learning activities. This may have included teacher-led activities, collaborative learning exercises, or any other educative approaches that the teacher chose to employ.
6. Throughout this period, students received intermittent written assignments, as part of the teachers' normal instructional practices. The assignments included both in-class, independent activities and take-home assignments.
7. Each teacher selected one written assignment in mathematics that would serve as the "feedback event." These events generally occurred weekly. However, due to

scheduling issues, there were two feedback events during one of the seven weeks. The feedback event will be referred to as the *selected assignment*.

Students set short-term (proximal) goals (Appendix F, Part 1, page 170) for the selected assignment. This goal setting activity simply asked students to establish a target number of problems that they thought they would solve correctly.

8. As an epilogue to the selected assignment, each student used the second half of the Assignment Rating Slip (Appendix F, Part 2, page 170) to provide the teacher with some insight on the perceived difficulty of the assignment and the effort that the student expended in completing the work.
9. Teachers graded the selected assignments. The teachers of the experimental group placed special emphasis on the quantity and quality of the written feedback that they provided on this assignment. Teachers of the experimental group were encouraged to use the Assignment Rating Slip (Appendix F, page 170) to help them align their comments with student perceptions of task difficulty and effort expended. Conversely, the teachers of the control group graded assignments as usual, with no special attention devoted to feedback, and without regard to the Assignment Rating Slips.

The control group's teachers provided their usual amount of written feedback. Statistical analysis subsequently confirmed that the caliber of their feedback, as gauged by the Feedback Assessment Rubric, was significantly lower than that of the experimental group's teachers.

10. For each selected assignment, students completed the Feedback Effectiveness Survey (Appendix E, page 169) to rate their perceptions of the efficacy of the written feedback that they received from their teachers.
11. The researcher used the Feedback Assessment *Rubric* (i.e., an analytical measure of feedback, shown in Appendix C, page 167) as a guide to measure the written feedback provided by the teacher on the selected assignment. Both groups were regularly monitored to insure that the teachers in the experimental group were providing more feedback than their counterparts in the control group.
12. Teachers were to incorporate the skills that the students exercised in completing the selected assignment into a subsequent lesson or assignment. For example, if an assignment dealt with adding fractions, a similar classroom activity (or unit test) would follow the return of the graded assignment. This step was necessary to insure that the feedback occurred during formative assessment.
13. For each selected assignment, the following data were collected: Assignment grade, the total number of problems, the number of errors made, itemized scores from the Feedback Assessment Rubric, and responses to all items on the Feedback Effectiveness Survey. Descriptive statistics were run against each week's data to confirm that the feedback level for the experimental group exceeded that of the control group. Teachers of the experimental group were coached if their feedback levels noticeably decreased.
14. Completed assignments, Assignment Rating Slips, and Feedback Effectiveness Surveys were collected from the participating schools' offices each Friday afternoon. The following Monday morning, the student papers were returned to the school, along

with blank forms to be used during the upcoming week. Also included in the Monday morning packet was a *Weekly Update* letter (refer to Appendix H , on page 175, for examples). The 1- to 2-page updates included observations concerning fidelity to the research, and general suggestions for the ensuing week.

A second letter was sent to teachers of the experimental group's classrooms. It included student's comments excerpted from the Feedback Effectiveness Surveys and recommendations for refining the feedback. This correspondence was part of the intervention.

15. At the beginning of each subsequent week, students independently reviewed their distal goals. To maintain autonomy, neither the teacher nor the researcher saw students' goals.
16. At the conclusion of the seven-week period, both groups repeated the Academic Motivation Survey and the math competency test. The expectation was that the experimental group would show greater academic progress and a higher level of academic motivation than the control group.

Hypotheses

Research hypothesis 3.

Feedback scores, as measured by the Feedback Assessment Rubric (Appendix C, page 167), are significantly higher for the teachers in the experimental group than for the teachers in the control group. In addition, students in the experimental group rate their teachers' feedback as more effective, when compared to the ratings given to teachers in the control group, by their students. Student ratings are based on their responses on the

Feedback Effectiveness Survey (Appendix E, page 169). Scores from the experimental are significantly higher scores than scores from the control group (α=.05).

Research hypothesis 4.

There is a causal relationship between student's judgment of the effectiveness of the written feedback, as measured by the Feedback Effectiveness Survey, and students' academic motivation, as measured by the Academic Motivation Survey. In other words, the experimental group made larger gains in academic motivation than the control group as a result of the more effective feedback. An analysis of covariance (ANCOVA) provides support for the influence of feedback effectiveness, by group, on academic motivation. Academic Motivation pre-test scores are a covariate.

Research hypothesis 5.

There is a causal relationship between student's judgment of the effectiveness of the written feedback, as measured by the Feedback Effectiveness Survey, and students' academic performance, as measured by a mathematics assessment. In other words, the experimental group made larger gains in academic performance than the control group as a result of the more effective feedback. An analysis of covariance (ANCOVA) provides support for the influence of feedback effectiveness, by group, on academic performance. Academic performance pre-test scores are a covariate.

Research hypothesis 6.

There is a curvilinear relationship between students assignment grades and the teacher's feedback scores from the Feedback Assessment Rubric. Feedback scores are relatively low for both high- and low-assignment grades, and relatively high for average grades. This pattern exists for both the control group and the experimental group.

However, as postulated in Hypothesis 3, the feedback scores are higher for the experimental group.

This relationship exists because teachers decide, either consciously or subconsciously, that students performing high quality work required little commentary, and those performing very low caliber works do not exploit extensive feedback. Intermediate quality work, reflecting the highest potential for improvement, receives the greatest amount of feedback.

Summary of the Procedure

For students in the experimental group, high caliber written feedback was hypothesized to result in greater levels of feedback effectiveness. A moderate correlation was expected between feedback scores from the Feedback Assessment Rubric and both academic motivation and academic performance. However, student perceptions of feedback effectiveness, as measured by the Feedback Effectiveness Survey, was expected to have a more direct and profound causal effect on motivation and performance. The procedures outlined above were expected to yield differential levels of feedback effectiveness, and highlight its impact on motivation and performance.

Results

This study was a quasi-experimental study of the relationship between the caliber of teacher's written commentary, as reflected by feedback scores on the Feedback Assessment Rubric, and three student outcomes: feedback effectiveness, academic motivation, and academic performance.

The study involved four fourth grade classrooms in two schools in a suburban school district. Each school housed one classroom of students in the "control" group and one classroom of students in the "experimental" classroom. Participant characteristics are summarized in Table 7 on page 96.

Data was collected on 64 student participants in the study, 31 in the control group and 33 in the experimental group. One of the 65 from whom permission was granted, a student from the experimental group at school 2, was subsequently excluded from the study due to her limited English proficiency, her inability to complete many of the weekly assignments, and her difficulty comprehending survey questions.

Six distinct survey instruments were collected as part of the study: A pre-test and a post-test of Academic Motivation; a pre-test and a post-test of academic performance; a Feedback Assessment Rubric for each completed assignment (eight per student); and a Feedback Effectiveness Survey for each completed assignment (eight per student). Table 9 summarizes the data collected, by instrument type and participating group. Overall, fairly comprehensive information was collected since there was a low student absentee rate and teachers were conscientious. A minimum of 94% of the pre-test/post-test instruments were returned, and the lowest return rate for any instrument/group combination was 82%. The completeness of the data strengthens the findings.

Table 9. Data Collected for Study 2

Instrument	Max	Total		Control		Experiment'l	
		n	%	*n*=31	%	*n*=34	%
Pre-test of Academic Motivation	65	64	98	30	97	34	100
Pre-test of Academic Performance	65	61	94	27	87	34	100
Post-test of Academic Motivation	65	61	94	29	94	32	94
Post-test of Academic Performance	65	62	95	29	94	33	97
Feedback Effectiveness Surveys	520	450	87	208	84	242	89
Feedback Scores (Assignments)	520	446	86	203	82	243	89

In this study, the participating students completed 450 Feedback Effectiveness surveys. Although the vast majority of the returned surveys were completed in their entirety, about 2% of the responses were omitted. In these cases, a default response of "Not Sure," or a value of 3 on a 5-point Likert scale, was used. Use of this intermediate value is justified for two reasons. First, it seems intuitive that intentionally omitting a response is equivalent to being "not sure." Second, some value was needed because leaving the omission null would have caused overall Feedback Effectiveness evaluations to be artificially lowered. If a disproportionate number of omissions occurred in one of the two groups, this could have resulted in misleading between-groups comparisons. In this study, the data was fairly comprehensive.

The *Procedure* section of this chapter (page 100) provides the details of the activities performed during this study. Briefly, the study was composed of pre-tests of academic motivation and performance, eight iterations of feedback during a seven-week period, and post-tests of academic motivation and performance. The expectation was that the intervention (i.e., "enhanced" written feedback by the experimental group's teachers) would cause the experimental group to score higher on the post-tests, after considering pre-test differences.

Research hypothesis 3

Feedback scores, as measured by the Feedback Assessment Rubric (Appendix C, page 167), are significantly higher for the teachers in the experimental group than for the teachers in the control group. In addition, students in the experimental group rate their teachers' feedback as more effective, when compared to the ratings given to teachers in the control group, by their students. Student ratings are based on their responses on the Feedback Effectiveness Survey (Appendix E, page 169). Scores from the experimental are significantly higher scores than scores from the control group (α=.05).

Data were analyzed using SPSS version 10.0.7 for the PC. This hypothesis was evaluated in two ways. First, a General Linear Model Repeated Measures procedure was run to inspect group means, on a week-by-week basis (Table 10). Second, a *t*-test, using average student scores, was run to compare overall group means.

Table 10. Feedback Means and Standard Deviations by Group and Event

Measure	Group		Feedback Event Number							
			1	2	3	4	5	6	7	8
Feedback Score	Control	$\overline{X}$	1.97	2.16	2.51	2.47	1.10	2.04	1.58	1.43
		SD	1.77	1.05	1.35	1.28	.95	1.28	1.35	1.15
	Experimental	$\overline{X}$	4.28	6.06	4.78	6.38	4.77	5.20	5.87	3.61
		SD	1.52	2.13	1.63	1.90	1.88	1.20	2.69	2.15
Feedback Effect	Control	$\overline{X}$	44.24	47.89	46.85	45.31	44.21	45.70	46.18	44.08
		SD	7.78	9.49	7.45	8.03	7.63	7.16	6.38	6.84
	Experimental	$\overline{X}$	50.63	51.74	46.30	49.15	51.28	51.35	52.70	51.51
		SD	4.80	5.58	8.47	6.99	5.32	6.45	6.06	6.02

The General Linear Model Repeated Measures procedures were run twice, once using raw data, and a second time using refined data. The first analyses were confined to those students who had completed all eight assignments or had responded to all eight Feedback Effectiveness Surveys. These analyses considered 35 cases in which teacher's written

comments yielded complete sets of feedback scores (13 from the control group and 22 from the experimental group), and student surveys yielded 36 complete sets of feedback effectiveness scores (15 from the control group and 21 from the experimental group). Both tests were statistically significant ($p<.01$), indicating that teachers in the experimental group provided higher caliber feedback than did teachers in the control group, and students in the experimental group perceived their feedback to be more effective than did the students in the control group. However, there was concern that these tests were not fully disclosing since they only considered about 55% of the data. A second set of analyses was performed, where the mean score for each student was substituted for missing data **if** the student had at least six of the eight measured data points. One data point was added for fifteen students and two data points were provided for five students. As a result, the second set of analyses considered both feedback scores and feedback effects for 55 cases (25 from the control group and 30 from the experimental group); approximately 85% of the students were considered in the second model.

Figure 7 on page 114 depicts the average feedback scores, by week, for teachers of the control and experimental groups. Recall that these scores reflect the frequency and intensity of the comments that the teachers wrote on the students' assignments. Some weekly fluctuations were expected since the "opportunities" for commentary varied based on factors such as assignment length, assignment difficulty, and student performance. For example, short assignments and worksheets that were intended to improve fluency should have had fewer faults and correspondingly fewer teacher markings.

Curiously, for the experimental group, students' ratings of feedback effectiveness did not quite fluctuate in tandem with teachers' feedback scores. As shown in Figure 8, during weeks five and six, for students in the experimental group, impressions of feedback effectiveness continued to improve, even though the teachers' use of feedback (Figure 7) was relatively constant. One possible explanation for this inconsistency is that effective written feedback has residual effects, continuing to elicit positive impressions for the next week or two.

There are at least three possible explanations for the dip in the experimental group students' impressions of feedback effectiveness during week 3. The most innocuous explanation is that this is simply measurement error. The mean and standard deviation for this week were 46.30 and 8.47, respectively. For n=30, the standard error of the mean would be $8.47/\sqrt{30}$, or 1.55. Therefore, the 95% confidence interval for the mean would be approximately two standard deviations, or 46.30 ± 3.10. There may be no "true" dip in feedback effectiveness at this point. A second possibility is that the assignment in week 3 was unusual; it could have been more difficult, less familiar, or shorter. Any of these features could have affected perceptions of feedback effectiveness. A final possibility is that the feedback that the teachers provided was more extensive than their counterparts in the control group but not more informative.

Key statistical results for the General Linear Model are shown in Table 11, on page 115. Both feedback scores (i.e., the teachers' level of commentary) and feedback effect (i.e., students' impressions of feedback utility) were significantly higher for the experimental group than for the control group (p<.01).

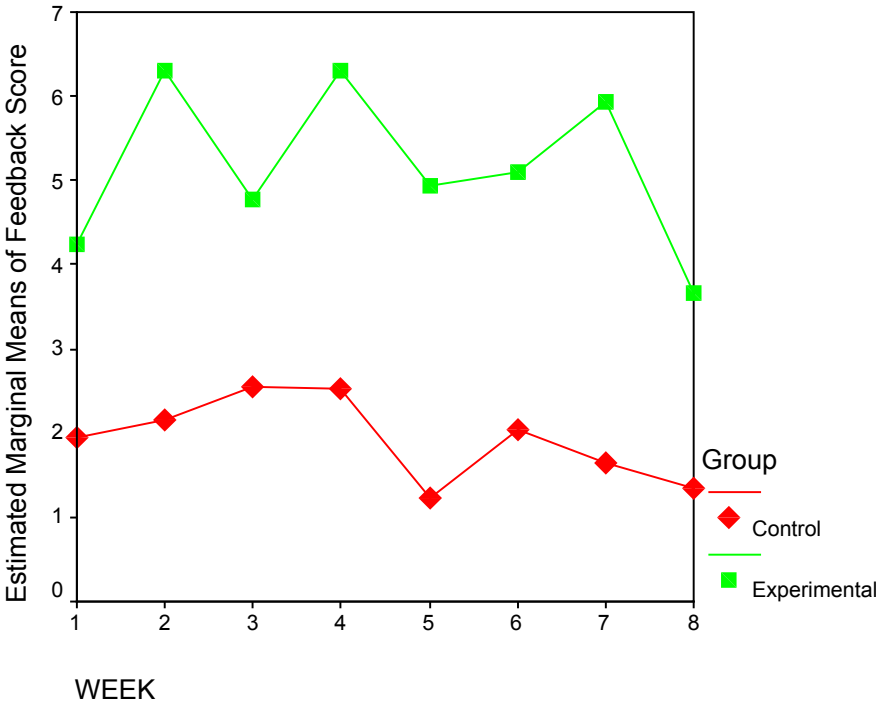


Figure 7. Feedback Scores, as Measured by the Feedback Assessment Rubric by Group and Week

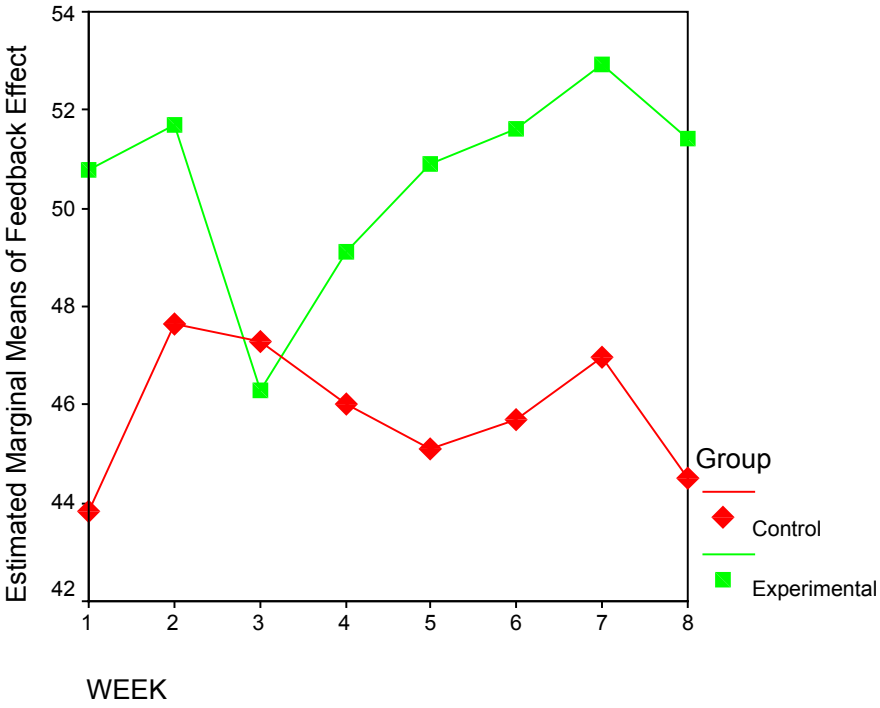


Figure 8. Feedback Effect, as Measured by the Feedback Effectiveness Survey by Group and Week

Table 11. Between-subjects Effects of Feedback

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	η_p^2	Observed Power
Feedback Score	1136.37	1	1136.37	184.39	.000	.777	1.000
Feedback Effect	2424.26	1	2424.26	13.47	.001	.203	.950

The effect sizes (or partial eta squared, η_p^2) of .777 for Feedback Score and .203 for Feedback Effect indicate that about 78% and 20%, respectively, of the period-related differences were due to the intervention. Over time, the intervention had a large impact on Feedback Scores and a smaller influence on Feedback Effects.

Next, a *t*-test was performed to assess overall group differences on various feedback measures. Scores for all eight feedback events were accumulated and averaged, on a per-student basis, to attain a single score for each student on each assessment instrument. Table 12 shows the means and standard deviations of the calculated values, for the two groups. Recall that feedback score was obtained from the Feedback Assessment Rubric, and is a weighted scoring of thirteen types of teacher commentary. High intensity comments on effort and ability are doubled, and miscellaneous comments are halved. Feedback frequency was also obtained from the Feedback Assessment Rubric, but is a simple accumulation of the number of teacher comments. Feedback effect represents student perceptions of feedback quality as reported on the Feedback Effectiveness Surveys. Visual inspection of this table reveals large differences between the groups, on all measures.

Table 12. Means and Standard Deviations of Groups on Feedback Measures

	Control Group			Experimental Group		
	N	$\overline{X}$	SD	N	$\overline{X}$	SD
Feedback Score	31	1.90	.46	33	5.12	1.09
Feedback Frequency	31	2.31	.70	33	5.01	1.55
Feedback Effect	31	45.86	5.80	33	50.64	4.87

Table 13 presents the results of *t*-tests for two representations of feedback assessment obtained from the Feedback Assessment Rubric, the feedback score and the feedback frequency. The corresponding students' feedback effectiveness ratings, from the Feedback Effectiveness Survey, are also shown. Both feedback assessment values are presented to demonstrate that the feedback score calculation was not devised simply to achieve statistical significance.

Table 13. *t*-tests for the Rubric-based Feedback Measures and Student-declared Feedback Effectiveness

	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
						Lower	Upper
Feedback Score*	15.62	43.50	.000	3.22	.21	2.80	3.63
Feedback Frequency*	9.06	45.28	.000	2.70	.30	2.10	3.30
Feedback Effect	3.56	58.76	.001	4.78	1.34	2.09	7.47

* Rubric-based measure

Inspection of Table 13 reveals that both the researcher's assessment of teacher feedback (i.e., feedback score and feedback frequency) and the students' subjective evaluations of the utility of this feedback (i.e., feedback effect) exhibited group-related differences. The null hypothesis of no difference between group means is rejected

(p<.01). Further, Figure 9 and Figure 10, on page 118, illustrate that the group differences are in favor of the experimental group, as expected.

The effect sizes for the independent samples *t*-test were calculated using the formula

$$d = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{(N-1)\hat{\sigma}_1^2 + (N-1)\hat{\sigma}_2^2}{N_1 + N_2 - 2}}},$$

yielding values of 3.79, 2.21, and .90 for Feedback Score, Feedback Frequency, and Feedback Effect, respectively. These values represent the number of standard deviations between the means for the two groups. Differences of this magnitude indicate that the intervention had a large effect.

Component measures for both feedback score and feedback effect were also analyzed. Table 14 on page 119 shows the means for the individual feedback measures that comprise the aggregate Feedback Score. Note that only *Miscellaneous comments* occurred with similar frequency in both groups. This category of feedback includes generic comments such as provision of the correct answer, admonishing the student to "be careful," directing the student to "show your work," and instructing him or her to "see me."

Table 15 on page 119 shows the means for the individual Likert-type questions on the Feedback Effectiveness Survey (Appendix E, page 169) that comprise the feedback effectiveness score. Reverse-scored items have been inverted in this table to simplify comparisons. Note that in every case the mean scores for the experimental group exceeded those of the control group. All measures support Research Hypothesis 3.

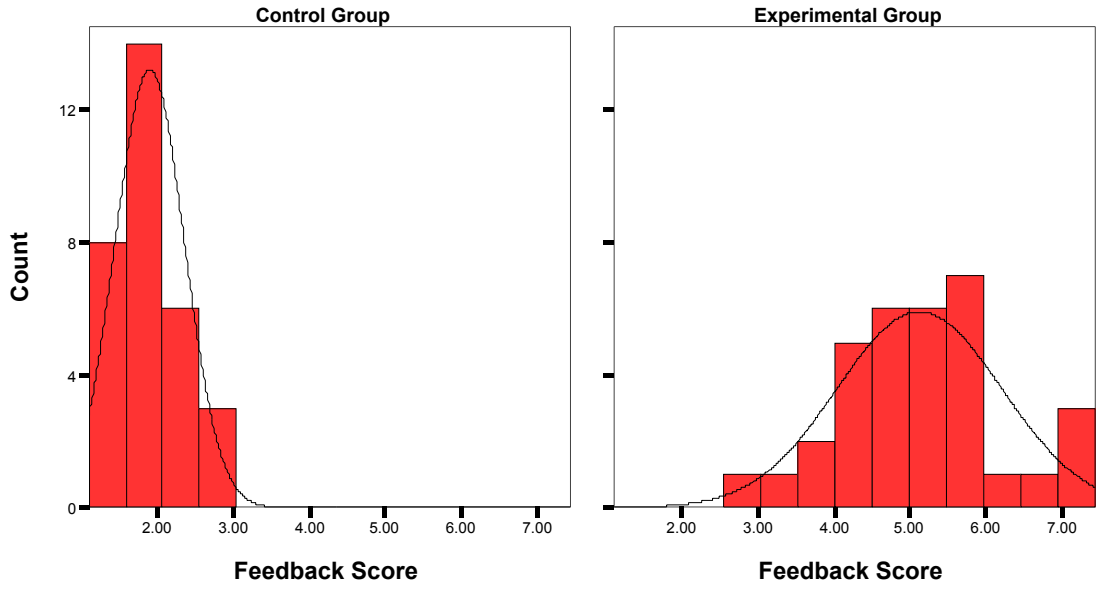


Figure 9. Histograms of Average Feedback Scores by Group

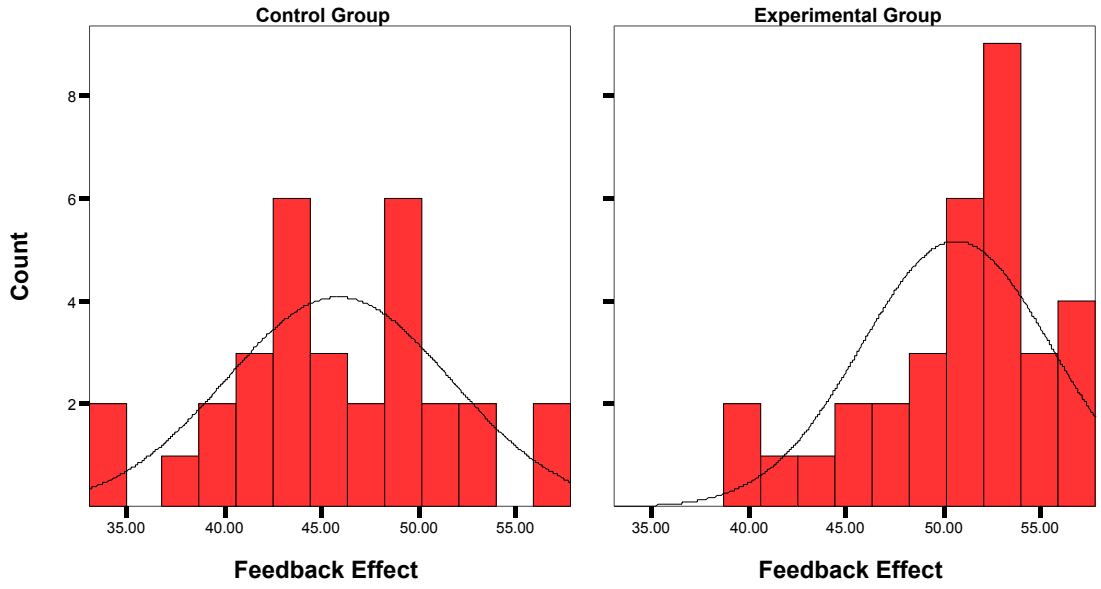


Figure 10. Histograms of Average Feedback Effectiveness by Group

Table 14. Means of Individual Items on the Rubric-based Feedback Measure

	Control			Experimental	
Feedback Measure	**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**
Miscellaneous comment	1.18	.75		1.24	1.08
Expressed pleasure	.42	.32		.96	.60
High praise of ability	.19	.17		.67	.36
Average praise of effort	.01	.04		.61	.39
Average praise of ability	.29	.27		.44	.26
Instructed	.13	.12		.41	.44
Called attention to something	.08	.11		.38	.42
Asked a probing question	.01	.04		.18	.31
High praise of effort	.00	.00		.06	.08
Directed student elsewhere	.00	.00		.03	.09
Digressions	.00	.00		.01	.05
Answered an implicit/explicit question	.00	.00		.00	.00
Illegible teacher markings	.00	.00		.00	.00
Feedback Score	1.90	.46		5.12	1.09

Table 15. Means of Individual Items on the Feedback Effectiveness Survey by Group

	Control			Experimental	
Survey Question	**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**
There were enough comments	3.77	.64		4.27	.65
I know where I made mistakes	3.78	.81		4.24	.76
I know why I made mistakes	3.71	.84		3.98	.78
I won't make these mistakes again	2.03	1.04		2.30	1.28
I liked reading the comments	2.95	.71		3.44	.64
My teacher cares that I learn	4.01	.77		4.44	.48
My teacher realizes my effort	2.82	.71		3.45	.51
My teacher believes in me	4.11	.60		4.42	.55
My teacher cares about me	3.95	.77		4.42	.61
This assignment helped me learn	3.00	.67		3.46	.54
This will help in the future	4.00	.76		4.21	.70
This was a valuable assignment	3.71	.87		4.01	.74
Feedback Effect	3.82	.48		4.22	.41

Research hypothesis 4

There is a causal relationship between student's judgment of the effectiveness of the written feedback, as measured by the Feedback Effectiveness Survey, and students' academic motivation, as measured by the Academic Motivation Survey. In other words, the experimental group made larger gains in academic motivation than the control group as a result of the more effective feedback. An analysis of covariance (ANCOVA), using SPSS version 10.0.7 for the PC, provides support for the influence of feedback effectiveness, by group, on academic motivation. Academic Motivation pre-test scores are a covariate.

To test this hypothesis, the twenty questions on the Academic Motivation Survey (Appendix J, page 179) were split into three categories: Questions related to Learning Goals, those related to Performance Goals, and those that pertain to Self-concepts of personal ability. This subdivision closely matched the categories used in the *Patterns of Adaptive Learning Scales* (PALS) (Midgley et al., 2000) that was the basis for the Academic Motivation Survey.

Table 16 shows the scores for all twenty questions, grouped into the three categories. Both pre-test and post-test means are shown, for both the control group and the experimental group. The *Diff.* columns show the difference between mean scores, at pre-test and post-test times, for the two groups. The Gain/Loss column shows how much ground the experimental group gained over the control group (i.e., how much the Difference between groups increased or decreased between the pre-test and the post-test). Difference scores and gain/loss values are included for illustrative purposes only and were not used in statistical tests. The experimental group showed greater improvement

(or less decline) than the control group in seven of the ten Learning Goal categories, two of the five Performance Goal categories, and four of the five Ability Self-concept categories.

Table 16. Means of Academic Motivation Survey by Group

#	Motivation Categories	Pretest Means			Posttest Means			Gain/
		Ctrl	Exp.	Diff.	Ctrl	Exp.	Diff.	Loss
	Learning Goal	**3.91**	**4.05**	**0.14**	**4.00**	**4.39**	**0.39**	**0.25**
2	Preference for familiar*	1.97	2.59	0.62	2.34	2.78	0.44	-0.18
4	Importance of newness	4.43	4.41	-0.02	4.31	4.78	0.47	0.49
6	Dislike of newness*	3.13	3.12	-0.01	3.38	3.31	-0.07	-0.06
7	Preference for sameness*	2.40	2.56	0.16	2.83	3.13	0.30	0.14
8	Learning goal	4.67	4.56	-0.11	4.41	4.75	0.34	0.45
10	Mastery goal	4.40	4.50	0.10	4.28	4.81	0.53	0.43
11	Preference for familiarity*	2.00	2.06	0.06	2.00	2.84	0.84	0.78
12	Importance of understanding	4.40	4.62	0.22	4.34	4.62	0.28	0.06
13	Preference for comfort*	1.90	2.53	0.63	2.62	3.03	0.41	-0.22
17	Importance of improvement	4.70	4.65	-0.05	4.48	4.81	0.33	0.38
	Performance Goal	**3.20**	**3.07**	**-0.13**	**3.34**	**3.24**	**-0.10**	**0.03**
3	Importance of image	3.03	3.29	0.26	3.21	3.03	-0.18	-0.44
9	Performance goal	3.63	3.56	-0.07	3.48	3.87	0.39	0.46
14	Lack of effort goal	3.30	3.15	-0.15	3.41	3.66	0.25	0.40
15	Appearance of intelligence	3.30	3.00	-0.30	3.17	2.94	-0.23	0.07
16	Social appearances	2.83	2.56	-0.27	3.41	2.72	-0.69	-0.42
	Ability Self-Concept	**3.81**	**3.88**	**0.07**	**4.28**	**4.48**	**0.20**	**0.13**
1	Certain of mastery	3.70	3.85	0.15	4.31	4.53	0.22	0.07
5	Certain of ability	3.03	3.21	0.18	3.72	4.44	0.72	0.54
18	Confidence in perseverance	4.20	4.29	0.09	4.45	4.41	-0.04	-0.13
19	Confidence in ability	4.33	4.18	-0.15	4.48	4.44	-0.04	0.11
20	Confidence in effort	3.90	3.82	-0.08	4.45	4.56	0.11	0.19
	Motivation Score	3.71	3.76	0.05	3.91	4.12	0.21	**0.16**
	Performance Score	62.91	56.16	-6.75	87.00	81.96	-5.04	**1.71**

*** Negatively-scored items have been reversed for comparison purposes**

An Analysis of Covariance (ANCOVA) was performed on each of the three Academic Motivation categories, using the treatment group as the independent variable and the corresponding pre-test scores a covariate. As shown in Table 17, there was a statistically significant difference on the post-test score for Learning Goal motivation

(p<.05). At the conclusion of the study, the experimental group demonstrated a higher Learning Goal orientation than did the control group. These inter-group differences are further illustrated in Figure 11 on page 123.

Table 17. ANCOVA Results for Between-Groups Comparisons of Academic Motivation Factors using Pre-test scores as covariates

Dependent Variable	Control		Exper.		F	Sig.	Power	Adj. R^2
	M	SE	M	SE				
Learning goal	4.07	.09	4.33	.08	4.80	.032	.577	.448
Performance goal	3.30	.18	3.28	.17	.00	.952	.050	n/a
Confidence in Ability	4.30	.09	4.46	.08	1.74	.193	.254	n/a
Total Score	3.93	.08	4.10	.07	2.67	.107	.363	n/a

There were no statistically significant differences in the areas of Performance Goal orientation and Ability Self-concept. The demonstrated gain in Learning Goal orientation supports Research Hypothesis 5. Lack of statistical significance in the other two categories does not weaken this support. The primary objective of this research was to enhance students' desire to learn, as demonstrated by the improvement in the Learning Goal orientation. Students continued to maintain their desire to perform well and their level of self-confidence through the seven-week experimental period. This adds further support for the benefits of the intervention.

Research hypothesis 5

There is a causal relationship between student's judgment of the effectiveness of the written feedback, as measured by the Feedback Effectiveness Survey, and students' academic performance, as measured by a mathematics assessment. In other words, the experimental group made larger gains in academic performance than the control group as a result of the more effective feedback. An analysis of covariance (ANCOVA), using

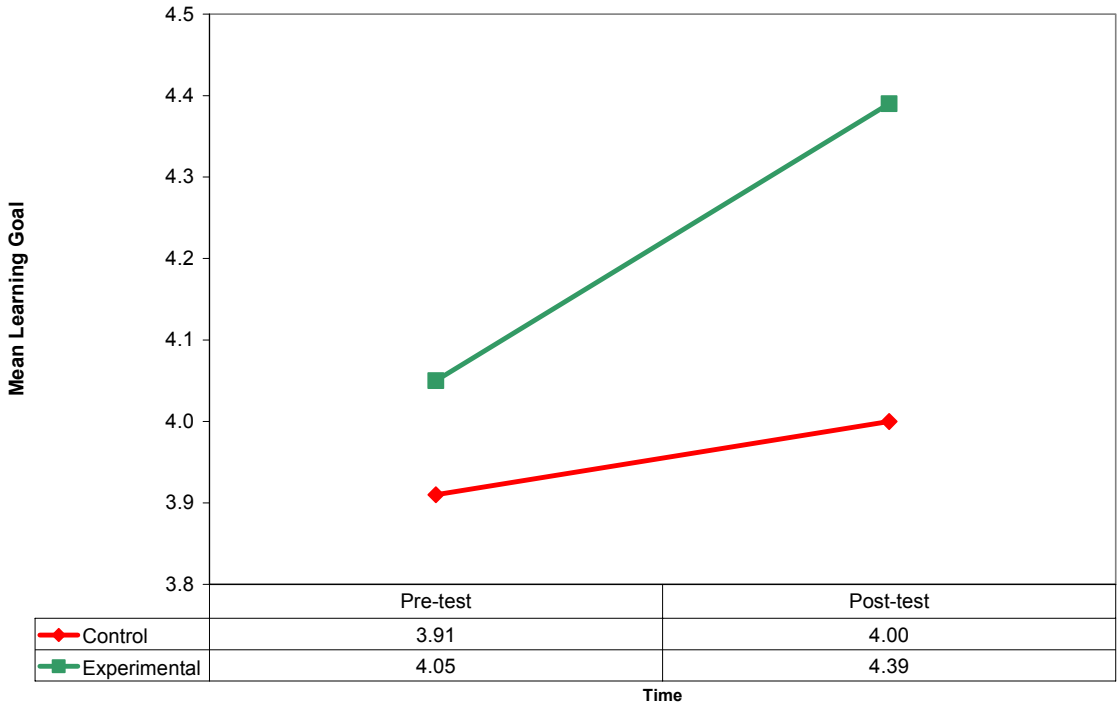


Figure 11. Learning Goals by Group and Time

SPSS version 10.0.7 for the PC, provides support for the influence of feedback effectiveness, by group, on academic performance. Academic performance pre-test scores are a covariate.

As implemented, the research was unable to evaluate this research hypothesis adequately. The research design called for all classrooms to take an identical pre-test and post-test of academic performance. However, two circumstances prevented this approach:

1. The second school's participation began four weeks after the first school's. Since students were at different points in the academic year, they couldn't be tested over the same information.
2. The two classrooms in the second school were at different points in the textbook (one was beginning chapter 8 and the other was beginning chapter 9). The teachers were uncomfortable with trying to devise a common pre-test/post-test.

The net effect of these extenuating circumstances was that the four classrooms took three different post-tests: the control group and experimental group in school 1 took the same test; and both the control group and the experimental groups in school 2 took unique tests. Consequently, only a small sample size (n=28) was available for the pre-test/post-test analysis of academic performance. For students in school 1, an Analysis of Covariance was performed on the post-test scores of academic performance, using the pre-test scores as a covariate and the treatment group as an independent variable. Mean differences were not statistically significant (p=.997).

Research hypothesis 6

There is a curvilinear relationship between students assignment grades and the teacher's feedback scores from the Feedback Assessment Rubric. Feedback scores are relatively low for both high- and low-assignment grades, and relatively high for average grades. This pattern exists for both the control group and the experimental group. However, as postulated in Hypothesis 3, the feedback scores are higher for the experimental group.

This relationship exists because teachers decide, either consciously or subconsciously, that students performing high quality work required little commentary, and those performing very low caliber works do not exploit extensive feedback. Intermediate quality work, reflecting the highest potential for improvement, receives the greatest amount of feedback.

The raw data was inadequate for assessing this hypothesis due to the restricted range of Feedback Scores; over 97% of the scores for the control group (i.e., 199 out of 203) are integer values from 0 to 6 (seven possible values), and nearly 98% of the scores for the experimental group (i.e., 238 out of 243) are integer values from 2 to 10 (nine possible values). Meaningful scatterplot values cannot be obtained when 437 data points are spread across eleven integer values (i.e., 0-10).

In order to effectively examine this hypothesis, greater variance in measures was needed, to accentuate the between-groups differences. Variance was obtained by summing all feedback responses for a student (excluding miscellaneous comments) and graphing this total *feedback frequency* score against the total number of errors made by

the student. Since the control group and the experimental group were subjected to different environments, the two groups were examined separately.

Figure 12 is a scatterplot of the number of errors made by each student in the control group against the corresponding number of comments made by the teacher (i.e., the feedback frequency). Also shown are three lines produced by SPSS's curve estimation regression function: a straight linear regression line, a curvilinear (i.e., quadric) regression line, and an oscillating cubic regression line.

Table 18 summarizes the statistical results of the curve fitting procedures. The linear regression line does a poor job of predicting Feedback Frequency (R^2=.009, *p*=.613). The quadratic, curvilinear regression line does a much better job of prediction (R^2=.294, p<.01). The cubic regression line does the best job (R^2=.448, p<.01), but this may be a spurious result owing to the reasonably small number of observations and relatively low feedback frequencies. The scatterplot and the regression analyses tend to support the research hypothesis of a curvilinear relationship between assignment grade (as reflected by the number of errors) and the feedback score (as reflected by feedback frequency).

Table 18. Curve Fitting Results for Error Rate versus Feedback Frequency by Students in the Control Group

Regression Type	R^2	df	F	Sig.	*Beta* Weights			
					b_0	b_1	b_2	b_3
Linear	.009	29	.26	.613	7.1342	-.0204		
Quadratic	.294	28	5.82	.008	4.8414	.3888	-.0101	
Cubic	.448	27	7.30	.001	3.4715	.9345	-.0480	.0006

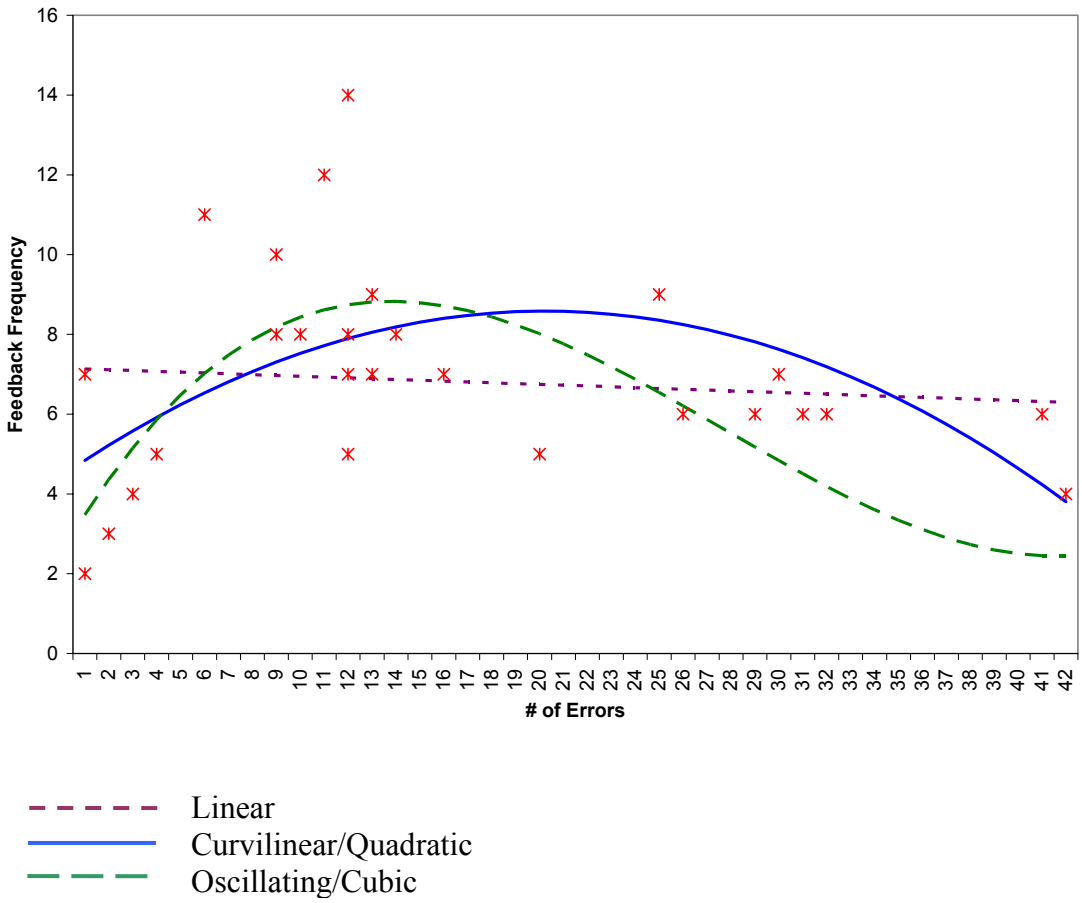


Figure 12. Feedback Frequency versus Errors Made by Students in the Control Group

Next, the relationship between error rate and feedback frequency was examined for the experimental group (Figure 13). Again, three calculated regression lines are shown: a straight linear regression line, a curved quadric regression line, and an oscillating cubic regression line. Table 19 summarizes the statistical results of the curve fitting procedures. In this case, all three regression lines do virtually identical jobs of predicting Feedback Frequency (R^2=.332-.339, p<.01).

Table 19. Curve Fitting Results for Error Rate versus Feedback Frequency by Students in the Experimental Group

Regression Type	R^2	df	F	Sig.	*Beta* Weights			
					b_0	b_1	b_2	b_3
Linear	.332	31	15.4	.000	21.831	.3043		
Quadratic	.334	30	7.5	.002	22.547	.2291	.0014	
Cubic	.339	29	5.0	.007	20.299	.6050	-.0146	.0002

For the experimental group, the relationship between error rate and feedback frequency is unclear. Since the tendency is to select the most parsimonious explanation, the linear relationship seems most likely. So, the research hypothesis is not supported for the experimental group. However, since the intent of the research was to influence teachers' exploitation of written feedback, it stands to reason that their pattern of feedback administration could have been correspondingly disrupted.

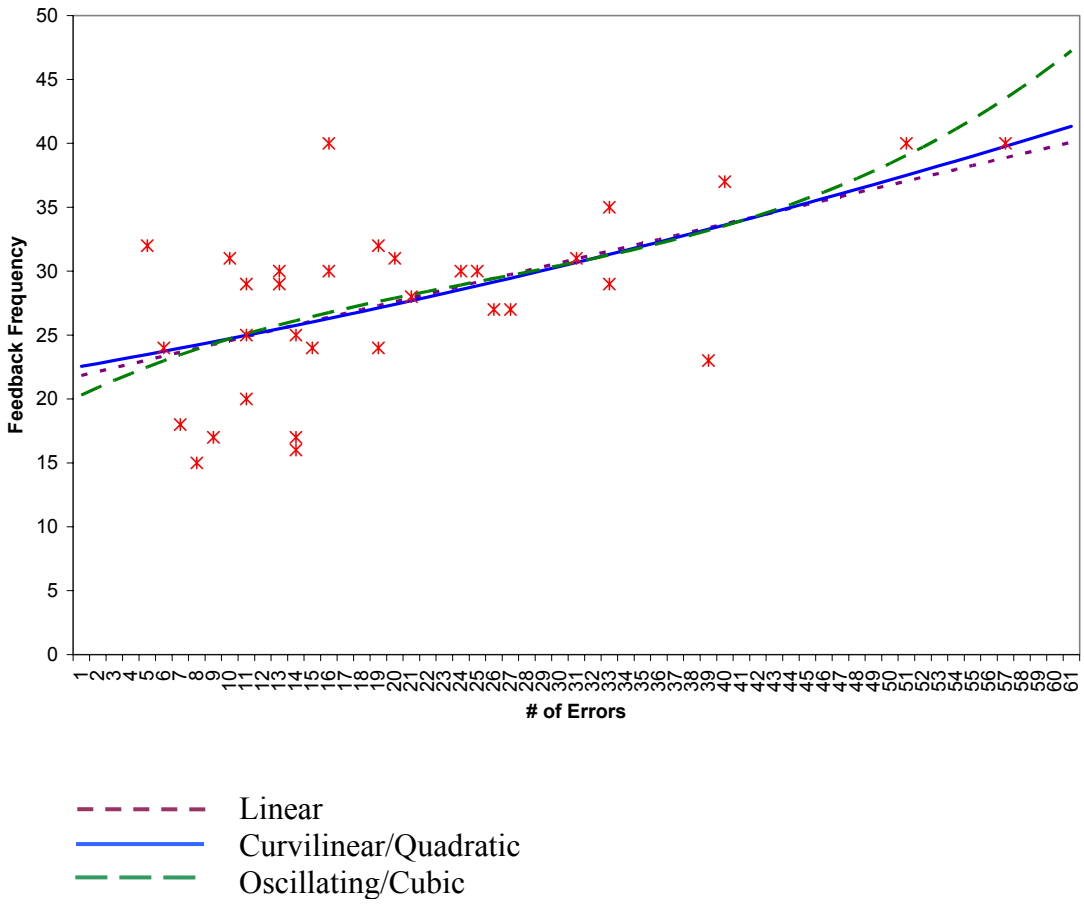


Figure 13. Feedback Frequency versus Errors Made by Students in the Experimental Group

Summary of Study 2

Study 2 provided further support for a causal relationship between an objective feedback score, as measured by the Feedback Assessment Rubric, and students' perceptions of feedback effectiveness, as measured by the Feedback Effectiveness Survey. It also substantiated a causal relationship between the caliber of the teacher's written feedback and the *Learning Goal Orientation* component of academic motivation; effective commentary promoted students' learning goals. For the control group of Study 2, the curvilinear relationship between assignment grade and the level of teacher commentary was also supported.

Two predictions were not supported. First, the hypothesis that higher levels of written feedback would improve academic performance could not be substantiated due to inadequate data; extenuating circumstances rendered half of the data unusable. Second, for the experimental group of Study 2, there was not a curvilinear relationship between assignment grade and level of teacher commentary. However, this relationship may be a consequence of the intervention itself rather than a fault in the hypothesis.

This study was extremely successful, especially in light of the challenges inherent in field-based research. This success is attributed to a reasonably well designed intervention and an extremely high level of cooperation and support from the participating schools, teachers, and students.

The next chapter will conclude the dissertation with a summary evaluation of the research. Recommendations for enhancements will be offered should a replication of the research be undertaken. Finally, ramifications of the investigation will be discussed along with and suggestions for future research.

Chapter 5. Discussion

This research consisted of two studies intended to provide support for a causal relationship between the caliber of the written feedback provided by the teacher and the perceived effectiveness of this feedback from the students' perspectives. In addition, it was hypothesized that higher levels of perceived feedback effectiveness would influence students' level of academic motivation and academic performance. Finally, it was postulated that the intensity of the written feedback that a teacher provides fluctuates in a curvilinear fashion with the caliber of student assignments: both high quality and low quality assignments would receive relatively sparse commentary, and intermediate-quality assignments would receive greater attention.

Overall, the research hypotheses were supported. There was support for the causal relationship between the intensity of a teacher's written feedback and student perceptions of feedback effectiveness. It was demonstrated that effective feedback enhanced students' Learning Goal Orientations toward academic motivation. However, a link between effective written feedback and academic performance could not be shown, possibly due to inadequate data.

Since the outcomes of both of the studies were predicated on the quality of the measurement tools and adherence to protocols, a comprehensive discussion of the research results will begin with a retrospection of the instruments and activities that comprised the study, presented in the order that they were introduced into the studies. This is followed by general observations concerning the studies, discussions of the individual studies, and recommendations for future research and practice.

Analysis of Components of the Intervention

Collaborative Feedback Sessions

In preparation for providing enhanced written feedback, three of the teachers (i.e., the two experimental group teachers and the *ABAB*-type study teacher) participated in two, one-hour collaborative sessions with the researcher. The purpose of these sessions was to heighten teachers' awareness of the characteristics of written feedback, and its sometimes-subtle effects. The goal of the sessions was to increase teachers' sensitivity to feedback and to intensify their focus on providing written feedback (resource materials used in these sessions are shown in Appendix K, beginning on page 181). Teachers were to endorse a list of guidelines for written feedback (Appendix L, page 203), and to employ these guidelines when grading written assignments.

There was one piece of ancillary evidence that the sessions were successful: at the beginning of the second session for one of the teachers, the teacher commented that she had been much more cognizant of providing feedback during the previous evening's grading. While empirically trivial, this comment does suggest that the sessions had some impact.

A much more persuasive testament to the effectiveness of the collaborative feedback sessions was the observed differences in feedback scores. There was a statistically significant difference in the mean feedback scores between the baseline and intervention periods of Study 1. The increased feedback level followed the collaborative sessions with the teacher. Further, the teachers of the experimental group of Study 2, who participated in the collaborative sessions, provided a higher level of feedback than did the teachers of the control group, who were excluded from the sessions.

Although the collaborative feedback sessions appeared to be successful, it should be noted that success in replicating this aspect of the research will be somewhat dependent on the personalities and demeanors of the participants. Not only must the researcher adequately convey the characteristics and the significance of effective feedback, but the participating teachers also must endorse and make an effort to implement this philosophy.

Academic Motivation Surveys

As described in Chapter 4, the Academic Motivation Survey (Appendix J, page 179) was based on the *Patterns of Adaptive Learning Scales* (PALS) (Midgley et al., 2000). The abridged, customized version of this instrument seemed well suited to the research questions. The use of multiple subcategories of motivation (learning goal orientation, performance goal orientation, and academic self-concept beliefs) proved especially valuable in investigating the relationships between written feedback and academic motivation.

Students did not seem to have difficulty in understanding or responding to the survey questions. However, some students voiced opinions that some of the questions were redundant. In actuality, and intentionally, some questions were only subtly different from others. No other issues surfaced with respect to the survey. This instrument appears to have been effective in assessing academic motivation, and it was well suited for the current research.

Academic Performance Tests

Unlike the Academic Motivation Survey, the academic performance test was well conceived conceptually, but difficult to implement operationally. This was a consequence of the circumstances under which the research had to be conducted. There

were staggered start times for the participating schools, and the classrooms of the second school were at different points in the academic calendar. Ideally, all groups participating in Study 2 would have had a similar curriculum for the research period, would have been at the same point in the curriculum, and would have participated concurrently. Since this was not an option, a uniform pre-test/post-test combination could not be administered.

If this research were to be repeated, a refined participant selection mechanism would be needed to investigate adequately the relationship between the level of written feedback and its effect on academic performance. All research participants should have a common core of information to be taught and learned during the investigational period, and the teachers and the researchers would need to devise collectively a single, comprehensive test for assessing performance gains, for all students, during the period under investigation.

Goal Setting Activity

The Goal Setting Activity (Appendix G, page 171) was used once per classroom. For the control and experimental groups, this activity occurred at the outset of the research. For the *ABAB*-type study, this activity occurred at the beginning of the first intervention period, A_1.

In every case, the teacher performed the goal setting activity without supervision, so there was no way to assess either the fidelity to the script or the uniformity of the activity. In retrospect, it would have been good to have observed the activity, but circumstances did not permit observation.

All teachers stated that they successfully completed the activity without difficulty. Two teachers commented that they thought that the activity was intrinsically valuable

because their students often question why they have to do certain mathematics assignments. One teacher reported that the students especially enjoyed naming careers that required math skills, and the students had thought of many of the careers included in the script. Based on teacher feedback, it seems like this instrument served its intended purpose.

Assignment Rating Slips

The Assignment Rating Slip (Appendix F, page 170) was a two-part survey instrument. Part 1 simply asked students to indicate the number of problems on the assignment, and asked them how many problems they were striving to answer correctly. This portion of the survey was fairly straightforward, and presumably served its intended purpose of encouraging students to establish short-term goals for the associated assignment. Since the goal was intended to be autonomous, there was no direct means of evaluating the effectiveness of this motivational activity. However, one of the open-ended comments that a student volunteered on the Feedback Effectiveness Survey—from the experimental group, during week 5—was "I was better by 2 problems. I said I would get 38 right, but I got 40 out of 40!" This suggests that the activity had some impact, at least in this one instance.

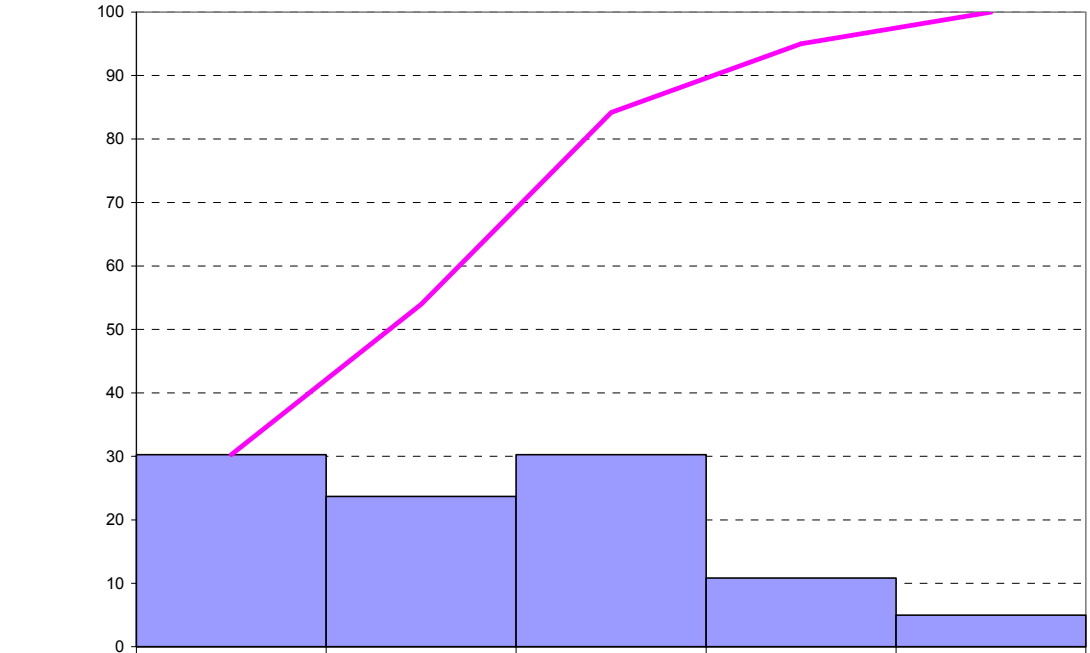
Part 2 of this instrument was intended to provide the teacher with insight into the student's perception of the assignment's difficulty and the amount of effort that the student expended in completing the assignment. The pattern of student responses on Part 2 of the Assignment Rating Slip was intriguing. First, only about 15.8% of the *assignment difficulty* ratings (refer to Figure 14) were in the *Hard* (10.8%) to *Very Hard* (5.0%) range. There are a variety of plausible explanations for why 84% of the

assignments were characterized as not challenging. Perhaps students underestimate the demands that they face, or overestimate their abilities; maybe they are reluctant to recognize their own limitations; or it may be that the assignments were too easy.

The unanticipated distribution of assignment difficulty ratings suggests another potential use for the Assignment Rating Slips. Teachers may be able to use a similar vehicle to help them adjust the level of challenge of assignments. It would seem that the ideal assignment would be viewed as *Hard*-to-*Average* by the majority of students, *Easy* for some, and either *Very Easy* or *Very Hard* for as few students as possible.

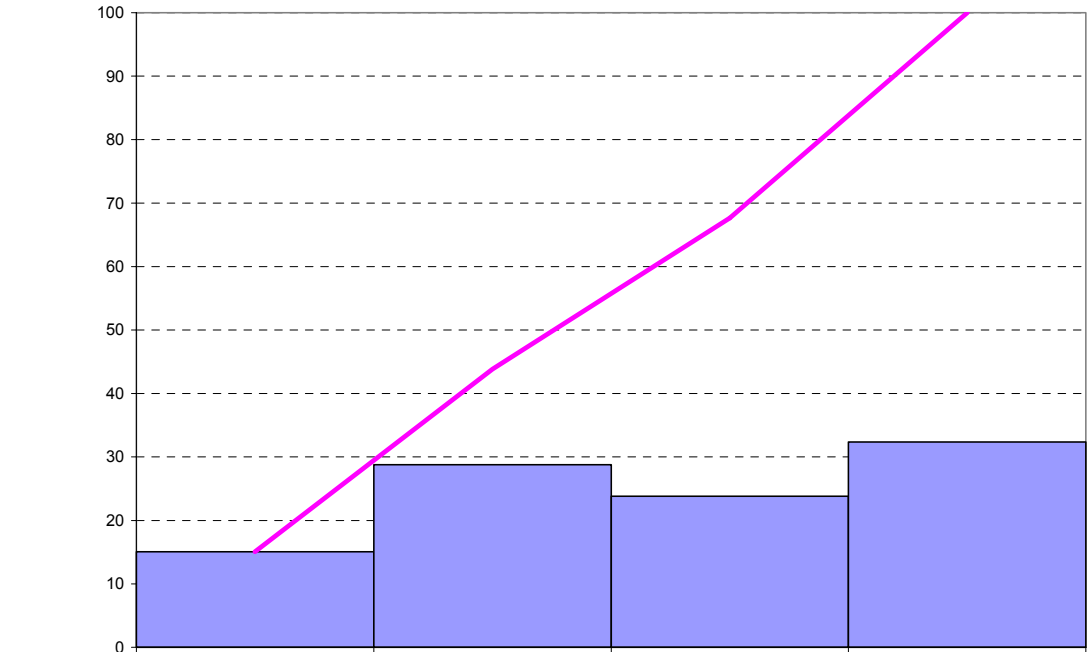
The *effort expenditure* ratings on the Assignment Rating Slip (Figure 15) were also very informative, especially when considered in conjunction with the *assignment difficulty* ratings. Although only 5.0% of the assignments were rated as *Very Hard*, students claimed to have worked *Very Hard* one-third (32.4%) of the time. There are two somewhat dichotomous insights that can be derived from this information. First, some students concede to a lack of effort. Some possible explanations for this disposition are that the students are uninterested, that they are not being adequately challenged, or that they want to promote the perception of high ability (i.e., that they do not need to work hard). For these students, there may be some benefit in encouraging greater effort. Second, students often perceive themselves as being diligent, so admonitions to "work harder" are likely to be counterproductive. Student perceptions should help guide teacher commentary on effort and ability.

A final observation concerning the Assignment Rating Slip involves student declarations of *time spent* on assignments. Students were asked to report the number of minutes devoted to the work. In retrospect, this was not the ideal method of gauging the



	Very Easy	Easy	Average	Hard	Very Hard
Percent	30.25	23.70	30.25	10.84	4.97
Cumulative	30.25	53.95	84.20	95.03	100.00

Figure 14. Assignment Difficulty Ratings



	Not Hard	Average	Hard	Very Hard
Percent	15.06	28.76	23.82	32.36
Cumulative	15.06	43.82	67.64	100.00

Figure 15. Effort Expenditure Ratings

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amount of time invested in the activity. The key shortcoming of this approach was the belated realization that many fourth graders do not have a complete understanding of elapsed time. For example, students may not be able to figure out that working on the assignment from 1:45 p.m. to 2:05 p.m. equals 20 minutes of time spent. Therefore, some of the time estimates may have been inaccurate. More importantly, the intent of the question was to solicit another indication of effort expended. It appears that a more effective approach would have been to use a Likert-type question, such as:

How long did you work on this assignment:

❑ Finished quickly ❑ Right amount of time ❑ Too long ❑ Way too long

Overall, the Assignment Rating Slip appears to have been an effective mechanism for encouraging students to set short-term goals, and for providing teachers with insight into students' perceptions of their investment in the assignments. Through this instrument, additional, serendipitous insight was gained: views on assignment difficulty could help teachers fine-tune how they academically challenge students.

Feedback Effectiveness Surveys

Although the Feedback Effectiveness Survey served its purpose, one opportunity for improvement surfaced during the research phase. Several of the questions made assumptions about either the student's work or the teacher's comments. Specifically, the following questions presupposed that the student had made one or more mistakes on the assignment:

- The comments helped me understand **where** I made mistakes.
- The comments helped me understand **why** I made mistakes.
- I **expect** to make these types of mistakes in the future.

These questions may receive artificially low scores from students who attain high grades on the evaluated assignments. For example, if a student receives 100%, how is he or she supposed to respond to the prompt "The comments helped me understand **where** I made mistakes?" Since the frequency of perfect assignments was probably similar for both the control and the experimental group, the net effect of this flaw was probably negligible. However, if necessary, this possible shortcoming in the form's design could have been overcome by conditionally analyzing responses to the presumptuous questions based on whether the student made errors on the assignment (since corresponding student grades were maintained).

There was a second issue with the question "I **expect** to make these types of mistakes in the future." Responses to this item will somewhat depend on the familiarity of the material; newly-introduced or challenging topics will generally elicit more pessimistic responses to this question. Effective teacher feedback should be able to ameliorate the negativity, but the raw scores cannot be interpreted out of context.

A final supposition inherent in the Feedback Effectiveness Survey was that the following questions assume that the teacher provided some commentary on the students' papers:

- The comments show that my teacher cares that I learn from this assignment.
- The comments show that my teacher cares about me.
- The comments show that my teacher believes I can learn to do work like this.

In cases where there were no teacher comments, these questions take on a slightly different meaning: How did the student interpret the absence of comments? Although the underlying issue is the same (i.e., the message conveyed by the teacher's marking and

grading), the questions should have avoided the presumptive wording. The Feedback Effectiveness Survey, as designed, would have been most effective if every assignment had had faults and had received teacher commentary.

Despite the opportunities for improvement noted above, this instrument appeared to have served its intended purpose well. Some of the assets of the survey were that there were no noted difficulties in completing the form, it was concise and not burdensome, and a post hoc analysis of all individual items reflected expected attitudinal shifts.

Feedback Assessment Rubric

The Feedback Assessment *Rubric* (i.e., an analytical measure of feedback, shown in Appendix C, page 167) was intended as a tool for collecting data on the types and frequencies of comments, based on the various categories of messages conveyed. For example, how often did instructional sequences occur, how many times did the teacher praise the student's ability, and did the teacher recognize the child's effort? If a viable Feedback Assessment Rubric could be constructed, future research might be able to perform a more in-depth analysis of the relationships between categories of feedback and specific feedback effects.

However, for this particular research the rather elaborate Feedback Assessment Rubric was unnecessarily detailed. Although the instrument did provide additional insight into patterns of teacher commentary, much of the information was superfluous to the research questions posed.

The Feedback Assessment Rubric was heavily influenced by prior research on feedback categories (Bardine, 1999; Foote, 1999; Schunk, 1983). As such, the basic design was sound. However, one additional category, *expressions of pleasure*, was added

based on an analysis of the first few weeks worth of data (assignments that had already been coded were re-analyzed and re-coded).

In practice, the actual Feedback Assessment Rubric form was not used. Instead, a coding key was written on a copy of each assignment, and the feedback categories were tallied directly on the assignment. The key was:

Z E A ☺ I D P C Q X G

(i.e., the letters and symbols shown in parentheses on Appendix C, page 167). This approach conserved paper and was relatively easy to implement.

There were two main complications inherent in the use of the Feedback Assessment Rubric. First, it was not always a straightforward process of assigning a single meaning or purpose to the individual comments. For example, the comment "Great!" could be interpreted as recognition of either effort or ability (it was treated as an ability-related comment). Second, it was not always easy to deduce what constituted a single "comment." For example, if the teacher wrote several calculation corrections on a single problem, should each corrected figure be counted as an instance of feedback or should the entire corrective be counted as a single comment? The practice that was consistently employed was to count a maximum of one instance of a feedback category per math problem unless it was obvious that the markings had distinct purposes.

Although there were opportunities to improve and abridge the Feedback Assessment Rubric, it still served its intended purpose well. It provided a mechanism for accumulating teachers' feedback patterns and for performing some high-level statistical analyses of teacher commentary.

Study Observations, Results and Conclusions

Cross-study Observations

The preceding section discussed the individual survey instruments, their strengths, their weaknesses, and opportunities for improvement. The current section considers anomalies and opportunities that revolve around the research procedures themselves.

One unexploited opportunity concerns site supervision. In the current studies, the researcher did not observe the intervention activities. For example, there was no oversight of the administration of surveys nor was there empirical evidence concerning either the goal setting activity or the periodic review of goal statements. However, there was significant evidence that the teachers were very faithful to most study components. There was 100% attendance at planning meetings and collaborative sessions. Teachers strictly adhered to all schedules. They consistently administered and returned surveys. They responded to all communications. Teacher fidelity to the observable components of the study strongly suggests that they were equally faithful to the unverified tasks.

A second methodological issue was the type of measurement tools used. Three of the tools used in the studies were self-report instruments: the Academic Motivation Survey (Study 2 only), the Assignment Rating Slip, and the Feedback Effectiveness Survey. Three risks inherent in any self-report are that the respondents may provide socially desirable responses (i.e., they may answer in ways that they consider "proper," to maintain a favorable appearance), they may be intentionally deceptive or evasive, and they may lack sufficient introspective or expressive abilities to communicate their true attitudes. Although these limitations cannot be dismissed, self-report measures are the best means of obtaining attitudinal information, and there was little incentive for students

to knowingly misrepresent themselves on these particular survey instruments. Further, the free-form comments provided by the students on the Feedback Effectiveness Survey seem to suggest that the children were forthright in their responses on this instrument.

Another concern involved the repetitive process of surveys, eight iterations for four of the classes and twelve iterations for one class. There was a possibility that students would have viewed the frequent inquiries as tedious. They could have become bored, causing them to respond in cavalier or dismissive ways. Fortunately, there was little evidence of such indifference; responses to survey instruments were consistent throughout the studies, with major variations only at anticipated locations (e.g., when feedback levels varied).

One anomaly encountered during the conduct of the research involved the timing of treatments. Originally, Study 1 was planned to last twelve weeks and Study 2 was scheduled for eight weeks. However, events transpired to reduce both studies by one week. All originally planned activities occurred, but on a compressed timeframe; instead of one feedback event per week, two events occurred during one of the weeks. Since there was no a priori basis for a weekly cycle of feedback events (as opposed to semi-weekly, daily, etc.), the impact of the schedule revisions was largely superficial.

There was one morally distressing aspect of the research. The Feedback Effectiveness Surveys contained an open-ended question, providing the students with an opportunity to express their feelings, views, and any concerns they might harbor. During the study, there were a number of plaintive comments made by students in the control group and by students in the *ABAB*-type study during the baseline phases. It would have been beneficial for the teacher to have been cognizant of this information. For example,

comments such as “I need help” and “I didn’t cheat on my homework” reflect opportunities to provide focused instruction and to correct misunderstandings. However, communiqués such as these were withheld from the respective classroom teachers because the information could have biased the study by providing “feedback” where none previously existed. Researchers should be prepared for such conscience-nagging events and should recognize that they are an unavoidable risk of privileged correspondence.

Finally, there may have been two unintended motivational consequences from the use of the repetitive survey instruments. The Assignment Rating Slip was a two-part form that was geared toward the study’s participants. Part 1 was “for” students, to assist them in setting autonomous, short-term goals. Part 2 was “for” teachers: students were to provide input for the teacher concerning the effort that they expended in completing the work, to facilitate teachers’ written commentary. However, Part 2 of this instrument could have served a collateral function. The postscript might have caused students to reflect on their work, producing motivational consequences (e.g., satisfaction or disappointment, pride or discouragement). Introspection, even if for an ulterior purpose, may affect motivation.

In a similar vein, the Feedback Effectiveness Survey was intended as a means of assessing students’ impressions of the teachers’ feedback; the consumers of this information were supposed to be the researcher and the teachers of the experimental group. However, in completing these surveys, students were called upon to reflect on their work and the teachers’ involvement in the educational process. This reflection could have affected students’ academic attitudes, their perspectives on their teachers, or

other educational beliefs. The simple introduction of this survey instrument could have impacted student motivation.

While the studies did achieve the majority of their goals, the aforementioned observations provide additional insight into the actual implementation of the research and may be of use in helping the reader interpret the findings in context. In addition, replications of these studies should consider these issues and, if appropriate, adjust the procedures accordingly.

Study 1 Discussion

This study provided limited support for the research hypothesis that enhanced written feedback (as measured by the researcher) results in more effective feedback, from the student's perspective. The results of this study were predicated on the difference in feedback effectiveness between the baseline and the intervention periods. If the participating teacher is already providing comprehensive written feedback, there may be little incremental improvement observed, obfuscating the interpretation of the study. An effective *ABAB*-type study of this sort requires that the teacher make a significant shift in the level of written feedback provided.

For the *ABAB*-type study associated with this research, missing data points were particularly damaging. The minimum number of twelve data collection points was established (i.e., three per period, for four periods) due to practical limitations; more than a dozen iterations would have fatigued participants. Unfortunately, complete data were available for only eight of the fifteen participants. A second major complication encountered in the execution of the *ABAB*-type study was that it relied heavily on the participating teacher making an instantaneous transition from "normal" written feedback

to "enhanced" written feedback. The particular teacher, with over twenty years of experience and an established approach to teaching, had some difficulty making this transition. This problem is exemplified by Table 5 on page 88, which compares the mean Feedback Scores for the six intervention measures from the *ABAB*-type study with the first six Feedback Score measures from the other participating classrooms. Inspection of this table reveals that the Feedback Scores for two of the four intervention measures (i.e., measures 1 and 4) are more in line with the control group's feedback level than with the experimental group's. Also noteworthy is the fact that the lowest scores occurred during the first intervention measure of the period; perhaps the teacher had to work up to the new feedback level.

ABAB-type studies are supposed to insure that the measured dependent variables stabilize before the independent variable is altered (Creswell, 2002; Schloss & Smith, 1994). The current study failed to adhere to this rule, and suffered the consequence of confounded data interpretability.

In light of the apparent time required for the teacher to adjust feedback levels, and in an effort to avoid excessive surveys, the following study amendment is suggested. There should be a 1-week delay following each baseline period. During this hiatus, the teacher will provide enhanced written feedback on a weekly assignment, but the students would not complete the survey forms. The researcher should collect and analyze the assignments and provide the teacher with additional practice and coaching, to help raise written feedback to the desired intervention period level.

Study 2 Discussion

This study provided support for an association between feedback scores (as measured by the researcher) and feedback effectiveness (as perceived by the students). The exhibited relationship between feedback scores and feedback effectiveness was reasonably straightforward and clear-cut. The anticipated statistical analyses were performed with little difficulty and without irregularity.

The study also furnished evidence of a relationship between students' perceptions of feedback effectiveness and their *Learning Goal Orientations*. Further, it demonstrated that this increased orientation toward learning goals did not diminish either students' Performance Goals (i.e., their interest in high achievement) or their ability self-concepts. The effect of perceived feedback effectiveness on the Learning Goal Orientation component of academic motivation was unambiguous.

However, the study failed to demonstrate a relationship between feedback effectiveness and academic performance. This aspect of the investigation was severely limited in its ability to assess changes in academic performance for a variety of reasons. First, it was inordinately difficult for the researcher to recruit study participants since he was not affiliated with any school district and had no effective mechanism for gaining entry into an elementary school setting. It took almost six months to locate a school district and elementary schools that were able and willing to participate in the research.

Although the eventual participants were ideal in many respects, the two participating schools were enlisted one month apart, and the classrooms were academically dissimilar. Academically, the two groups in the first school were significantly different ($p<.01$); the mean score on the pre-test for the control group was 74.6 (SE=5.4), and the mean for the

experimental group was 44.2 (SE=7.0). Further, the two groups in the second school were not covering the same lessons as students in the first school, and the two classrooms in the second school were at different points in their textbook. Consequently, a true pre-test/post-test opportunity only existed for the participants in the first school, and the small sample size and non-equivalent groups rendered these results problematic at best.

Despite these implementation difficulties, it still appears that the use of intact classrooms was the only viable approach to performing the intervention. It would have been impractical, unreasonable, and possibly unethical to expect a single classroom teacher to administer feedback at differing levels to different students. Plus, it was logistically impossible to obtain a truly random sample of teachers and student participants.

In most studies involving data furnished by participants, responses can be absent, indecipherable, or ambiguous. In this study, the data was fairly comprehensive, decipherable, and unambiguous. Data quality was high.

One characteristic of the study's implementation that is especially noteworthy is that the four participating teachers selected the roles that they would play; one teacher from each school chose to be in the experimental group. One must allow for the possibility that the personal factors that led to their role selection also contributed to the observed differences in their students' outcomes. Despite this risk, self-selection of roles seemed appropriate since this tact hopefully yielded participating teachers who would be the most committed to implementing the proposed intervention.

Finally, there were inherent limitations with the quasi-experimental design format that was used for this study. The four groups could have had a variety of non-random

cognitive, affective, and behavioral characteristics that accounted for the measured differences, or the target groups could have been uniquely affected by the intervention. While an attempt was made to control for extraneous factors, there is always the possibility that these factors influenced the validity of the study.

Final Conclusions and Recommendations

The preceding discussion was a reflection on the quality of the studies and specific recommendations for improvement. In addition, there were a number of revelations that arose during the studies.

One unforeseen, yet retrospectively understandable, outcome of the quasi-experimental study was that students in the experimental group more frequently provided comments on the Feedback Effectiveness Survey than did their counterparts in the control group. In total, there were 191 comments from the 34 students in the experimental group versus 117 comments from the 31 students in the control group. While group sizes differed by less than 10%, the experimental group volunteered 63% more free-form responses to the teacher commentary. In reading the comments (Appendix M, page 209), the researcher developed the distinct impression that the foci of the student comments varied based on what group they were in (i.e., either the control group or the experimental group), or, for the *ABAB*-type study, the *period* they were in (i.e., either baseline or intervention). For example, students not receiving the intervention tended to make comments that focused on academic performance (e.g., grades) whereas those receiving enhanced written feedback were more likely to reflect on learning and enjoyment. A qualitative analysis of these comments, while beyond the scope of this dissertation, could

provide valuable insight into students' goal orientations as influenced by teachers' increased focus on written feedback.

The student comments served a crucial function by providing easily decipherable, ongoing critiques of the teachers' written commentary. Each week, the students' comments were consolidated and shared with the respective classroom teacher **if** that teacher was providing enhanced written feedback (i.e., student comments were not shared with the teachers in the control group or with the teacher in the *ABAB*-type study during the baseline periods, A_1 and A_2). These student-provided comments closed the feedback "loop:" students completed homework assignments, the teachers graded the assignments, and the students, in turn, "evaluated" the teachers' commentary. The student comments allowed the teachers and the researcher to gauge whether the written feedback was on target. The student comments were indispensable.

A second collateral outcome of the studies was a post hoc analysis of teacher commentary by category (Table 20). Note that over half (55.4%) of the comments made by the control group's teachers' fell into the *miscellaneous* category. These markings generally took the form of simply providing the correct answer. While it is important for the student to be informed of right answers, the markings add little value beyond what could be accomplished by simply posting an answer sheet. These "comments" would seem to have little educative value and even less motivational impact.

Another noteworthy facet of the teacher commentary was the higher rate of student praising, and more frequent expressions of pleasure by the teachers of the experimental group (56.5% versus 33.8%). Prior research by Schunk (1982; 1983) demonstrated that teachers' attributions of past accomplishments to effort and/or ability promotes

perceptions of self-efficacy and enhances subsequent achievement. Based on the results of the current research, it is possible that the higher frequency of ability and effort attributions by teachers of the experimental group led to a higher Learning Goal orientation.

Table 20. Distribution of Teacher Commentary by Category

Category	Count	Mean	% of Cntl	% of Exp	% of Total	Cumu-lative %
Misc. Comment	571	1.28	55.4	25.2	33.6	33.6
Expressed Pleasure	318	.71	15.2	20.1	18.7	52.4
Praised Ability, High	213	.48	8.9	14.0	12.6	64.9
Praised Ability, Avg.	153	.34	9.3	8.9	9.0	74.0
Praised Effort, Avg.	153	.34	0.4	12.3	9.0	83.0
Instructed	120	.27	6.1	7.4	7.1	90.0
Called Attention to	103	.23	4.0	6.9	6.1	96.1
Asked Probing Question	41	.09	0.6	3.1	2.4	98.5
Praised Effort, High	15	.03	0.0	1.2	0.9	99.4
Directed Elsewhere	7	.02	0.0	0.6	0.4	99.8
Digression	3	.01	0.0	0.2	0.2	100.0
Illegible Marking	0	.00	0.0	0.0	0.0	100.0
Answered a Question	0	.00	0.0	0.0	0.0	100.0

A prior study lends further support to the current research findings. Cohen et al. (1985) found that special education teachers provided diagnostic feedback only about 8.6% of the time, and less than 2% of the time on division, subtraction, and addition worksheets. If the four categories of the Feedback Assessment Rubric *Instructed*, *Called Attention to*, *Asked [a] probing question*, and *Directed [the student] Elsewhere* are considered to be "diagnostic feedback," then two conclusions follow: The percentage of diagnostic feedback is still quite low, but higher than that provided by special education teachers, and teachers of the experimental group provided considerably more diagnostic feedback than did the teachers of the control group (18.0% versus 10.7%). This latter

conclusion further strengthens the argument for enhancing teachers' use of written feedback.

Although the detailed measure of teacher commentary was only of ancillary importance in addressing the research questions, it offered some key insights into the substance of teachers' grading of assignments. The majority of traditional teacher grading was non-diagnostic; the teacher simply wrote in the correct answer or provided similarly generic information. In contrast, teachers who employed "enhanced" written feedback focused more on providing positive attributions (i.e., appropriately praising effort and ability, and demonstrating pleasure) and on furnishing diagnostic feedback.

Another insight gained by analyzing teacher commentary is the recognition that students with flawless papers can achieve measurable benefit from scrupulously placed accolades. This opinion is supported by the numerous free-form comments made by appreciative students: "I really liked the '*A* is for awesome' thing," and "I think the comments were great! They show how hard I tried… I got 40 out of 40!" Consistent with Bardine's (1999) findings, "students like to see praise that is earned" (p. 246). Why should students with error-free assignments be any less deserving of teacher attention than those who are still struggling?

The Assignment Rating Slip (Appendix F, page 170), a two-question goal setting activity and a four-question postscript to the written assignment, was expected to be a rather prosaic instrument. The fact that it garnered attention is rather surprising. Some of the student responses to this goal setting activity were both unexpected and alarming. Intuitively, the researcher expected students to establish relatively high goals for the assignment. This was not always the case. In a number of instances, students set very

modest, pessimistic goals (e.g., to get 4 right out of 13). Approximately 3% of students set goals of less than 25% correct; 8% of the goals were for less than 50% correct; and 16% of the goals were for less than a 70%. The question of why students *expect to* or *aim to* fail 16% of the time certainly warrants further investigation.

The current research focused on written feedback in the area of mathematics. An unanticipated parameter within the study was the relatively low level of feedback. As noted in Chapter 4, teachers in the control group provided six or fewer comments on over 97% of the assignments, and experimental group teachers commented ten or fewer times on over 98% of the papers. A partial explanation for this infrequency of commentary is assignment length: All assignments were either one or two pages long (typically, the former). Lengthier assignments would likely provide greater insight into patterns of written feedback. However, written mathematics assignments are typically short in the middle elementary grades.

In the current study, feedback was related to student responses on absolute, non-interpretive questions. Students were not expected to provide creative, insightful, or intuitive answers. Consequently, the potential scope of teacher commentary was limited. Other subject areas—such as writing, reading, and art—afford a wider variety of teacher feedback. While the case for enhanced feedback applies to all subject areas, the opportunities and latitude for teacher comment is mediated by assignment attributes.

One of the premises of this research was that it would be most efficacious when applied to students in middle elementary grades; ideal candidates need to have a somewhat-developed understanding of the interaction between effort, ability, and outcome; and malleable attitudes toward academics, ability self-concept, and interest.

While this research did provide promising results, enhanced written feedback may provide diminishing returns in later grades (i.e., once attitudes are more firmly fixed).

Another aspect of Study 2 worth noting is that it involved two groups, a "control" group and an "experimental" group. In actuality, some intervention was performed on both groups so that the additive effect of enhanced written feedback could be assessed within pre-established environmental parameters. A prerequisite for the intervention was that students establish and periodically monitor personal, autonomous goals. A more robust implementation of this study's intervention would enlist a third, pristine control group. This third group would be exempted from all goal-setting activities, and would not complete Assignment Rating Slips. The three-group comparison would provide insight into the cumulative effects of enhanced written feedback goal maintenance, and student reflection on survey instruments.

Chapter 1 of this dissertation contended that we "should leverage students' natural curiosity and innate enthusiasm by providing them with captivating topics and a nurturing environment. One form of nourishment is formative assessment, and one ingredient of this guidance is written feedback" (p. 13). The accompanying research provided evidence that enhanced written feedback during formative assessment can serve as one tool in improving students' Learning Goal orientation. Since learning goals perform a fundamental and enduring motivational function, effective written feedback can nurture students' academic ambitions in a non-controlling, individualized manner. Written feedback facilitates student achievement, and acknowledges student accomplishments.

For feedback to be effective, it must be dialogical. Bidirectional exchanges are essential to meaningful communication: Students initiate these conversations through

their written assignments, teachers respond through commentary, recipients provide reactions to the critiques and apply the guidance, and the teachers refine accordingly subsequent feedback. It is through these negotiated conversations that written feedback during formative assessment evolves into instructive, motivating discourse.

Elementary school teachers can further their students' academic motivation and improve their chances of subsequent learning by providing effective written feedback. Written feedback affords an opportunity for teachers to provide individualized, personalized contributions to students goals, emotions, and personal agency beliefs.

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Appendices

A. Institution Review Board Approval for the Research Project

OFFICE OF RESEARCH ADMINISTRATION

Interdepartmental Correspondence

The UM-St. Louis Human Subjects Committee reviewed the following protocol:

Name: Craig Waddell

Title: The Effects of Negotiated Written Feedback Within Informative Assessment on Fourth Grade Students' Motivation and Goal Orientations Toward Mathematics

This proposal was approved by the Human Subjects Committee for a period of one year starting from the date listed below. The Human Subjects Committee must be notified in writing prior to major changes in the approved protocol. Examples of major changes are the addition of research sites or research instruments.

An annual report must be filed with the committee. This report should indicate the starting date of the project and the number of subjects since the start of project, or since last annual report.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator is required to retain the other copy of the signed consent form for at least three years following the completion of the research activity and the forms must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

Protocol Number	Date	Signature - Chair
030617W	7/31/03	Carl J Dassi

B. Consent Form for Participation in the Research

College of Education
Division of Educational Psychology, Research and Evaluation
469 Marillac Hall
8001 Natural Bridge Road
St. Louis, Missouri 63121-4499
Telephone: 314-516-5783
Fax: 314-516-5784

Informed Consent for Participation in Research Activities

The effects of teacher's written comments on students' Performance and Attitudes About Math

Participant _____ HSC Approval Number _030617W_____

Principal Investigator __Craig A. Waddell_____ PI's Phone Number _____

Why am I being asked to participate?

Your child (or ward) is invited to participate in a research study about the effects of written feedback on mathematics assignments, conducted by Craig Waddell, a doctoral candidate in Educational Psychology at the University of Missouri-St. Louis. Your child has been asked to participate in the research to help educators better understand the role of feedback on student performance. We ask that you read this form and ask any questions you may have before agreeing to allow your child to be in the research. Your child's participation in this research is voluntary. Your decision whether to permit participation will not affect your current or future relations with the University or your child's elementary school. If you decide to permit participation, you are free to withdraw your child at any time without affecting that relationship.

What is the purpose of this research?

This research will investigate whether having a teacher write more extensive, tailored comments on math assignments will help students learn, and improve their attitudes toward mathematics.

What procedures are involved?

If you agree to participate in this research, your child can expect:

1. To complete four short surveys about his or her attitudes toward mathematics, evenly spaced throughout the semester
2. To complete four mathematics quizzes, evenly spaced throughout the semester, to gauge learning progress. These additional quizzes will not affect his or her math grade.
3. For several written assignments, the student will complete a very simple, 6-item questionnaire, expressing opinions concerning effort expended on the assignment, and its perceived value.

4. Each week, the student will complete a short, 12-question survey concerning his or her opinion of the written feedback that the teacher gave on the weeks' mathematics assignments.

- Classroom structure and student relationships will not be affected by this research. Your child's only commitment is to complete periodic surveys and take four additional quizzes that will be scored but will not affect the final mathematics grade.

Approximately fifty students will be involved in this research at the University of Missouri-St. Louis, all from your child's school.

What are the potential risks and discomforts?

There are certain risks and discomforts that may be associated with this research. They include:

- The student will be required to fill out several surveys and take four additional quizzes throughout the semester. He or she may view this activity as an additional burden or an imposition.

- Since the teacher will periodically place additional comments on student homework, the student may be disappointed by critical comments. An effort will be made to make comments in a sensitive, non-offensive manner, but critiques may cause discomfort.

- There is no physical risk to participants, and psychological risks are minimal. There is very little chance that students will come to any harm as a result of this research.

Are there benefits to taking part in the research?

- This research is being performed based on a belief that the experiment will increase students' learning and enjoyment of mathematics. If effective, this research will benefit the student and the school, and will inform educational practices.

What other options are there?

- If you withhold permission for your child to participate in this research, the student will complete all mathematics assignments as usual.

Will I be told about new information that may affect my decision to participate?

During the course of the study, you will be informed of any significant new findings (either good or bad), such as changes in the risks or benefits resulting from participation in the research, or new alternatives to participation, that might cause you to change your mind about continuing in the study. If new information is provided to you, your consent to continue to participate in this study will be re-obtained.

What about privacy and confidentiality?

Protected Health Information (PHI) is any health information through which you can be identified. PHI is protected by federal law under HIPAA (the Health Insurance Portability and Accountability Act).

- This study will not involve PHI.

The only people who will know that your child is a research subject are members of the research team and your child's teacher. No information about your child, or provided by your child during the research, will be disclosed to others without your written permission, except:

- if necessary to protect your rights or welfare (for example, the University of Missouri-St Louis Institutional Review Board monitors the research or consent process); or
- if required by law.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your child's identity. There are no plans to take photographs, videos or audiotape recordings. However, if any pictures or recordings of your child are created for educational purposes, your child's identity will be protected or disguised. Any information that is obtained in connection with this study, and that can be identified with your child, will remain confidential and will be disclosed only with your permission or as required by law.

Surveys and quizzes will be scored by the researcher and entered into the researcher's personal computer, by the researcher. This computer is password protected. Student names will be carried only until all data has been collected. This is necessary because assignments need to be matched with subsequent student surveys. As soon as all data has been collated, student names will be eliminated

Do you already have contact restrictions in place with UM-SL? [ ] Yes [ ] No
(Example: no calls at home, no messages left for you, etc.)

Please specify any contact restrictions you want to request for this study only.

_____

_____

What are the costs for participating in this research?

- There is no cost associated with participation in this research.

Will I be paid for my participation in this research?

- You will not receive any pay or other compensation in exchange for allowing your child to participate in this research.

Can I withdraw or be removed from the study?

You can choose whether to permit your child to participate in this study. If you permit your child to participate in this study, you may withdraw him or her at any time without consequences of any kind. Your child also may refuse to answer any questions that he or she does not want to answer and still remain in the study. The investigator may withdraw your child from this research if circumstances arise which warrant doing so. If you decide to end your child's participation in the study, please complete the withdrawal letter found at http://www.umsl.edu/services/ora/IRB.html, or you may request that the Investigator send you a copy of the letter.

Who should I contact if I have questions?

The researcher conducting this study is Craig Waddell. If you have any questions, you may contact the researcher at [redacted], after 6:00 p.m. or on weekends.

What are my rights as a research subject?

If you have any questions about your child's rights as a research subject, you may call the Chairperson of the Institutional Review Board at [redacted].

What if I am a UMSL student?

You may choose not to allow your child to participate, or to stop participation in this research, at any time. This decision will not affect your class standing or grades at UM-SL. The investigator also may end your child's participation in the research. If this happens, your class standing will not be affected. You will not be offered or receive any special consideration if your child participates in this research.

What if I am a UMSL employee?

Your child's participation in this research is, in no way, part of your university duties, and your refusal to participate will not in any way affect your employment with the university or the benefits, privileges, or opportunities associated with your employment at UM-SL. You will not be offered or receive any special consideration if you participate in this research.

Remember: Your child's participation in this research is voluntary. Your decision whether to allow participation will not affect your current or future relations with the University or your child's elementary school. If you decide to permit your child to participate, you are free to withdraw this permission at any time without affecting that relationship.

You will be given a copy of this form for your information and to keep for your records.

I have read the above statement and have been able to express my concerns, to which the investigator has responded satisfactorily. I believe I understand the purpose of the study, as well as the potential benefits and risks that are involved. I give my permission to allow my child to participate in the research described above.

All signature dates must match.

_____		_____	
Participant's Signature	Date	Participant's Printed Name	
_____		_____	
Parent or Guardian's Signature	Date	Parent or Guardian's Printed Name	
_____		_____	
Witness' Signature	Date	Witness' Printed Name	
_____			
Researcher's Signature	Date		

C. Feedback Assessment Rubric

Student: _____ Assignment Number: ____

Instructions: Using tally marks, *count* each and every sentence, phrase, or symbol of teacher-provided commentary. Each piece of feedback should be counted once. If a comment is emphatic, mark it in the *High Intensity* column. Otherwise, count it in the *Average Intensity* column. Typically, the majority of comments are of *Average Intensity*.

	Intensity	
Feedback Activity (*code*)	**Average**	**High**[!]
Illegible (*Z*)		
Praised effort (*E*)		
Praised ability (*A*)		
Expression of Pleasure (☺)		
Provided instruction (*I*)		
Directed student elsewhere (*D*)		
Posed probing questions (*P*)		
Called attention to something (*C*)		
Answered an implicit/explicit question (*Q*)		
Digressions (*X*)		
General/nonspecific comments (*G*)		
Total # of Tally Marks in this Column:		

Enter Total ↓		Double Total ↓		**Feedback Score** ↓
	+		=	/
			=	

↑ Number of wrong answers + 1

↑ **Feedback Rate**

[!] Code to denote High Intensity feedback

D. Examples of Feedback Categories

Praised/urge effort (E):

- Good effort
- Always do your best
- Thank you for being neat
- Keep it up
- You show your work well
- Very neat
- We'll practice this together

High intensity praise of effort (E!):

- Great effort!

Praise/comment on ability (A):

- Good job remembering
- Yes!
- Good
- Nice
- You got it!
- We will re-teach (i.e., lack of ability)

High intensity praise of ability (A!):

- Great job!
- Super
- Wonderful
- Just perfect!
- Wow!

Expressing pleasure (☺):

- smiley faces (☺)
- stars (★)
- *stamped images*

Provided instruction (I):

- perpendicular lines cross
- remember: ...
- don't forget...
- be sure to…

Directed student elsewhere (D):

- use your notes
- check your planner

Posed probing questions (P):

- what do you do next?
- which...
- how do you...

Called attention to something (C):

- you forgot…
- homework practice has really helped
- *circle or underline key information*

Answered implicit or explicit question (Q):

-

Digressions (X):

- Happy Birthday!
- Thank you for helping others

General/nonspecific comments (G):

- be careful
- *providing the correct answer*
- see me
- show your work

E. Feedback Effectiveness Survey

Name: _____ Assignment Number: ____

Instructions: The assignment that was just returned to you has marks, comments, and a grade or score written on it. Please take a minute or two to tell me how you felt about those comments. Circle the word or phrase that best describes what you think. There are no right or wrong answers; this questionnaire is for you to express what you think and how you feel. Please mark all answers clearly and honestly.

1.	I think there were enough comments.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
2.	The comments helped me understand **where** I made mistakes.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
3.	The comments helped me understand **why** I made mistakes.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
4.	I **expect** to make these types of mistakes in the future.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
5.	I **disliked** reading the comments.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
6.	The comments show that my teacher cares that I learn from this assignment.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
7.	I **don't** think my teacher realizes how hard I tried.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
8.	The comments show that my teacher believes I can learn to do work like this.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
9.	The comments show that my teacher cares about me.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
10.	This assignment **didn't** help me learn.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
11.	This assignment will help me with future schoolwork.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
12.	This assignment was of value to me.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
13.	Do you have any other thoughts about either the assignment or the comments? You can say whatever you want (except you cannot use bad language):				
	_____				
	_____				

F. Assignment Rating Slip

Name: _____ Assignment Number: ____

PART 1 – Complete this section before you begin your assignment.

There are ____ problems in this assignment.

I am going to get at least ____ problems correct. This will be difficult, but I think I can do it.

PART 2 – Complete this section after you have finished the assignment.

1. I thought this assignment was (check one box):

   ❑ Very Easy ❑ Easy ❑ Average ❑ Hard ❑ Very Hard

2. I spent ____ minutes working on this assignment.

3. How hard did you work on this assignment:

   ❑ Not hard ❑ Average ❑ Hard ❑ Very Hard

4. I had help doing this assignment: ❑ Yes ❑ No

G. Goal Setting Activity

Introduction

According to Martin Ford's (1992) Motivation Systems Theory, motivation is comprised of three dimensions of the individual:

- Personal agency beliefs, such as self-confidence, autonomy (independence), and opportunity
- Emotions, such as self-esteem/worthiness, optimism/pessimism, and sociability
- Goals, including comprehension, achievement, and recognition

The purpose of this goal-setting activity is to have students establish and/or reflect on their individual reasons for exerting effort in math throughout the semester. According to Pintrich and Schunk (2002), motivation is "the process whereby goal-directed activity is instigated and sustained" (p. 5). Goals are a precondition for motivation. Why do students try? What do they hope to gain?

This exercise will give students an opportunity to reflect on their mathematics-related goals, and to make those goals more salient. The outcome from this activity is an individual, private, statement of goals that the student has for this semester's mathematics studies.

Procedure

1. The teacher moderates a brief (5- to 10-minute) discussion on the importance of mathematics, to individuals, in everyday life. A sample script follows. It can be adapted to suit the teacher's personal style, beliefs, and student audience:

   Class, as you know, we spend a lot of time working on math assignments. Do you ever think about why we bother? Do you ever wonder whether this math stuff *is good for anything? Why does anyone need to know how to add, subtract, multiply, divide, work with fractions, or solve word problems?*

   Before we begin "working" on math today, let's talk a bit about why we "do math." I want you to take a minute or two and think about this:
   1) What would you like to do when you grow up, and
   2) As a grown-up, what good will math be?

   Give students an opportunity to share their views on the preceding questions. You may want to list various careers on the board, along with the relevance of math (see attachment). The book Career Ideas for Kids Who Like Math, by Diane Lindsey Reeves, discusses the following fifteen careers: Actuary, Automotive Mechanic, Banker, Builder, Computer Consultant, Economist, Geographer, Machinist, Manufacturing Engineer, Market Researcher, Mathematician, Purchasing Agent, Stockbroker, Traffic Planner, and Urban Planner.

2. After the preceding discussion winds down, instruct students to create a goal statement.
   A sample script follows.

   Now, I would like all of you to take a few minutes to think about what math means to you. I'm handing out a form for you to fill out. It has three questions that I want you to answer.

   *I want you to read the questions and write your answers. Then I want you to put this paper in a place where you will be able to find it each week. This paper is for you and you alone. I will not grade them, I will not collect them, and I will not read them. They will not be going home. You can show them to other people if you want to, but **only** if you want to.*

3. Give students about five minutes to complete the assignment. Then, instruct them to put the papers away, in a place where they will be able to find them next week.

Math Usage in Various Careers

Career	Math's Roles
Accountant	Figuring taxes, tracking expenses, sales, purchases, profits, losses
Business	Purchases, sales, bids, profits, losses, expenses
Cashier	Figuring meal costs, collecting payments, making change, taking tips
Chemist or scientist	Formulas, weights, measures, fractions, growth rates
Computer programmer	Solving business problems (e.g., manufacturing applications, billing customers, collecting payments, creating paychecks)
Dentist, doctor, or nurse	Medicine dosages, temperature/pulse/blood pressure,
Fashion	Designing patterns, ordering/buying material, sewing different-sized outfits, setting sale prices
Fireman	Water control (pressure, rates, and volumes), temperatures, boiling points, explosive mixtures/powers/dangers, rescue weights/strengths/capacity
Homemaker (any adult)	Cooking/baking, grocery shopping, paying bills, borrowing money
Lawyers	Billing clients, settling lawsuits, arranging payments
Pilot or astronaut	Air speeds, distances, fuel consumption rates, compass readings, cargo weights
Policeman	Speeds, code talk (e.g., 10-38 means "ambulance needed"), travel time, street addresses
Sports star	Weight/time/distance training, negotiating contracts, travel and training expenses, figuring averages, scores, and percentages
Teacher	Math instruction, grading papers, figuring grades, ordering supplies, classroom projects
Writer	Research, making book deals, appointments and interviews

Name: _____

My Math Plans

List some of the ways that someone your age might be able to use math:

_____

_____

_____

_____

Think about what you want to do when you grow up. How might math be useful to you?

_____

_____

_____

_____

Now, make a list of what you want to accomplish in math during the remainder of this school year. This list is private; **nobody** else will see this list unless you choose to share it with them.

_____

_____

_____

_____

_____

H. Examples of Weekly Updates

From: **Waddell, Craig**
Sent: Sunday, February 01, 2004 7:42 PM
To: [redacted]
Cc: [redacted]
Subject: Research Update - Week 2

Hello, everyone,

Just a quick note to bring you all up-to-date:

- [redacted], [redacted], and [redacted]: I will start putting a copy of these weekly updates in the folders that are returned to you on Mondays. You can read either these e-mails or the notes; whichever is more convenient.
- Your graded papers will be returned early Monday morning. Blank forms for the upcoming week will be enclosed, too.
- The surveys/forms from Week #2 were great! I received every document for every participating student in attendance. Thank you very much. Frankly, I was pleasantly surprised that there weren't more absences.
- A FEW students neglected to answer a couple of items on the Feedback Effectiveness surveys. However, I noticed that they were better at completing the surveys than they were at completing their homework, so I can't hardly complain. If you could gently remind them to answer all twelve questions, that would be great (question 13 is optional).
- Remember to have your students privately review their goal statements early in the week.
- [redacted]: Thursday at 2:30 will work for me. I'll see you then.
- [redacted]: Look for another e-mail/note from me, providing additional information from you students' weekly surveys.

From my perspective, everything is going excellently. I appreciate the notes that you provide in the Friday package. Fell free to call, write, or e-mail me anytime. I am also always willing to stop by if you would like to chat in person. Thanks again.

Craig

From: **Craig Waddell**
Date: Sunday, February 08, 2004 9:04 PM
To: [redacted]
Subject: Research Update - Week 3, **Experimental Group**

Hi, [redacted],

Things continue to go well with your group. A few of the open-ended comments were pretty interesting. Here are all of them, along with a couple of my thoughts:

1. "I like what she put on my paper." Alright!
2. "She gave me good comments that I can understand." Good job!
3. "This assignment was very, very, very fun!" Gosh, I guess he/she liked the assignment.
4. "The assignment was hard but my teacher was good on the assignment." Okay, four positive reactions. It seems like your comments helped offset the negative feelings about the assignment's difficulty.
5. "The math X [multiplication] is hard but I still tried." This was from [redacted]. It might be a good idea next time to make some comment about her potential/ability. Let her know the you have confidence in her.
6. "I think I should of got a 100 instead of a 94 because I got them all right except for one because I copied the problem wrong." Unfortunately, students need to learn that a careless mistake has the same result and consequence as any other mental error.
7. [redacted] wrote, "I did not like the comment she put about the problem 2." There were two comments around this problem. I <u>think</u> the comment she was referring to was, "Pay close attention to all of the problems." I can understand how she <u>might</u> have been upset: If her error was caused by lack of understanding rather than by lack of attention, she might have been hurt by the suggestion that she was being careless. This is one of the risks we take when we try to attribute mistakes to specific causes. There's no real protection against this, other than to be careful about making assumptions. I think the best approach is what we're doing: gauging students' reactions to our comments and making adjustments.
8. "I don't think my teacher cares about me because my friends got 100% and so did I and she did not put anything else [other than] 'excellent' on my paper." I think this really highlights the fact that your students are paying close attention to your written comments. I think you should write an additional comment on [redacted]'s paper before your return it, and make sure she sees it.

[redacted], things are going really well. Keep up the great work. Also, feel free to preview the student's comments on the Feedback Effectiveness Surveys before you give them to me. The information is meant for both of us.

Thank you,

Craig

I. Constructing Negotiated Written Feedback

At one point during each of the proposed studies, selected teachers and the researcher established strategies for providing effective written feedback. This training took the form of a small workshop. It consisted of two, one-hour sessions to discuss feedback guidelines, the potential effects of feedback, and the intricacies of effective feedback. The format of the two sessions is summarized in Figure 16. The researcher utilized a Microsoft PowerPoint® presentation (Appendix K, page 181) to help focus the discussion.

Session 1 began with a brainstorming activity on the characteristics of feedback (e.g., what it is, and what it does). This led into a discussion of how these teachers use feedback in their classrooms, followed by consideration of some research-based dimensions of feedback including *feedback* versus *guidance*, and *formative feedback* versus *summative assessment*. Also covered was the interpretative nature of feedback. Finally, came a discussion on the characteristics of good feedback, using Appendix L (page 203) as a starting point. Teachers willingly adopted this model.

Session 2 focused on the practical applications of the written feedback model. This began by reviewing the activities and outcomes of Session 1. Then came an analysis of 4-5 teachers' unique markings of an identical, fictitious assignment. The teacher and the researcher then worked together to critique the teacher feedback, identifying pros and cons, and suggesting revisions. Next, teachers took two additional fictitious, student-completed mathematics assignments, graded them, and provided appropriate written feedback. The marked papers were then evaluated by the teacher and the researcher for feedback quality. Revisions were suggested and agreed upon. Finally, the teachers

reviewed the concepts presented during the workshop and agreed to applying them during the intervention portions of the studies.

Session #	Topic or Activity	Goal for the Participants
1	Overview	Activate prior knowledge and beliefs
	Discuss written feedback within the classroom	List ways in which written feedback is currently used by the teacher
	Discuss forms and functions of written feedback	Explain the distinctions between formative and summative feedback
	Consider student interpretations of feedback	Demonstrate the subjective nature of feedback
	Discuss characteristics of good feedback	Review and, optionally, refine the *Guidelines* (Appendix L)
2	Introduction	Review previous sessions' conclusions
	Evaluate exemplars of good and bad written feedback	Identify characteristics that influence the quality of written feedback
	Practice giving written feedback	Mark fictitious mathematics assignments. Review and revise.
	Wrap-up	Review concepts and commit to applying them in the classroom.

Figure 16. Outline of the Feedback Workshop

J. Academic Motivation Survey

Name: _____

Here are some questions about yourself as a student in math class. Please circle the word or phrase that best describes what you think.

1.	I'm certain I can master the skills taught in math class this year.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
2.	I prefer to do math work that is familiar to me, rather than work I have to learn how to do.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
3.	It's important to me that other students in my class think I am good at my math work.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
4.	It's important to me that I learn a lot of new math concepts this year.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
5.	I'm certain I can figure out how to do the most difficult math work.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
6.	I don't like to learn a lot of new math concepts in class.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
7.	I prefer to do math as I have always done it, rather than trying something new.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
8.	One of my goals in math class is to learn as much as I can.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
9.	One of my goals is to show others that I'm good at my math work.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
10.	One of my goals is to master a lot of new math skills this year.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
11.	I like math concepts that are familiar to me, rather than those I haven't thought about before.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
12.	It's important to me that I thoroughly understand my math class work.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
13.	I would choose math work I knew I could do, rather than work I haven't done before.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
14.	One of my goals is to show others that math class work is easy for me.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree

15.	One of my goals is to look smart in comparison to the other students in math class.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
16.	It's important to me that I look smart compared to others in my math class.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
17.	It's important to me that I improve my math skills this year.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
18.	I can do almost all the work in math class if I don't give up.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
19.	Even if the math work is hard, I can learn it.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
20.	I can do even the hardest work in math class if I try.				
	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree

Providing Effective Feedback During Formative Evaluation

Craig Waddell
January 2004

Agenda for Session 1

1. Overview
2. Discuss formative assessment
3. Discuss written feedback within the classroom
4. Discuss forms & functions of written feedback
5. Consider student interpretations of feedback
6. Discuss characteristics of good feedback

This agenda is intended as a general guide, to focus discussion.

Consider Assignments

1. Why do you give independent assignments?
2. Do you grade them? If so, why?
3. Do you return the graded assignments?

   If so, why?
4. *What are the consequences of the returned, graded assignments?*

Consider Feedback

- What are the purposes of feedback?
- What are the characteristics of effective feedback?

Formative vs. Summative Assessment

"It is important to distinguish between two major forms of assessment. The first, formative assessment, involves the use of assessments (usually administered in the context of the classroom) as sources of feedback to improve teaching and learning. The second, summative assessment, measures what students have learned at the end of some set of learning activities" (Bransford, Brown, & Cocking, 2000, p. 140).

The Importance of Feedback

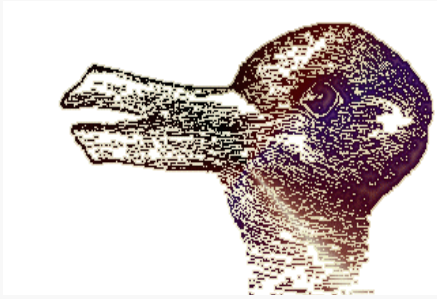
"Feedback is a critical element in efforts to motivate humans. Feedback can facilitate realistic goal setting, trigger adaptive emotional responses, and provide a solid basis for constructing and modifying personal agency beliefs. It can also suggest opportunities to pursue goals other than those that initiated the behavior episode. In contrast, when feedback is absent, it is easy for goals—even important goals—to lose salience and priority, and eventually end up 'on the shelf.'" (Ford, 1992, p. 210).

Feedback vs. Guidance

"Feedback is information about the effect of our actions. The environment or other people 'feed back' to us the impact or upshot of our behavior, be that impact intended or unintended. Guidance gives direction; feedback tells me whether I am on course" (Wiggins, 1993, p. 184).

Subjectivity

The recipient/student judges feedback's efficacy (i.e., sensing versus perceiving and interpreting).



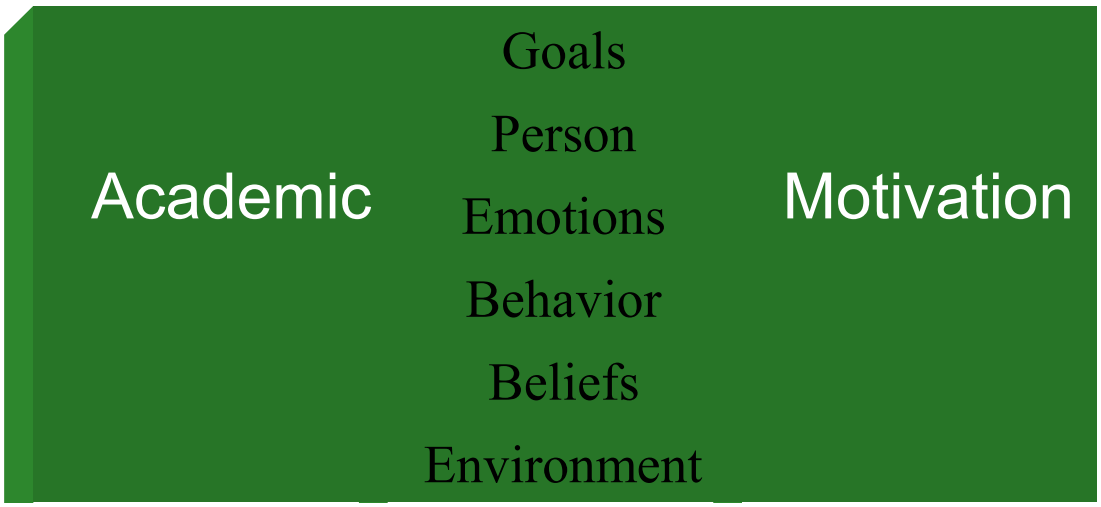
Feedback's Effects

What are the possible impacts that feedback can have on students?

Effective Feedback

"When anyone is trying to learn, feedback about the effort has three elements: recognition of the *desired goal*, evidence about *present position*, and some understanding of a *way to close the gap* between the two" (Black & Wiliam, 1998, p. 143).

Academic Motivation



Pekrun's Taxonomy of Student Emotions

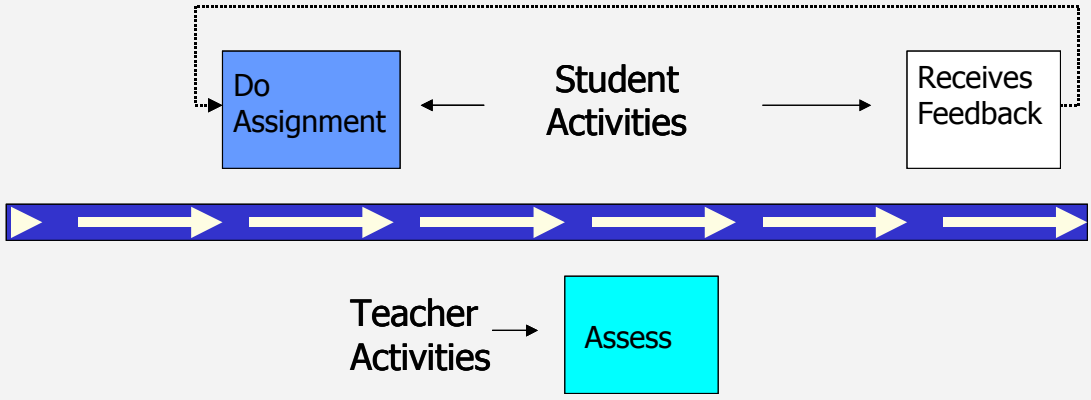
	Positive	Negative
Task-related		
• *Prospective*	Hope	Anxiety
	Anticipatory joy	Hopelessness (resignation)
• *Process*	Enjoyment	Boredom
• *Retrospective*	Relief	
	Joy of outcome	Sadness
	Pride	Disappointment
		Shame/guilt
Social	Gratitude	Anger
	Empathy	Jealousy/envy
	Admiration	Contempt
	Sympathy/love	Antipathy/hate

Motivated Learning (McCombs, 1991, 1998, 2001)

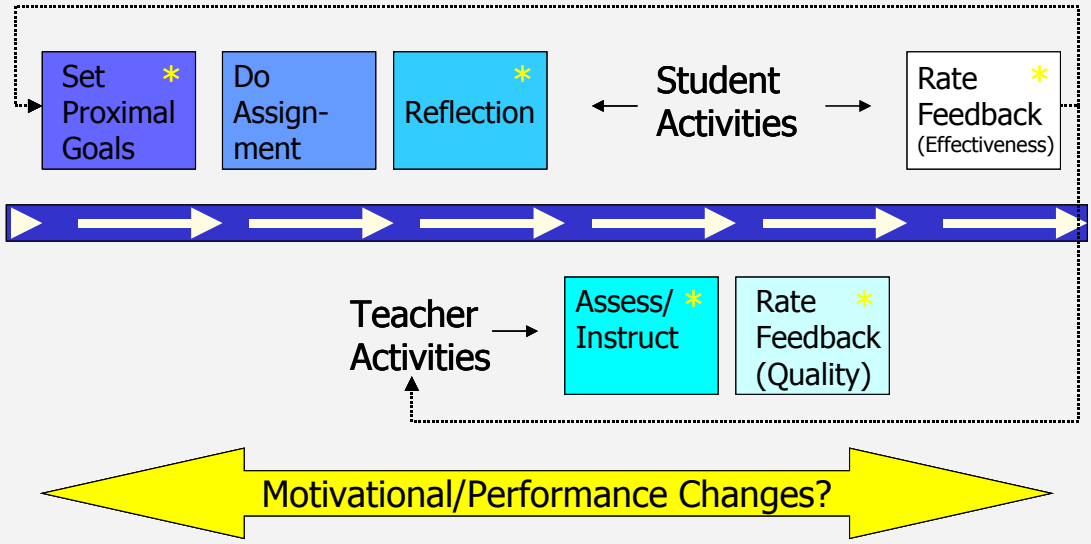
1. Schooling that is personally relevant to interests/goals.
2. Appropriate self-efficacy beliefs.
3. A feeling of personal responsibility.
4. Higher level thinking and self-regulation skills.
5. Effective and efficient (meta-)cognitive strategies.
6. Emotional and affective self-control.
7. Tangible outcomes signal success and goal attainment.

Effective written feedback affects all of these areas.

Typical Feedback



Effective, Negotiated Feedback



Characteristics of Good Feedback

- Legible
- Decipherable
- Specific
- Timely
- Prospective
- Appropriately praising and critical
- Genuine
- Constructive
- Devoid of social comparisons
- Gauges progress
- Frequent and ongoing
- Self-assessing and self-adjusting
- Optimistic
- Appropriately focused
- Personalized and sensitive
- Manageable
- Effective

Supporting Research

Session 1 Summary

- The importance of feedback
- The art and science of providing effective feedback
- The cognitive, social, and emotional repercussions of feedback
- Preview of Session 2

Agenda for Session 2

1. Introduction
2. Evaluate samples of written feedback
3. Practice giving written feedback
4. Wrap-up

Instructional Functions

1. Review/reteach
2. Present new material
3. Guided practice
4. **Provide feedback; reteach if needed**
5. **Independent practice**
6. Periodic Review

Adapted from Rosenshine & Stevens

Practice #1

- Instructions: Using the answer key provided, "grade" a fictitious student's homework assignment.
- Compare your scoring against that of five other teachers.
- What assets and opportunities do you observe in the various feedback approaches?

Q1, Please see me.

Student's Paper

3½/10

1. Mr. Adams was born in 1931. In what year did he turn 29?

1931
+ 29
1960

2. A bowler played three games. She scored 149, 177, and 154. What was her average?

Q2 This is the total of her 3 scores. Now we need to find her average.

149
177
154
480

Y2

3. You have $345 in a checking account. You write two checks, one for $45 and one for $29. How much money is left in your checking account?

45
+29
74

345
- 74
$271

4.

8907
- 2059
6958

5. A candy factory made 176 pounds of chocolates. They put them in 4-pound boxes. How many boxes did they fill?

44
4)176
16
16
0

6. A family divides an inheritance of $18,400 among its children, giving each of them $2,300. How many children are there?

8
2300)18400
184

7.

42
23)966
92
46
46

8. A sack of oranges weighs 27 pounds. A sack of apples weighs 32 pounds. Find the total weight of 16 bags of oranges and 43 bags of apples.

16
+43
59

27
+32
59

59
×59
531
2950
3481

9. A farmer owns one square mile of land. He gives 4/5 of it to his daughter. She, in turn, gives 2/3 of her share to her son. How much land goes to the son?

$\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$

10. $\frac{2}{3} + \frac{3}{4} = \frac{5}{7}$

Please Show your work! Student's Paper 65% +6.5 10

1. Mr. Adams was born in 1931. In what year did he turn 29?

1931 + 29 = 1960 (11)

2. A bowler played three games. She scored 149, 177, and 154. What was her average?

149 + 177 + 154 = 480

-½ You've got a good start... what's next?

3. You have $345 in a checking account. You write two checks, one for $45 and one for $29. How much money is left in your checking account?

45 + 29 = 74; 345 − 74 = $271

4. 8907 − 2059 = 6958

5. A candy factory made 176 pounds of chocolates. They put them in 4-pound boxes. How many boxes did they fill?

176 ÷ 4 = 44

6. A family divides an inheritance of $18,400 among its children, giving each of them $2,300. How many children are there?

18400 ÷ 2300 = 8

7. 966 ÷ 23 = 42

8. A sack of oranges weighs 27 pounds. A sack of apples weighs 32 pounds. Find the total weight of 16 bags of oranges and 43 bags of apples.

16 + 43 = 59; 27 + 32 = 59; 59 × 59 = 3481

9. A farmer owns one square mile of land. He gives 4/5 of it to his daughter. She, in turn, gives 2/3 of her share to her son. How much land goes to the son?

$\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$

10. $\frac{2}{3} + \frac{3}{4} = \frac{5}{7}$

Can you add these numbers? What do you have to do first?

Student's Paper 6.5/10 = 65% Let's do this one again.

1. Mr. Adams was born in 1931. In what year did he turn 29?

1931 + 29 = 1960 ✓

-1/2 2. A bowler played three games. She scored 149, 177, and 154. What was her average?

149 + 177 + 154 = 480

3. You have $345 in a checking account. You write two checks, one for $45 and one for $29. How much money is left in your checking account?

45 + 29 = 74 ; 345 − 74 = $271 Looks good!

4. 8907 − 2059 = 6848 Remember to regroup!

5. A candy factory made 176 pounds of chocolates. They put them in 4-pound boxes. How many boxes did they fill?

176 ÷ 4 = 44

6. A family divides an inheritance of $18,400 among its children, giving each of them $2,300. How many children are there?

18400 ÷ 2300 = 8

7. 966 ÷ 23 = 42

8. A sack of oranges weighs 27 pounds. A sack of apples weighs 32 pounds. Find the total weight of 16 bags of oranges and 43 bags of apples.

16 bags × 27 lbs/bag = 432 lbs
43 bags of apples × 32 lbs/bag = 1,376 lbs
16 + 43 = 59 ; 27 + 32 = 59 ; 59 × 59 = 3481

9. A farmer owns one square mile of land. He gives 4/5 of it to his daughter. She, in turn, gives 2/3 of her share to her son. How much land goes to the son?

4/5 × 2/3 = 8/15

10. 2/3 + 3/4 = 5/7

Remember to change the fractions so that they have common denominators

2/3 = 8/12 ; 3/4 = 9/12 ; 17/12 = 1 5/12

Often ask children to explain answers in more than one way

Student's Paper

(Would talk to the student)

+10

1. Mr. Adams was born in 1931. In what year did he turn 29?

1931
+ 29
1960

Good!

2. A bowler played three games. She scored 149, 177, and 154. What was her average?

149
177
154
480

+5

Incomplete — look at this word — Try again. Return to me

3. You have $345 in a checking account. You write two checks, one for $45 and one for $29. How much money is left in your checking account?

+10

45
+29
74

345
- 74
$271

4. 8907
- 2059
6958

Show another way to complete this

5. A candy factory made 176 pounds of chocolates. They put them in 4-pound boxes. How many boxes did they fill?

+10

44
4)176
16
16
0

6. A family divides an inheritance of $18,400 among its children, giving each of them $2,300. How many children are there?

+10

8
2300)18400
184

7. 42
23)966
92
46
46

Show another way, please

8. A sack of oranges weighs 27 pounds. A sack of apples weighs 32 pounds. Find the total weight of 16 bags of oranges and 43 bags of apples.

See me

16
+43
59

27
+32
59

59
×59
531
2950
3481

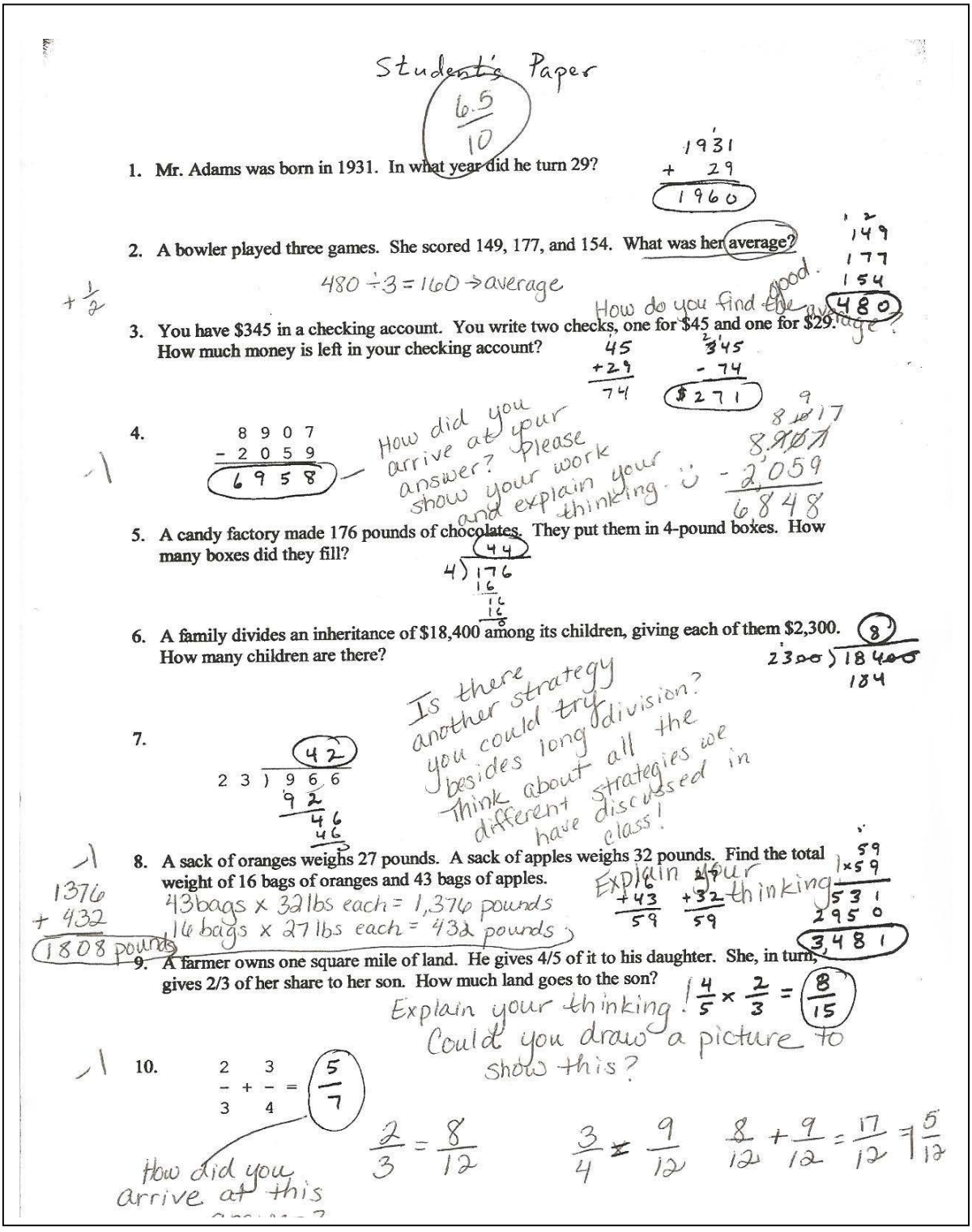
9. A farmer owns one square mile of land. He gives 4/5 of it to his daughter. She, in turn, gives 2/3 of her share to her son. How much land goes to the son?

Explain this

$\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$

10. $\frac{2}{3} + \frac{3}{4} = \frac{5}{7}$

Think again. Whatever you do to the ...



Student's Paper

6.5/10

1. Mr. Adams was born in 1931. In what year did he turn 29?

1931 + 29 = 1960

2. A bowler played three games. She scored 149, 177, and 154. What was her average?

149 + 177 + 154 = 480

480 ÷ 3 = 160 → average

+ 1/2

How do you find the average? Good.

3. You have $345 in a checking account. You write two checks, one for $45 and one for $29. How much money is left in your checking account?

45 + 29 = 74

345 − 74 = $271

4. 8907 − 2059 = 6958

How did you arrive at your answer? Please show your work and explain your thinking. ☺

8,907 − 2,059 = 6848

−1

5. A candy factory made 176 pounds of chocolates. They put them in 4-pound boxes. How many boxes did they fill?

176 ÷ 4 = 44

6. A family divides an inheritance of $18,400 among its children, giving each of them $2,300. How many children are there?

18400 ÷ 2300 = 8

184

7. 966 ÷ 23 = 42

Is there another strategy you could try besides long division? Think about all the different strategies we have discussed in class!

8. A sack of oranges weighs 27 pounds. A sack of apples weighs 32 pounds. Find the total weight of 16 bags of oranges and 43 bags of apples.

43 bags × 32 lbs each = 1,376 pounds

16 bags × 27 lbs each = 432 pounds

1376 + 432 = 1808 pounds

−1

Explain your thinking

16 + 43 = 59

27 + 32 = 59

59 × 59 = 3481

9. A farmer owns one square mile of land. He gives 4/5 of it to his daughter. She, in turn, gives 2/3 of her share to her son. How much land goes to the son?

Explain your thinking! 4/5 × 2/3 = 8/15

Could you draw a picture to show this?

10. 2/3 + 3/4 = 5/7

−1

How did you arrive at this answer?

2/3 = 8/12

3/4 = 9/12

8/12 + 9/12 = 17/12 = 1 5/12

Review

Review and/or revise the *Characteristics of Good Feedback* handout.

Practice #2

- Grade two additional assignments, using:
  - The answer key provided,
  - The Assignment Rating Slip, and
  - The student answer sheets
- Discuss your rationale for the markings
- Do the Characteristics of Good Feedback apply?

  How might you adapt them?

Assignment Rating Slip

Name: Student #1 Assignment Number: ____

PART 1 – Complete this section before you begin your assignment.

There are 6 problems in this assignment.

I am going to get at least 4 problems correct. This will be difficult, but I think I can do it.

PART 2 – Complete this section after you have finished the assignment.

1. I thought this assignment was (check one box):

   ☐ Very Easy ☐ Easy ☐ Average ☐ Hard ☑ Very Hard

2. I spent 30 minutes working on this assignment.

3. How hard did you work on this assignment:

   ☐ Not hard ☐ Average ☐ Hard ☑ Very Hard

4. I had help doing this assignment: ☐ Yes ☑ No

Student Answers #1

x 3/6

Math Word Problems[1]

1. Tyler Jefferson is running for governor. Some of his friends are going to have a benefit dinner for him. A ticket to the dinner costs $52.00. Four hundred twelve people have purchased tickets. How much money will the dinner raise for Mr. Jefferson's campaign fund?

425
52
850
2125
2975

Always remember to add 0 when multiplying second row!

2. Mrs. Smith has to calculate the number of students in her class so she could make sure that she has enough reading books in her crate. There are four rows of chairs with eight chairs in each row in the classroom. There are five empty chairs. How many students does Mrs. Smith have in her class?

1 2 3 4 5 6 7 8 8
1 2 3 4 5 6 7 8 8
1 2 3 4 5 6 7 8 8
1 2 3 4 5 6 7 8 +3

27

3. Our teacher told us a story about three families who were having a feud. The dispute was over which family owned the four wild hound dogs that wandered in the woods. Half of the Marks family said the dogs belonged to the Smiths family. One-fourth of the Marks family said the dogs belonged to the Jacks family. The rest of the Marks family said, "What dogs?" There are 32 people in the Marks family. How many of them said "What dogs"?

1/2 = Smith → 1 2 3 4 5 6 7 8 = 16
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32

1/2 1/4 = Jacks

What is your answer for Jacks? What happens next?

4. Julia and Joseph had a dispute over who earned the most allowance last week. Julia earned $6.39 for mowing the lawn and $10.85 for her other chores. Joseph earned $8.09 for helping Dad to trim the trees and $12.74 for the rest of his chores. How much more did Joseph earn?

8.09
+12.74
$20.83

-1/2

I see Josephs money, what about Julia's?

5. Daniel, Dylan, and Timothy are called the Terrible Trio because they are always getting in trouble together. My father said they are just wild. One Halloween they bought a crate of fireworks and scared all the animals on our avenue with the noise. There were twelve packs in the crate. Each pack had forty-eight firecrackers in it. How many firecrackers were in the crate?

48
x 12
96
48
144

A 1/2

Don't forget 0

6. A new library and a new auditorium are being built in our capital. The workmen have been very busy. They have already been at work for seventy-eight days. The cost of the library will be $2,250,000.00. The state legislature approved $4,490,000.00 to build the library and the auditorium. How much money was set aside for the auditorium?

4,490,000.00
- 2,250,000.00
$2,240,000.00

Assignment Rating Slip

Name: Student #2 Assignment Number: ____

PART 1 – Complete this section before you begin your assignment.

There are 6 problems in this assignment.

I am going to get at least 5 problems correct. This will be difficult, but I think I can do it.

PART 2 – Complete this section after you have finished the assignment.

1. I thought this assignment was (check one box):

☐ Very Easy ☐ Easy ☑ Average ☐ Hard ☐ Very Hard

2. I spent 15 minutes working on this assignment.

3. How hard did you work on this assignment:

☐ Not hard ☑ Average ☐ Hard ☐ Very Hard

4. I had help doing this assignment: ☐ Yes ☑ No

Student Answers #2

+4.5/6

Math Word Problems[1]

X Tyler Jefferson is running ~~for governor. Some of~~ his friends are going to have a benefit dinner for him. A ticket to the dinner costs $52.00. Four hundred twelve people have ~~purchased~~ tickets. How much money will the dinner raise for Mr. Jefferson's campaign fund?

422
52
844
21100
$21,944

Pay attention to numbers!

2. Mrs. Smith has to calculate the number of students in her class so she could make sure that she has enough reading books in her crate. There are four rows of chairs with eight chairs in each row in the classroom. There are five empty chairs. How many students does Mrs. Smith have in her class?

4 x 8 = 32 chairs 32 - 5 = 27 non-empty chairs

27 students

3. Our teacher told us a story about three families who were having a feud. The dispute was over which family owned the four wild hound dogs that wandered in the woods. Half of the Marks family said the dogs belonged to the Smiths family. One-fourth of the Marks family said the dogs belonged to the Jacks family. The rest of the Marks family said, "What dogs?" There are 32 people in the Marks family. How many of them said "What dogs"?

2)32 16 - said "Smith" 4)32 8 - said "Marks"

16+8 = 24

32-24=8

8 said "What dogs"

4. Julia and Joseph had a dispute over who earned the most allowance last week. Julia earned $6.39 for mowing the lawn and $10.85 for her other chores. Joseph earned $8.09 for helping Dad to trim the trees and $12.74 for the rest of his chores. How much more did Joseph earn?

-1/2

Julia: 6.39 + 10.85 = $17.24

Joseph: 8.09 + 12.74 = $20.83

What do you need to do with these 2 numbers

5. Daniel, Dylan, and Timothy are called the Terrible Trio because they are always getting in trouble together. My father said they are just wild. One Halloween they bought a crate of fireworks and scared all the animals on our avenue with the noise. There were twelve packs in the crate. Each pack had forty-eight firecrackers in it. How many firecrackers were in the crate?

12 packs
x 48 firecrackers per pack
96
480
576

576 firecrackers

6. A new library and a new auditorium are being built in our capital. The workmen have been very busy. They have already been at work for seventy-eight days. The cost of the library will be $2,250,000.00. The state legislature approved $4,490,000.00 to build the library and the auditorium. How much money was set aside for the auditorium?

$ 4,490,000.00
- $ 2,250,000.00
$ 2,240,000.00

Session 2 Summary

- What conclusions have you made with respect to written feedback?
- Will you commit to increasing your attention to providing written feedback (in mathematics) over the next several weeks?

L. Guidelines for Teachers: Providing Effective Feedback

Teachers give students written assignments (e.g., in-class work and homework assignments) to provide opportunities for academic learning and enrichment. Typically, emphasis is placed on students' performance on these tasks, such as the number of correct/incorrect responses. However, the effectiveness of these exercises can be significantly enhanced by written comments that teachers affix to the returned assignment. Devoid of written feedback, assignments are self-study, independent learning exercises. When teachers provide commentary, it transforms the assignment into a collaborative learning experience; teachers contribute to student learning and motivation by providing feedback, guidance, confidence, and encouragement. This pamphlet provides suggestions on how to provide feedback that helps students learn and develop.

Providing written feedback takes time and effort, critically scarce commodities of a conscientious teacher. So, teachers may be reluctant to commit their resources to written feedback. However, well-constructed written feedback can provide highly-focused, individualized, instruction to students, from the academically weakest ones to the most advanced ones. Written feedback lets teachers converse with his or her students, one-on-one, in a personalized, educative manner.

Conceptually, written feedback is an inherent part of teaching, but little formal instruction exists on how to provide <u>effective</u> written feedback. The following guidelines are provided to assist in this process.

Characteristics of Good Feedback

Legibility: No feedback, no matter how keen, insightful, or inspiring, is of any value if the student cannot read the teacher's writing. Handwriting or printing must be readable.

Decipherability: A student must be able to tell both what a comment says (legibility) and what it means (decipherability). Teachers must use words and terminology that are within the student's vocabulary and are unambiguous. Any abbreviations or esoteric terms need to be understood by the student. Furthermore, it has to be clear as to what the comment pertains. For example, if the teacher writes *LCD?* beside a computational error, will the student know that *LCD* stands for Least Common Denominator, and is the underlying concept understood?

Specificity: Feedback is most valuable when it provides concise, explicit guidance. For example, rather than marking a subtraction error as failure to *borrow*, highlight which column of numbers was incorrectly computed. Perhaps the prototypical example of lack of specificity is when a teacher places an isolated question mark on a segment of an assignment. What is such a mark intended to convey? Comments should communicate to the recipient exactly where the confusion or misunderstanding lies. Note, however, that specificity is not the same as full disclosure. Teachers do not need to provide complete remedies for shortcomings with assignments, but teachers are responsible for clearly identifying problems and directing students toward reparations.

Timeliness: Feedback needs to be provided shortly after an assignment is submitted (i.e., within a couple of days). It needs to occur while the student's recollection of the

assignment is relatively fresh, while learning is still developing, and while the messages are germane.

Feed forward: If feedback is to have an educative value, it must contribute to successes in future ventures. Students must have an opportunity to apply the guidance that the teacher provides.

Appropriateness of Praise and Criticism: With so much emphasis on self-confidence and self-esteem over the recent decades, there is a natural tendency to provide complimentary comments on student work. Teachers certainly should provide praise when students have made noteworthy accomplishments or exerted superior effort. However, if praise is lavished, it loses its cognitive and emotional impact. Likewise, if criticism is excessive, it becomes hurtful and detrimental. Comments should be circumstantially appropriate.

Genuineness: Students need to perceive the teacher's attempts to provide guidance as honest and genuine. The student needs to believe that academic adjustments will yield future dividends. Further, praise and compliments must ring as true and sincere else the teacher loses credibility and the accolades lose force.

Constructiveness: The goal of feedback and guidance is to further the student's cognitive and emotional growth, and to help him or her reach personal goals. Therefore, all feedback should inform students how to make progress toward goals. Critical feedback can be quite constructive so long as it clearly and non-judgmentally advises the student what is wrong and provides an avenue for redress.

Devoid of Social Comparisons: Feedback should focus on the caliber of an individual's work, without comparison to the works and accomplishments of peers.

Comparing the accomplishments of one student with that of another student serves no educative purpose. It is quite appropriate to compare student's current work with prior work, to compare caliber of work with one's capabilities, and to measure progress toward individual goals. It is also appropriate to provide students with rubrics and exemplars, but without making social comparisons.

Gauge Progress Toward Goals: According to Black and Wiliam (1998), "When anyone is trying to learn, feedback about the effort has three elements: recognition of the desired goal, evidence about present position, and some understanding of a way to close the gap between the two" (p. 143). While social comparisons should be avoided, personal growth should be monitored, and celebrated as appropriate.

Feedback Scheduling: Feedback should be frequent and ongoing. Feedback informs students of progress toward goals. As such, it only makes sense that these "informational road signs" appear with sufficient frequency to minimize academic detours and pitfalls.

Self-assessing and Self-adjusting: Ideally, feedback would provide the student with the tools needed to self-assess performance and self-adjust procedures. The teacher should act as a facilitator insofar as possible, providing students with resources to maximize individual independence. Mistakes should be viewed as a normal, positive part of growth and development. If students can detect their academic shortcomings and self-correct, it will enhance their self-efficacy, self-esteem and educational development.

Teacher Confidence: Teachers need to recognize that all students possess a vast array of capabilities. While teachers should have realistic expectations, they should also adopt and convey confidence that their students have the innate ability to be academically

successful. Some students may have social and economic liabilities that make their situation particularly bleak, but they do possess the ability to succeed, under the right circumstances.

Appropriateness of Feedback Focus: Teachers need to be selective when they choose what aspects of the assignment warrant written feedback. Students will pay attention to what the teacher criticizes and will disregard what the teacher neglects. Therefore, it is important that the teacher focus attention on the most salient portions of an assignment. For example, if a student is deciphering mathematics word problems, the key skills being employed are 1) selecting the appropriate algorithm, and 2) correct assignment of variables. Although proper arithmetic computations are an essential part of the final solution, they are ancillary to this assignment.

Personalization and Sensitivity: Students should always be treated with dignity and respect. Most children appreciate occasional comments that refer to them by name. Criticisms should focus on the work and not the person, and should be phrased in a way that seeks to avoid emotional injury and embarrassment.

Manageability: There is a limited amount of information that a student can be expected to absorb at any single time. Likewise, teachers cannot afford to provide copious amounts of feedback. While written feedback should be productive, overwhelming either the student or the teacher can be demoralizing and counterproductive. When an assignment presents extensive opportunities for feedback, the teacher should focus on a handful of significant issues and let other items go unaddressed. For example, if a student's math homework is illegible, inaccurate, and incomplete, perhaps the initial focus should on legibility, which would also help address

accuracy. The issue of incompleteness could be deferred. However, it must be clear to the student that the feedback was not exhaustive.

Effectiveness: The ultimate goal is for the teacher to communicate cognitive and affective information to the student. Therefore, it is essential that the teacher know that the messages were conveyed as intended and interpreted as desired. It must be made clear to the students that they can receive clarification, in a non-threatening environment, whenever they have questions or issues with any written feedback.

M. Comments from Participants

Comments from Participants in the ABAB-type Study

Period A_1	Period B_1
Week 1	
1. Yes, because I got a good grade and it was fun. 2. I think my teacher cares about my work and will remember me in the future. 3. I did a good job.	1. To study harder because my teacher said so. 2. I did bad on this assignment. 3. No, because I think she knows that I can do better. 4. My teacher does care about me and I try my hardest on every paper I do. My dad, my mom, and everybody knows how hard I try. 5. I did not understand the comments the teacher gave me. I am sad that I got a "F".
Week 2	
1. I know I can do better. On the next one, I am going to get an A or B! 2. Not really. I tried my best and I know I can do better. 3. I need help. 4. I know I got a bad grade but I tried my best and that's what counts the most to me. 5. One comment: I will try better.	1. I really tried hard and I got good results!! 2. My facts. 3. Think harder. 4. I think that my teacher cares about the work that I do, and so do my parents. 5. I like your comments Miss [name].
Week 3	
1. I will love to do better in math and my facts. 2. No, because there were no comments. 3. No, I don't have anything to except I can do a lot better 4. I understand where I made my mistakes. My teacher cares about the way I do work. 5. I did great. 6. I am just glad	1. My facts. 2. I messed up on this assignment and could have done better. 3. I do think my teacher cares about my work. 4. I like your comments Mrs. [name].

Period A_2	Period B_2
Week 1	
1. I thought I didn't understand it but I kept trying. 2. My teacher thinks I'm good. She gave me an A!!!! 3. I think that my mom and dad will be happy to see this paper! 4. I did great. 5. I am disappointed in myself.	1. I didn't cheat on my work. 2. I tried my hardest on this paper. 3. No comments.
Week 2	
1. Facts!!!! 2. I think my teacher does care that I can do work like this. 3. No more. 4. I like your comments.	1. I made a mistake and now I have a chance to fix it. 2. Getting better but, facts! Facts! 3. I have to do better than what I am doing now. 4. I guess I just didn't remember what the teacher said about zeros.
Week 3	
1. I have no further comments about the assignment except I wish my teacher would write more comments. 2. There was only 1 comment. 3. I think my parents and teacher think that I should try harder but I don't think my dad knows how hard I try.	1. Nice comments. 2. I got an A. 3. I improved a lot. 4. This assignment was of value to me. 5. I am mad at myself.

Comments from Participants in the Quasi-Experimental Study

Week 1	
Control Group	**Experimental Group**
Class #1 1. No, because that's what I did and that is the grade and things I got. 2. This assignment #1 was kind of hard. That's why I missed 6. But I tried hard. 3. I think this assignment was very hard. 4. I'm not a very good math person and I don't like math. 5. I didn't get #14, 15, & 21. My mom and dad didn't understand. My dad said that you should explain it more to me. 6. I'll try harder next time. 7. I got a good score. I am the one that did the work and got it wrong. I like Ms. [name] because she showed me what I did wrong. 8. I got bad, bad, bad. **Class #2** 9. I think that my homework was fun and I think that I did really good on it. 10. I think Mrs. [name] gave me good comments. 11. I have no idea. 12. The comment made me feel confident.	**Class #3** 1. The assignment was okay but she wrote too much. 2. I liked the assignment. I liked her comments because she encouraged my right answers and told me what was wrong with my wrong ones, not just mark it. 3. I think it was very, very easy. 4. I liked the math paper and Mrs. [name] is a great teacher and she put everything good on my paper. 5. I like when my teacher put a lot of stuff on my paper. 6. I like what my teacher put on my paper and I learned a lot of stuff. 7. I think that she writes too much on my paper. **Class #4** 8. The comments made me sure my teacher cares. 9. I like my comments. There were many [?] comments for me. 10. My comments sometimes make me feel sad sometimes like I can't do anything. But this was an exception because it made me feel good. 11. I loved my comment because they made me feel strong and confident. 12. The comment made me feel good and proud of myself. 13. Thanks for the comment. I really enjoyed reading it. It made me feel confident. 14. I thought the comment showed me that I am good at this and I thought it was pretty nice. 15. I liked my comment because I liked the figure of speech. 16. The comment made me feel good. 17. I loved the comments and it will help me in the future. 18. I like it, it was the easiest thing I ever did. 19. The comment made me feel happy and proud about myself. 20. I liked my comment. thank you Ms. [name]

	21. I thought it was fun 22. The assignment was difficult but I liked figuring out the riddle, which was Pyramids of Egypt.
Week 2	
Control Group	**Experimental Group**
Class #1 1. No, because I think I could do better by what my teacher checked off and see what I did and fix it. 2. I think I worked very hard and did my best. 3. I am glad what grade I got. 4. I am disappointed with my grade. I didn't like this assignment. 5. I feel GREAT about my grade. And GREAT for all the stuff my teacher helped me through this chapter. 6. I did not like my grade. 7. I love math and this was something that helped me learn a lot. 8. No, just that I only get B's in math. 9. I knew that I was going to get an A on math. That is why I like math. 10. I made careless mistakes. 11. I need to work on math. 12. It is easy. I really don't like doing them because we know how to do multiplication. 13. I like my grade and Mrs. [name]. 14. I am ok with it, and I tried and that's all that matters. 15. I feel it's okay. I made one mistake but I feel good with it. **Class #2** 16. I like my math homework. It was fun. I like what Mrs. [name] said to me. 17. Try to do my best. It's that I do. Thanks for trying to make me better Mrs. [name]. :-) 18. You told me a lot, Miss [name] and I love that you did. I know that you really care about me.	**Class #3** 1. I like the comments because I learn from my mistakes. 2. I think saying I was ready for 3 digits was encouraging. 3. This was a fun worksheet. 4. I think it was a fun sheet. 5. I'm glad that she put those comments because I know that I can go to three digits. 6. I love when my teacher put comments. 7. I have no comments except this was a fun assignment. 8. I know my teacher cares about me because I got a very good comment. **Class #4** 9. I think the comments were very positive and nice. 10. I liked this assignment and the comments. 11. No, the assignment and comments were all good for me. I like the comments I got. 12. I don't really like my comments that much because [end] 13. Thank you! It was fun! 14. I tried the best I could and I still did not succeed. 15. Mrs. [name] I really need to work on my number sentences. Thank you for the comment. 16. She gave me a nice comment. Thank you Mrs. [name]. 17. I really liked the comments for this assignment. 18. I thought this was an easy assignment. Thank you for the comments, Mrs. [name]. 19. I loved the comments, it helped me understand more and it will help me with my future. 20. Yes, I really liked this and she taught me a lot. 21. I believe the comments meant I did a

	good job. 22. I [think] that my comment was nice and it made me happy. 23. Thank you, Ms. [name]. I loved the comments.
Week 3	
Control Group	**Experimental Group**
Class #1 1. No, because that is what score I got. 2. I did my best. That is all I can do. 3. I like my grade I got. 4. I am amazed by my grade. 5. It was easy. 6. I think that I did ok on this assignment. 7. I loved this assignment. 8. I love multiplication. 9. I knew I was going to get an A on this. I thought this was going to be hard but it was easy. 10. I think I did really good. 11. I think I did very good. 12. I don't like doing $ because it is hard to keep doing it and sometimes I forget. 13. I thought I did good except I missed one. **Class #2** 14. I liked this assignment; was cool. 15. I love doing fractions. 16. No, I don't but thank you for asking!	**Class #3** 1. I did not like the comment she put about the problem 2. 2. I like what she put on my paper. 3. This assignment was very, very, very fun! 4. She gave me good comments that I can understand. 5. I don't think my teacher cares about me because my friends got 100% and so did I and she did not put anything else than excellent. 6. The assignment was hard but my teacher was good on the assignment. 7. I think I should of got a 100 instead of a 94 because I got them all right except for one because I copied the problem wrong. 8. The math X [multiplication] is hard but I still tried. **Class #4** 9. I think the comments are fine and I enjoy reading them because they are always convincing and supportive! 10. No, but I like the comments that the teacher gave me. 11. I really liked my comments. They showed me that I can be really good at math. 12. It was fun but I feel I did better. 13. I think that I can work better, but I couldn't because I was distracted a few times. 14. I tried my very best and I still did not make it. 15. The comments my teacher wrote showed me what I need to work on. 16. I liked your comments. 17. I will try to work harder. 18. I liked the comments. 19. I thought the comments were ok, not the best. Maybe 1 or 2 more comments. 20. I thought Mrs. [name] gave good comments.

	21. This helped me a lot. I liked the comments, I just forgot about the lines. 22. I didn't like this assignment because I don't like measuring quarters three times in a row. 23. I think my teacher understands that I did my best. 24. I [word?] the comments showed [where] I messed up so I will [word?] to do better. 25. I did not really like the comments.

Week 4	
Control Group	**Experimental Group**
Class #1 1. I did my best and got 100%. 2. I am happy with my grade. 3. I can do better. 4. No, I think I did good getting 88% (B) and that's all my teacher wrote. 5. I think I did a little better than last time. 6. I thought the assignment was very easy but I guess I was wrong. 7. I like division but sometimes I get stuck. 8. I knew I was going to get -1 or -2 on this because it looked easy and I got -1. 9. I tried hard. 10. I need to work on math more. 11. This was fun, and we need to do this more often because I will get a lot of A's. 12. I think I did good but I missed 1. I agree with her now [that] I saw my mistake. **Class #2** 13. I think this assignment helped me learn new stuff. It was really fun and good. 14. I love doing fractions, even if I am not good at them. 15. Thanks for asking. I do not get (understand) the one I got wrong.	**Class #3** 1. This was a fun assignment except that I got a "C". 2. The comments helped me learn a lot. 3. !!!!!?!!!!! 4. I think she put too much comments and I did not like the comments. 5. I like the comments my teacher made on it. **Class #4** 6. Like always, I think the comments were fine. They help me understand what I did wrong. 7. I like reading these comments, and there were the right amount of comments for me. 8. I loved my comments. 9. I liked the comments. 10. I thought the comments were clear, and I thought they were great. 11. I'll try next time. 12. I liked the comments a lot. 13. Thanks for comments. I really understand how I got it wrong. 14. Thank you, Mrs. [name]. 15. I liked doing this assignment. 16. I thought the comments were good, but not the best. 17. I thought Mrs. [name] was being nice. I like my comments. 18. I loved the comment. It will help me with my future, and I'm happy with my grade. 19. This assignment was fun. 20. I think my teacher suspects [sic] me to do all my work like this. 21. I liked my comments because I needed to try harder. 22. The comments were okay.

Week 5	
Control Group	**Experimental Group**
Class #1 1. I did my best. 2. I am ok with my grade. 3. I like my grade. 4. I did my best on it. 5. It was okay reading the estimates. 6. I get confused with division. 7. I knew I was going to get a 100% because it looked easy. 8. I think I did really good. 9. I did good. 10. I need to practice it more so it stays in my head. 11. I think I did good; I got an 100 A+. **Class #2** 12. I love math :-) 13. No, but it was nice to ask. Well, really I did not get it.	**Class #3** 1. Some I got wrong because I was not here Wed. and Thurs. We had a sub. and she didn't tell me how to do it. 2. I really thought the comments were good. 3. This is fun! 4. I'm glad that I got a 100% this time. 5. I love my grade. 6. :-) ? :-) 7. I did not like getting a 50% on my math. It made me mad. 8. I liked my grade! :-) 9. I like what she wrote. It was, "you did great, keep it up." **Class #4** 10. The comment was good. I like reading them. 11. This comments I read has great [sic]. I like them very much. 12. I loved my comments. 13. This was easy. 14. I think the comments were great! They show how hard I tried. I was better by 2 problems. I said I would get 38 right, but I got 40 out of 40! 15. I did it! 16. I really like reading the comments. 17. Thank you for the good comments. 18. This assignment was hard. 19. I loved the comments because they meant something to me. 20. I think Mrs. *name* put enough comments. 21. I loved the comments. It will help me with math a lot. 22. This assignment was very hard. That is why it took me 21 minutes. 23. I think I will remember one of these packets, and I will be happy of the grades I got.

	24. I liked the comment because I did really good. 25. I love the comments.
Week 6	
Control Group	**Experimental Group**
Class #1 1. I am glad I got a really good grade. 2. I like my grade. 3. I will do better. 4. When I look over hard work I can get 100 and my teacher cares about it because she drew smiley faces and wrote "100 A perfect." 5. I think I could have done better. 6. I did not really like it. 7. I get confused. 8. It was an easy project and I am glad we did it. 9. I worked very hard. 10. I like this. It is fun. 11. I got a 100 A+. **Class #2** 12. That I need to watch my + and - sign !! :-)	**Class #3** 1. No, not really. I don't have any comments and I did not like the comments. 2. I think I need to work harder because I was not [thinking] straight and that's why I messed up. 3. This is the funnest thing in the world because I love long division. 4. Thank you for telling me what I got wrong. 5. Yeah, I got a 100% A :-) 6. The assignment was easy and I liked the comments. 7. I like the 71%. It is better than an F. 8. I love when she writes "Keep it up. You're doing great!" **Class #4** 9. I think there were enough comments. Mrs. [name] always makes up good ones for me & classmates. 10. I liked the comments and the assignment. 11. I like my comments and I will keep up the hard work. 12. I really liked my comments. 13. I think I could do better! 14. I thought the comments were perfect! 15. I tried. 16. Thank you for the comments, and not counting it wrong because I messed up. 17. He didn't give me the answers. 18. I liked this assignment. 19. I really liked the comments. They show me that my teacher notices things. 20. I think Mrs. [name] gave enough comments. 21. I loved the comments and doing it all

	by myself. I just love math and I'm trying harder than I did. 22. This assignment was hard, and I really needed that help. 23. I believe my teacher thinks I will do work like this from now on. 24. It was a very nice comment. 25. I loved the comments.

Week 7	
Control Group	**Experimental Group**
Class #1 1. No, because I did good on my work. 2. I am glad I got a good grade. At first, I did not understand it. 3. I liked my grade I got. 4. I don't believe my grade. 5. No, it shows I can do this. 6. I think that I did well on this assignment. 7. I love the comments. 8. I love fractions! 9. This is easy work and I love doing it. 10. I think I did good. 11. I think I did really good. 12. This assignment really helped me and now I think I will do better in math. 13. I don't like my paper. 14. I need to take my time and look over them. 15. I got a hundred 100 A+. **Class #2** 16. I love math when I know how to do it. :-) 17. I do not, but thanks for asking me.	**Class #3** 1. I did not like the comment at all. 2. My teacher is just trying to teach us. 3. They helped me see where I made mistakes. 4. This was fun except for this kind of survey. I liked the other survey because they don't take as long. 5. I think I did good on this. 6. I love your comments that you wrote, and I have been studying. 7. Yeah!! Yeah!! Yeah!! 8. I thought it was easy. 9. I love doing math. **Class #4** 10. The comments helped me a lot. 11. I'm glad of the grade I got. 12. I liked the comments, and I will like to keep helping people. 13. I loved my comments!! :-) 14. It was fun! 15. I liked it a lot!! 16. The comments will make me try harder next time. 17. I liked your comments a lot. 18. Thank you for giving me a second chance. 19. I will try to get this right. 20. I liked the comments the teacher said. 21. I really liked the comments! 22. Thank you Mrs. [name]!! :-) 23. I loved the comments. Thank you Mrs. [name] for being a great teacher!!!! :-) :-) :-) 24. This was the best one I did. 25. I liked the comments because it was a nice comment. 26. Thank you Ms. [name] for giving me another chance.

Week 8	
Control Group	**Experimental Group**
Class #1 1. I'm just glad it doesn't go in the grade book. 2. I do not like my grade. 3. I like my grade. 4. I know Mrs. [name] knows I tried. 5. It's okay. I like fractions. 6. This was very hard, and now I know how I made mistakes and where. 7. I should have tried harder. 8. I could of done better. 9. I think everything was fine. 10. I did bad. 11. I don't like 16-14 because I didn't get any of them right. 12. I did bad, -7, F. Bad, bad. **Class #2** 13. No, but thanks for asking! Always your fav student [name]. 14. I love math.	**Class #3** 1. I listened. That's why I got 100%. 2. This kind of survey thingy is boorring. 3. I love your comments. 4. 100%. :-) - Sidebar on question 9: If I could, I would be beyond strongly disagree!! 5. I loved the comments! 6. I didn't really study and I don't know fractions but I still got an A. **Class #4** 7. Mrs. [name] is the greatest, she always has something nice to say to us. 8. I like the comment, "A is for Awesome." 9. I liked my grade :-) 10. This is new math to me! 11. I thought the comments were well thought out. 12. I tried my best. Thank you Ms. [name]! 13. I liked the comments. 14. Thanks for the comments Ms. [name]. 15. I am glad I got a really good grade on math. 16. I like doing these things that you send me. 17. I really liked the "A is for awesome" thing! 18. I liked reading the comments. 19. I loved "A is for Awesome." I only missed two and I'm proud of it. Thank you Ms. [name]. 20. This was one of the best work I did the whole year. 21. I think that now I have learned this work I will be able to do it in the future. 22. I really liked the comment. 23. I loved the comments.