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Maximizing Feedback for Self-Regulated Learning

Jodie Maria Hemerda
Walden University

Walden University

College of Education

This is to certify that the doctoral dissertation by

Jodie Hemerda

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Dr. Wellesley Robinson Foshay, Committee Chairperson, Education Faculty
Dr. Gerald Giraud, Committee Member, Education Faculty
Dr. Paula Dawidowicz, University Reviewer, Education Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2015

Abstract

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MA, Regis University, 2005

BS, Colorado State University, 1995

Dissertation Submitted in Partial Fulfillment

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Abstract

Application of clearly defined feedback types, which have been correlated with improved student performance, has great potential for maximizing instructor use of feedback and its effect on a learner's self-regulatory learning (SRL) for optimized learning. Within SRL, where learner performance is influenced by a recursive internal process, instructional feedback plays a critical role. Yet, the characteristics of external feedback that influence SRL to improve performance are unclear in the literature. Within a theoretical framework where feedback catalyzes self-regulation, this quantitative study sought to integrate feedback type research to expand the SRL model. Data were graded assignments from 23 undergraduate level and 8 graduate level online university courses randomly selected from a pool of 86 possible courses. Applying non-experimental logistic regression and using descriptive statistics, feedback was categorized to determine the quantity of each of the 5 feedback types [task correctness (FC), task elaboration (TE), task process (FP), self-regulation (FR), and personal or self-related (FS)], as well as how they correlated with improved performance. The results indicate that the feedback types were not normally distributed, FS was statistically not present and FE was most used, and the logistical regression indicated that the presence of FC and FR was minimally associated with improved performance. Additional experimentation is needed to normalize the type distribution and test the strength of the FC and FR effect. This study initiated a clarification in understanding the external component of feedback in the SRL model, which is necessary to harness feedback to create positive change in the self-regulatory processes of learners.

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Dedication

I dedicate this dissertation to Scott Hemerda. Thanks for always believing that I could succeed.

Acknowledgments

Completion of this multi-year project was never a lonely one. I feel honored to have been surrounded by an abundance of love, care, and encouragement, even when my focus was unclear and my will was shaken. This long journey has been graciously supported by incredibly encouraging and thoughtful friends, my ever-supportive mother, my loving and encouraging husband, my patient and forgiving children, and my committee members, especially Dr. Rob Foshay. Thank you all, I am forever indebted to you.

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Chapter 1: Introduction to the Study

Introduction

Dialogue should be an underlying, fundamental concept of engagement in the online learning space. The shift to online learning and the rapid release of educational technologies offers academia an opportunity for continuous improvement. Coupled with scholarly evidence in teaching and learning, communication, and developmental processes leads to redesigning the online teaching and learning environment. Rather than replicating outdated pedagogy, the online space presents an environment primed for learning when evidence-based practices are properly applied. Rooted in sound theory, dialogue functions as an ideal form of communication for deep learning (Bohm & Nichol, 2004; Shor & Freire, 1987; Senge, Scharmer, Jaworski, & Flowers, 2004; Blair & McGinty, 2012; Craig, Gholson, Brittingham, Williams, & Shubeck, 2012; D'Mello & Graesser, 2012). Whether that dialogue occurs face-to-face or virtually, participants benefit from the interaction.

The online classroom serves as a tool where both outer and inner dialogue is shared for collaboration, reflection, review, and learning. The ability to share inner thoughts in a way that supports dialogue and expansive collaboration in an online venue could be leveraged to revolutionize learning. In addition to the learning that occurs during interaction with content (monologue) and peers (dialogue), critical gaps are filled when instructional feedback (dialogue) is aimed at encouraging self-reflection (monologue) and self-regulatory learning (Enyedy & Hoadley, 2006; Lewis, 2013).

Recognized as filling the critical gaps in learning, feedback presents a research opportunity to investigate its potential. The National Research Council (2004) identified "deliberate practice" as a key to learning transfer, noting that this concept emphasized "the importance of helping students monitor their learning so that they seek feedback and actively evaluate their strategies and current levels of understanding" (p. 236). Sawatsky, Mikhael, Punatar, Nassar, and Agrwal (2013) have concurred, noting that "residents [medical students] can be taught how to perform handoffs through a brief curriculum based on the principles of deliberate practice and feedback" (p. 284). The complexity of how the learner incorporates feedback into the learning cycle extends beyond a timely correct or incorrect answer (Coll, Rochera, de Gispert & Diaz-Barriga, 2013). Depending on the learner, the task complexity, the instructor, and the setting, feedback can motivate, challenge, and illuminate as well as discourage, deter, and confuse. Hattie and Timperley (2007) identified feedback as the most influential factor on student educational achievement by a factor of two. The Institute of Education found that "approaches to feedback represented one of the most diverse and inconsistent aspects of learning and teaching practice" (Ferrel, 2013, p.11). Similarly, Wolsey (2008) categorized written feedback observations provided to students in an online course. Based on recent and relevant research, Wolsey (2008) defined a clear problem but failed to incorporate research into defining the feedback categories, which led to a non-researched based categorization. Given its importance in student achievement, there is a need to apply research-based categorization of feedback types to identify a potential relationship between feedback and student performance.

Because of its proven effectiveness, yet inconsistent and uninformed application and the limitations of previous research in the area, there is an opportunity for new research to explore how best to consistently use feedback in service of positive learning outcomes. To best understand and study feedback effects, research should fully incorporate the four distinct feedback types found in Hattie & Timperley's (2007) 12 meta-analyses of "196 studies and 6,972 effect sizes" (p. 83), including task-specific (FT), task process (FP), self-regulation (FR), and personal or self-related (FS) feedback.

In an effort to validate Hattie & Temperley's (2007) feedback categories, a review of recent literature led to a category distinction within the four feedback types labeled by Hattie and Timperley (2007). Currently, the four feedback types include FT, which may simply denote correct or incorrectness in its task-specificity, but it can also "include directions to acquire more, different, or correct information" (Hattie & Timperley, 2007, p. 90). Tanner and Jones (2007) and Furnborough and Truman (2009) found that students appreciated differentiation between feedback regarding correctness, and feedback offered as a tool for learning. Espasa and Mensese (2010) and Coll, Rochera, and de Gispert (2014) found two main types of feedback, one related to correctness (verification) and the other related to information about the error (elaboration). The National Research Council (2004) identified one key function of teachers as "correcting misconceptions" (p. 238) during the learning process, hence the need for the elaboration of feedback type noted by Espasa and Mensese (2010). Butler and Winne (1995) used a general label of feedback related to correctness as outcome feedback. The additional research substantiates the need

to separate FT into two separate categories of task specific feedback, one that relates to correctness and another that relates to the elaboration of that correctness.

Given the effort and time it takes instructors to provide students with feedback, effective feedback types need to be identified and used appropriately throughout teaching and learning as a universal standard. Clark and Mayer (2011) found that "crafting explanatory feedback is much more labor-intensive than corrective feedback" (p. 238) whereas Ferrel (2013) found that "giving better feedback actually improved the self dependency of learners and reduced the overall amount of time they spent giving feedback and the need to repeat the same feedback many times (see for example the evidence from the Dundee EFFECT project)" (p. 14). This study has the potential to identify the element of type within the domain of "better feedback" so as to support the self-regulatory learning of the student.

To avoid confusion and provide clear distinction between feedback types, I applied Hattie and Timperley's (2007) initial categorizations, but with the critical adjustment of splitting FT into two distinct categories: FC, feedback that indicates correctness; and FE, feedback that elaborates on the correctness of the task. Thus, the framework for this study included five feedback types: FC, FE, FR, FS and FP.

Application of the intricacies of feedback requires a sound model. Butler and Winne's (1995) model of self-regulated learning (SRL) provides a clear model for instructional designers, facilitators, and students to effectively integrate feedback into online learning spaces. Butler (2002) has noted the recursive "cycle of cognitive activities" used by self-regulated learners during task completion as they "analyze task

demands," use "metacognitive knowledge," identify goals, and then apply appropriate strategic approaches (p. 82). During the strategic application, self-regulated learners monitor outcomes and leverage feedback to find and fill gaps (Butler, 2002). Unfortunately, while the Butler and Winne (1995) model of SRL incorporated a wealth of reliable research, the model did not include the complexity of feedback types, and hence was limited in its contribution to the understanding and application of feedback in self-regulated learning in the online classroom.

Butler and Winne's (1995) SRL model offers an opportunity for significant insight into this essential component of knowledge construction. Its reliance on monitoring as an element of internal feedback and its effect on a "learner's knowledge and beliefs about the domain and tasks, learning processes and products, and performance" (Butler & Winne, 1995, p. 275) provides a useful foundation on which to build. While their SRL model simply differentiated feedback functions as internal and external, it provides an intricate detailing of cognitive processes that lead to effective learning.

The need for clarified feedback types to improve the SRL model is evident in recent literature as I discuss in Chapter 2. Relying on a simple dichotomy of internal and external feedback, one cannot acknowledge the complexity of the proposed five feedback types and would be unable to recognize the effect of their use as key elements of learning. With my study, I sought to understand the effectiveness of the five feedback types by assessing actual feedback instances and identify a connection of feedback with student performance.

By focusing explicitly on feedback type within SRL, my study addressed a gap created by other research that has not sufficiently accounted for imprecise feedback types and their indistinct application. I conducted an investigation of historical instances of instructor feedback to identify the five feedback types, understand their performance effect, and clarify the role of feedback in the SRL process. I proposed to identify the use of the five feedback types in existing feedback observations to ensure that the types were functional, applicable, and comprehensive. I also sought to identify how the feedback types impacted performance, if at all. The framework I established supported the connections between the known benefits of feedback and their place within the SRL model. Though my study was an initial step in validating the definitions of these improved feedback types and identifying a potential performance effect within a small sample of feedback from the university-of-study Fall 2012 term, its potential significance for improving the understanding of the role, categorization, and use of feedback as an effective catalyst within SRL in the field of education is astounding. With this contribution to a better understanding of feedback, leaders may harness the ability of technology, peers, and instructors to create a positive change in the self-regulatory processes of students.

Problem Statement

There is strong evidence supporting the importance of the feedback component of self-regulated learning (Butler & Winne, 1995; Carless, Salter, Yang, & Lam, 2011; Espasa & Menses, 2010; Embo, Driessen, Valcke, & van der Vleuten, 2014; Furnborough & Truman, 2009; Hattie & Timperley, 2007), yet the feedback types and

performance effects have not yet been fully explored. With clearly defined feedback types and a known performance effect, educators and learners alike will benefit from an adequate and consistent application of feedback. Appropriately labeling feedback can improve an understanding of its influence, maximize its effectiveness, and lead to an improved SRL model for optimized student learning. Butler and Winne's (1995) SRL model currently relies on a binary distinction between internal and external feedback. Without an understanding of that external feedback, the opportunity for instructional feedback to effect change in the internal processes of the learner are limited. I sought to measure the effectiveness of feedback types to identify a connection of feedback with student performance. The gap in the current research is an understanding of how the type and effect of feedback leads to a change in performance in the process of SRL.

Purpose of the Study

Within appropriate pedagogical models, educational technologies can support learning principles and enhance the student experience. Technology has been found to enhance feedback; therefore to fill the identified gap of the relationship between feedback type and effect of feedback on SRL that leads to a change in student performance, I evaluated feedback observations provided to students via a web-based interactive rubric tool. I used a quantitative approach to categorized observations of instructor feedback on student assignments, and measured a change in student performance associated with five feedback types. Consistent with the current literature on feedback, I included the five feedback types FC, FE, FP, FR, and FS.

Research Questions

This study addressed the following research questions and associated hypotheses:

1. How well did the five feedback types describe feedback observations used by the teachers in this study?
    a. At what frequency did online teachers provide the proposed five feedback types using a web-based tool to communicate feedback on assignments?
    b. What percentage of feedback observations contained overlap in the five feedback types? That is, what percentage of feedback observations could be categorized as more than one feedback type? What percentage of feedback observations were not included in the five feedback types?
2. Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, was there a significant relationship between score change and feedback types used?
    a. H_0: There is no score difference associated with the use of feedback type.
    b. H_1: There is a score difference associated with the use of FC.
    c. H_2: There is a score difference associated with the use of FE.
    d. H_3: There is a score difference associated with the use of FP.
    e. H_4: There is a score difference associated with the use of FR.
    f. H_5: There is a score difference associated with the use of FS.

Theoretical Framework for the Study

Butler and Winne (1995), Carless et al. (2011), Hattie and Timperley (2007), Espasa and Menses (2010) have all found an interrelatedness of feedback and self-regulation in learning and their findings resonate with Furnborough and Truman's (2009) observation that, in regard to the complexity and importance of self-regulation, "it can be argued that external feedback is unlikely to influence learning unless it is successful in stimulating internal feedback" (p. 401). Careless, Salter, Yang, and Lam (2011) sought a framework for sustainable feedback based on their "belief that, for feedback to be effective, it needs to place less emphasis on conventional feedback practices and develop further those in which student autonomy and self-monitoring capacities become paramount" (p. 404). This concept supports the work of Butler and Winne (1995), who found that feedback served as an "inherent catalyst" to self-regulation, and that effective learners seek out external feedback (p. 246). Feedback catalyzes, stimulates, and empowers within SRL, hence there is a need to study the self-regulation component of feedback.

In Figure 1 Butler and Winne (1995) illustrated this recursive flow of information in their model of SRL.

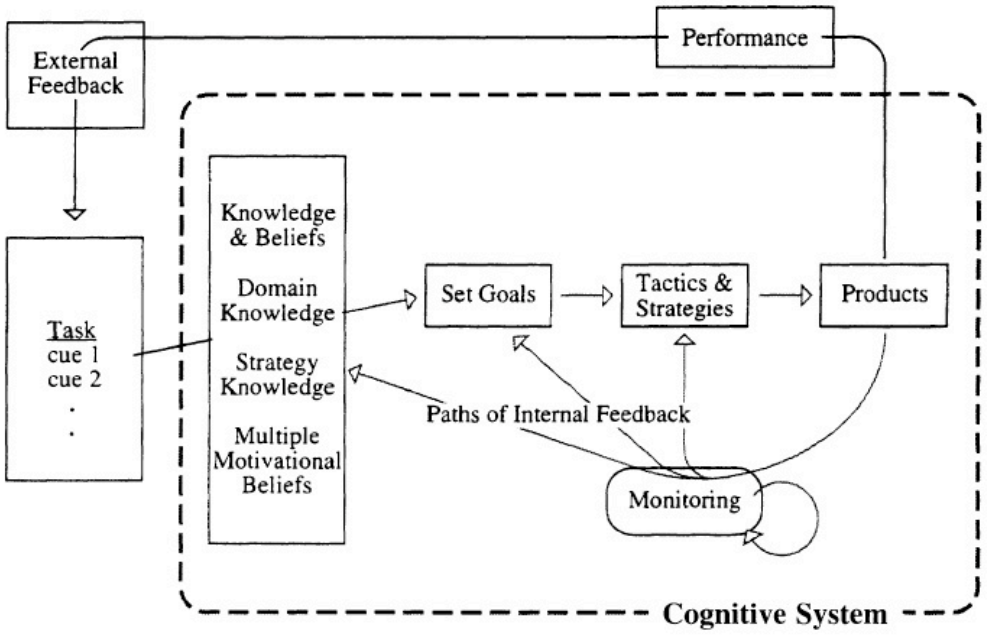

*Figure 1.*A logic model of self-regulated learning. From "Feedback and self-regulated learning: A theoretical synthesis," by D. L. Butler and P. H. Winne, 1995, *Review of Educational Research, 65*(3), p. 248. Reproduced with permission from the publisher.

In this model, learners interpret given tasks based on their knowledge and beliefs, identifying the necessary requirements to complete the task (including goals, strategies, and resources). Throughout the process, learner monitoring generates internal feedback, and products are both cognitive/affective and behavioral. This model highlights the importance of self-awareness, as the learner would need to be actively engaged throughout the process for SRL to lead to learning. By adding the external feedback types into Butler and Winne's (1995) SRL model, I created the following flow of information, visualized in Figure 2 that illustrates the importance of feedback processing where a student may or may not internalize the feedback.

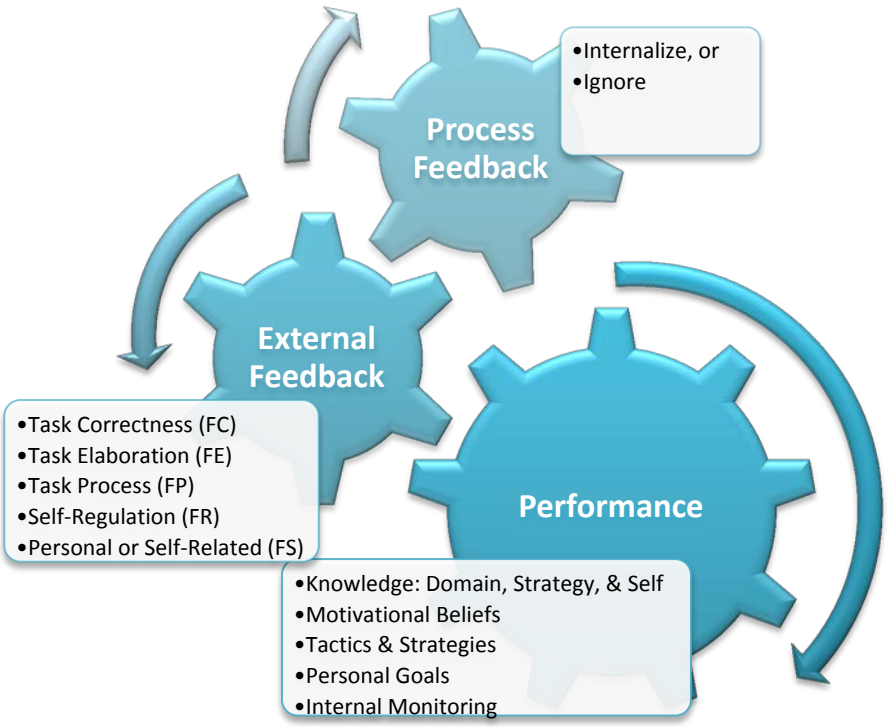

Figure 2. SRL model with five feedback types

Building on Butler and Winne's (1995) model of SRL, I sought to count, categorize, and identify the potential effect of the external feedback component on performance. According to Butler and Winne (1995), "effective learners seek out external feedback" that in turn serves as a "catalyst" within the self-regulation process (p. 246). This catalyst effect is illustrated as one of the gears in Figure 2. This model is not intended to replace the Butler and Winne (1995) model, but rather highlight the importance of external feedback within the SRL model.

To support cohesive research and classroom applications, educators need to use clear feedback type labels appropriately and consistently. To avoid any confusion and provide clear distinction between feedback types, in this study I modified Hattie and Timperley's initial categorizations of task-specific (FT), task process (FP), self-regulation

(FR), and personal or self-related (FS), by splitting FT into two distinct categories: FC, feedback that indicates correctness; and FE, feedback that elaborates on the correctness of the task.

Nature of the Study

This non-experimental logistic regression study applied measures to count, categorize, and identify the potential effect of the external feedback component. I applied quantitative measures to test whether the categorizations of the five feedback types aligned with actual feedback that instructors provided to students at the university-of-study. My logistic regression model analysis provides an initial validation of the feedback types for future studies, similar to the work of Wambuguh and Yonn-Brown (2013). In addition to validating the categories, I used quantitative measures to compute the difference in performance after the learner received feedback. With this correlation design, I sought to identify a relationship between feedback types and performance.

Setting and Sample

I collected the data directly from Waypoint Outcomes (an online grading technology) archives of 8-week online courses taught during the Fall 2012 term and analyzed historical data from graded assignments. To assess a relationship between performance and use of the feedback, I compared the performance score from Week 4 to Week 6 with Week 4 feedback type observations.

The population included instructors at the university-of-study who were fully-online, adjunct faculty, 85% of whom held a Ph.D. or terminal degrees and 15% of whom

held Master's degrees. Faculty attended an onboarding training that included the use of Waypoint to score student assignments.

Types and Source of Data

The historical data included comments and performance levels scored on two assignments using Waypoint Outcomes from the university-of-study's Fall 2012 term. The graded assignments I used for analysis were derived from the Week 4 and the Week 6 assignment. The assignments varied across graduate and undergraduate programs. To measure a consistent element across the diverse assignments, the study focused on the feedback associated with one common criterion from both Week 4 and Week 6 that pertained to grammar. Figure 3 illustrates an example of a rubric criterion scoring levels.

Meets Expectation	Approaches Expectation	Below Expectation	Limited Evidence
4	3	2	1

Figure 3. Rubric levels

Table 1 details the statistical instrument I used to support each research question.

Table 1

Research Question with Corresponding Analytic Strategy

Research Question	Analytic Strategy
How well do the 5 feedback types describe feedback observations used by these teachers?	
At what frequency are online teachers providing the proposed five feedback types using a web-based tool to communicate feedback on assignments?	Descriptive statistics (frequencies and percentages) were used to count instance of feedback observations that contains distinct characteristics of the modified feedback types, FC, FE, FP, FR, and FS.
What percentage of feedback observations contains overlap in the five feedback types? That is, what percentage of feedback observations can be categorized as more than one feedback type? What percentage of feedback observations are not included in the five feedback types?	Chi-Square Goodness of Fit was applied to determine if there are significant differences in the frequency of each type of feedback. This statistical measurement calculated how well the observed values matched what would be expected based on chance.
Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, is there a significant relationship between score change and feedback types used?	A logistical regression with exposure variables as the five feedback types in Week 4 measured for an odds ratio for an improvement in score from Week 4 to Week 6. Feedback types were forced into the dominant category to meet the need for mutual exclusivity.

I applied the G*Power calculator from Faul, Erdfelder, Buchner, and Lang (2009) to compute the required sample size, and determined that 148 students were required. I used this sample to measure the odds ratio of exposure to feedback types and improvement of the performance as measured by an increase in the rubric score on the grammar criterion from the first assignment (Week 4) to the second assignment (Week 6). I generated the random sample from the Fall 2012 term classes that met the case-study sampling qualifications. The sampling qualifications included grammar criterion scores for Week 4 and 6 as well as Week 4 grammar feedback observations. Using historical data avoided risk of attrition.

Collecting this data required me to work with a Waypoint Outcomes specialist to randomly select and retrieve graded assignments from the Fall 2012 term that met the sampling qualifications. I stripped the assignments of identifying marks, including student and instructor names. I obtained permission from a Waypoint Outcomes supervisor to use the data and their staff to support retrieving and cleaning the data. Institutional Review Board (IRB) approval was granted by Walden University prior to data collection.

Feedback analysis involved collecting historical feedback observations in graded assignments from Waypoint Outcomes, then categorizing and labeling those observations. I coded the feedback observations to categorize the feedback as task correctness (FC), task elaboration (TE), task process (FP), self-regulation (FR), and personal or self-related (FS) based on the provided definitions and constructs. The quantitative data produced results such as (a) frequency of FC, (b) frequency of FE, (c)

frequency of FP, (d) frequency of FR, (e) frequency of FS, and (f) frequency of non-categorized feedback types.

Definitions

The following list provides concise definitions for every construct used in this study:

Dialogue: "A communication process that aims to build relationships between people as they share experiences, ideas, and information about a common concern" (Schirch & Campt, 2007, p. 6).

Deliberate practice: Task mastery is gradually acquired as performance improves with appropriate sequential training that requires individual focus and external feedback in a reiterative process (Ericsson, 2006; Clark & Mayer 2011).

Elements of effective feedback: Components identified in the literature review as integral to feedback usefulness.

- *Task-specific or task specificity*: Provides explicit evidence related to the performed task (Hattie & Timperley, 2007, Tanner & Jones, 2007; Hatziapostolou & Paraskakis, 2010; Schlitz et al., 2009).
    - *Self-regulation*: The ability to internalize feedback based on commitment, control, confidence, and persistence for future application (Hattie, 2003; Hattie & Timperley, 2007; Careless, Salter, Yang, and Lam, 2011; Butler & Winne, 1995; Espasa & Menses, 2010; Tanner & Jones, 2007; Furnborough & Truman, 2009).

- *Low task complexity*: The difficulty associated with completing a task should be manageable such that feedback can be focused on particular elements, not overwhelming the learner (Hattie & Timperley, 2007; Gorsky, Capsi, & Smidt, 2007).
- *Timing*: Provides a measure of elapsed time between task completion and receiving feedback (Hattie & Timperley, 2007; Butler & Winne,1995; Tanner & Jones, 2007; Wang & Morgan, 2008; Hatziapostolou & Paraskakis, 2010; Schlitz et al., 2009; Erdman & Chan, 2013).
- *Positive and negative feedback*: Differing uses of feedback with unique consequences.
    - *Positive feedback*: Feedback on the correct attributes of task completion (Furnborough & Truman, 2009).
    - *Negative feedback*: Feedback on the incorrect attributes of task completion (Furnborough & Truman, 2009).
- *Non-threatening environment:* A way in which people communicate or interact that avoids creating a hostile feeling (Tanner & Jones, 2007; Schlitz et al., 2009).
- *Praise*: Conditional verbal rewards (Kohn, 1994; Hattie & Timperley, 2007).
    - *Two-way communication*: Feedback from the teacher to the student and feedback from the student to the teacher, provides an opportunity for the teacher to improve lessons (Blair and McGinty,

2012; Tanner & Jones, 2007; Careless, Salter, Yang, and Lam, 2011; Wang & Morgan, 2008; Schlitz et al., 2009).

- *Technology enhanced*: Use of media (video, audio, or computer enhanced) in feedback communication (Hattie & Temperley, 2007; Careless, Salter, Yang, and Lam, 2011; Wang & Morgan, 2008; Schlitz et al., 2009; Hattie, 2003; Hatziapostolou & Paraskakis, 2010).
- *Self-reliance*: Autonomous learner behavior (Butler & Winne, 1995; Schlitz et al., 2009; Hattie & Temperley, 2007; Knowles, 1990).
- *Assessment*: Activities used in the classroom to measure student learning (Hattie, 2003; Hattie & Timperley, 2007; Careless, Salter, Yang, and Lam, 2011).

Feedback: A response that informs a learner regarding the discrepancy between task performance and the intended task performance (Hattie, 2003).

- *Task-specific* (FT): Feedback that indicates correctness and may include the location of resources to improve task completion (Hattie and Timperley, 2007).
- *Correctness* (FC): Feedback that responds to whether the item was performed correctly (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010; National Research Council, 2004; Butler & Winne, 1995).

- *Elaborated correctness* (FE): Feedback that elaborates on what made the performance correct or incorrect (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010; Clark & Mayer, 2011).
- *Task process* (FP): Feedback that responds to the strategic process of performing the task, such as locating resources and proofreading (Hattie & Timperley, 2007).
- *Self-regulation* (FR): Feedback that responds to commitment, control, and confidence (Hattie & Timperley, 2007).
- *Personal or self-related* (FS): Feedback that responds to the student as a person or student's sense of self rather than the task at hand (Hattie & Timperley, 2007).

Grammar criterion: Grading criterion focused on the use of grammar, style, and APA guidelines.

Improved performance: Demonstrated by an increased rubric score measured by comparing the rubric score on the grammar criterion at Week 6 to the grammar criterion at Week 4.

Online learning: A structured, asynchronous, 8-week course populated with students and an instructor, content, discussions, assignments, and interactive learning opportunities intended to support course learning outcomes presented in an online environment.

Self-regulated learning (SRL): "Self-directive process by which learners transform their mental abilities into academic skills" (Zimmerman, 2002, p. 65).

SRL Model: Provides the logic of the self-regulated learning process (Butler & Winne, 1995).

- *Task*: Activities performed by learners.
- *Knowledge and beliefs*: These preexisting conditions influence a learners cognitive interactions and "jointly mediate the effects of externally provided feedback" (Butler & Winne, 1995, p. 15)
- *Domain knowledge*: Understanding of a particular field or discipline.
- *Strategy knowledge*: Understanding of tactics for learning.
- *Multiple motivational beliefs*: Numerous beliefs that affect learner motivation, specifically self-efficacy.
- *Self-efficacy*: "People's beliefs about their capabilities to produce effects" (Bandura, 1994, para. 1).
- *Goals*: Desired outcomes.
- *Tactics and strategies*: The means to progress in goal achievement (Butler and Winne, 1995).
- *Products*: the outcome of applying strategies toward goals (Butler and Winne, 1995).
- *Monitoring*: A learner's attention to their progress.
- *Internal feedback*: A learner's assessment of task success and method productivity goals (Butler and Winne, 1995).
- *Performance*: An accomplished task.

- *External feedback*: Feedback from a source other than internal learner processes may include an answer sheet, a response through a technology interface, peer, instructor, parent, or others.
- *Cognitive system*: A set of interdependent processes used to acquire knowledge and understanding.

Assumptions

Internal validity supports assertions about causality. Potential internal validity threats (Neuman, 2007) that could interfere with this study and limit the application of the study results include:

- Selection bias: I assumed that the instructors providing feedback may have a particular characteristic that affects their use of feedback. These traits serve as limitations to the application of the results of the study to the use of feedback by this particular group of instructors at this university-of-study. Random sampling of assignments diminished this concern.
- History: I assumed that there may have been an unrelated event that occurred that interfered with the provision of feedback or scoring by instructors during the timeframe of the particular course. Given the protection of privacy, there was no way to inquire as to events that may have interfered with the feedback. There is no evidence to suggest that the university-of-study changed their resources supporting feedback, so it can be assumed that there was no external event that may have interfered with feedback performance.

- Causation: I assumed that all changes in performance cannot be directly linked to the feedback (type and frequency), as there are several other influencing factors including:
    - Normal maturation, where students improve as they progress through the course may occur over the two-week period between the assignments. Presumably, this would be consistent for all students, regardless of feedback type, but not equally.
    - Lack of a control group, where students receive no feedback.
    - Treatment contamination, where students may receive feedback from sources outside of the assignment not collected as a part of this study. This feedback may come through a private video, email, or phone conversation with the instructor, a tutor, a peer, or other source.
    - Learner process, where learners may or may not read or internalize given feedback.
- Reliability of achievement measure: I assumed that the rubric was not a reliable measure of achievement. The rubric has not been validated as a reliable assessment tool. However, its consistent use by instructors provided the appropriate measure needed for this study without additional validation.

Potential internal validity threats (Neuman, 2007) that could be mitigated through checks and avoid limiting the application of the study results included:

- Experimenter expectancy: I assumed that familiarity with the graded assignments may lead to prejudicial review. The random selection of

assignments ensured that I was not familiar with the assignments. I taught four of the hundreds of courses available during the data sampling timeframe of Fall 2012.

External validity requires qualitatively sound information that applies to the real world. To ensure validity, I aligned the instruments with the research questions, the research questions with the problem, and all of the elements in between. I have outlined the following potential threats to validity to address potential validity concerns:

- Feedback categories may have been unclear in the assessment material. Clear job aids were used to mitigate this threat.
- The sample included graded assignments from a typical fall semester, though this should not lead to an assumption that the online student and faculty population is representative of all students and faculty.
- Though instructors are required to use standardized processes for grading, including the standard rubric and grading tool, there may be instructors who do not follow this protocol. Rubric scoring may not be consistent.
- Evidence of feedback does not guarantee student use of said feedback.

Scope and Delimitations

The vague description of internal and external feedback in the Butler and Winne (1995) SRL model indicated the need for clarified feedback types. Hence, there was a need to improve the categorization and definitions of feedback types. In my review of current research, I identified and defined five feedback types. With my study, I sought to

determine the existence of the feedback types within an analysis of feedback observations at an online university.

The goal of the study was to test the validity of the use of the five feedback type framework, and to determine if particular feedback types are associated with improved performance. The generalizations should be limited to the particular graded assignments I reviewed from the randomly selected sections within the university-of-study. Thus, the purpose of this study was not to generalize the results to the greater population, but rather to validate the five feedback types as comprehensive and distinctive while gathering initial data indicative of a potential connection between feedback type and performance for future study.

Limitations

Due to the limitations of data access, the results of the study are limited to a quantitative analysis of the graded assignments collected from the Fall 2012 term. The results describe the reviewed data from the assignments of the university-of-study. The implications of the results from this study support the value of the use of these feedback types to support improved performance and lend themselves to future research opportunities.

Significance

The goal of this study was to add to the body of knowledge regarding the use of feedback, specifically through educational technologies. Using an improved model of SRL, educational technologies could be advanced based on sound educational theory rather than the functionality of the tool. This study identified the types of feedback

teachers used to expand the feedback component of the SRL model. The feedback categorization may validate these feedback types and substantiate a connection between feedback types and performance. This study provides a useful data analysis and validation of the feedback types for future studies.

Application of a modified SRL model could improve the teaching and learning community's ability to understand the principles of self-regulated learning and should influence future teacher trainings and studies. With the intention to improve the SRL model, educational technologies should be advanced based on good educational theory rather than the functionality of the tool.

The application of best practices and the results of research to benefit learning extends beyond the classroom. Citizens of the complex and fast-changing Information Age need sharp lifelong learning skills to stay relevant and competitive. Self-regulated learning provides the structure for adaptation and growth while effecting social change within themselves and the world they wish to see. The power of understanding the relationship between internal and external systems within SRL should not be underestimated in its ability to resolve problems created by the limited understandings of today.

Summary

This study identified the type of feedback online teachers used and sought a connection between feedback type and student performance. The outcome may inform the university-of-study as to how its teachers can improve their use of feedback for future predictive studies. Application of the results could also inform a modified SRL model

which has the potential to improve the teaching and learning community's ability to understand the principles of self-regulated learning and should be used for future teacher trainings and studies. An improved understanding of the processes involved in learning can then be used to inform educators and those designing educational technology. Within appropriate pedagogical models, educational technologies support learning principles and enhance the student experience.

Chapter 2: Literature Review

Overview

This chapter presents the findings from a review of articles and texts that I began in 2007 and used to compose two Knowledge Area Modules (KAM) related to distance learning, educational technology, dialogue, and feedback. Building on that foundation, this literature review involved database searches regarding the intersection of self-regulated learning, feedback, and educational technology used to communicate feedback as well as the depth of work conducted by the key theorists I had identified in the KAMs. These searches resulted in a review of approximately 80 article abstracts and 40 full text articles. Of those 40, I rejected 20% because they had inadequate primary sources, were not empirical, or were not generalizable to my problem. I used Proquest Central, Academic Search Complete, Science Direct, ERIC, and Springer eBooks to search for the keywords *feedback*, *self-regulated learning*, and *educational technology*. I also used reference lists of qualifying articles to identify approximately 30 additional articles for review. I selected qualifying articles based on their contribution to original research in the areas of feedback, self-regulated learning, and educational technology, especially when two or more of the topics intersected. Based on a review of the selected articles, I selected 36 articles for inclusion in this literature review.

Feedback is instrumental to self-regulated learning. Butler and Winne's (1995) Self-Regulated Learning (SRL) model involves a comprehensive monitoring system of internal feedback and its relationship to learner performance. Their SRL model acknowledges the complex elements that influence how a learner incorporates feedback

into the learning cycle. For instructors, the ability to provide guidance within the model lies in external feedback. The opportunity to expand the SRL model by applying the metadata analysis of feedback by Hattie and Timperley (2007) was informed by additional studies.

Given that feedback is the most influential factor on student educational achievement (Hattie & Timperley, 2007), it requires additional consideration in the SRL model. This study provides an opportunity to validate feedback type categories within actual feedback and identify a connection between feedback and performance.

Consistent with the Hattie and Timperley (2007) findings that feedback was the most important factor of influence on a student's academic achievement, Butler and Winne (1995), Espasa and Menses (2010), Furnborough and Truman (2009), Enyedy and Hoadley (2006), Hatziapostolou & Paraskakis, (2010), Lemak, Reed, Montgomery, and Shin (2005), Wang and Morgan (2008), Schlitz et al. (2009), Cramp (2011), and Tanner and Jones (2007) identified similar supportive data. Current literature indicated a positive relationship between instructor feedback and student learning (Hattie, 2003; Knowles, 1990; Clark & Mayer, 2011; Hatziapostolou & Paraskakis, 2010; Espasa & Menses, 2010; Hattie & Timperley, 2007; Butler & Winne, 1995; Deng & Yuen, 2009; Furnborough & Truman, 2009; Wang & Morgan, 2008; Schlitz et al., 2009; and Tanner & Jones, 2007).

Feedback Defined

Hattie (2003) defined feedback as "actions or information provided by an agent (e.g., teacher, peer, book, parent, experience) that provides information regarding aspects

of one's performance or understanding" (p. 2). Hattie and Timperley (2007) expanded Hattie's original definition by noting,

> A teacher or parent can provide corrective information, a peer can provide an alternative strategy, a book can provide information to clarify ideas, a parent can provide encouragement, and a learner can look up the answer to evaluate the correctness of a response. Feedback thus is a 'consequence' of performance. (p. 81)

Hattie and Timperley (2007) emphasized that feedback is secondary to the student's initial learning interaction. This emphasis clarifies the need for instruction, and for some interaction with information prior to performance feedback. Sadler (2010) found that "unless this prerequisite knowledge is identified and addressed, the prospects for even the most thorough feedback are inherently limited" (p. 537). Hattie and Timperley (2007) acknowledged the need for initial instruction and evaluated the role of feedback, whereas Sadler (2010) devalued feedback and the role of the instructor in favor of peer assessment and peer learning.

Once the student's understanding has been assessed, feedback should help the learner answer: "Where am I going? How am I going?, and Where to next?" (Hattie, 2003, p. 2). The feedback informs the learner about the discrepancy, if any, "between what is understood (How am I going?) and what is aimed to be understood (Where am I going?)" while providing the student additional information that "can lead to restructuring understandings (Where to next?)" (Hattie, 2003, pp. 2-3). "To make the feedback effective, teachers need to make appropriate judgments about when, how, and at

what level to provide appropriate feedback and to which of the three questions it should be addressed" (Hattie & Timperley, 2007, p. 100). Though this seems heavily reliant on the teacher, Hattie and Timperley (2007) also noted that feedback can be given by numerous agents in addition to being "sought by students, peers, and so on, and detected by a learner without it being intentionally sought" (p. 82).

Espasa and Menses (2010) provided a more limited definition of feedback, "information on how to improve work and how to take learning further" (p. 289). Hattie's (2003) definition includes all activity in response to a learner's process, whereas Espasa and Menses (2010) limit feedback to activity that supports improvement of learning.

Tae-Eun (2011) used a feedback scale that focused on writing feedback and Basey, Maines, and Francis (2014) categorized feedback as encouraging, developmental and then by depth of response, both methods were too limited for generalized use.

For this study, I used Hattie and Timperley's (2007) expanded definition. Their definition is inclusive enough to include a variety of sources of feedback, without the limitations of Espasa and Menses (2010), Tae-Eun (2011), and Basey, Maines, and Francis (2014). Though it would be expected that feedback is intended to encourage and support learning, that assumption cannot be known when reviewing feedback observations. To avoid such an assumption, Hattie and Timperley's (2007) inclusive definition provided the necessary structure for my study.

Feedback Types

Hattie and Timperley (2007) identified four levels of feedback, including task-specific (FT), task process (FP), self-regulation (FR), and personal or self-related (FS). Table 2 documents the feedback types found in the literature.

Table 2

Feedback Types in the Literature Review

Hattie & Timperley, 2007	FT (task-specific)	FP (task process)	FR (self-regulation)	FS (self-related)	Other
Butler & Winne, 1995	Outcome Feedback = knowledge of results	Cognitive Feedback = based on Bruswik's (1956) lens model that links cues to achievement	Model of self-regulated learning proposed by Butler and Winne (1995)		
Espasa & Menses, 2010	Doubt resolution - Interactive & Retroactive Regulation	Results - Interactive, Retroactive, & Proactive Regulation	Final results - Interactive, Retroactive, & Proactive Regulation		
Furnborough & Truman, 2009		"Retrospective and future gap-altering feedback" (p. 400).	Mentions the complexity of self-regulation.		
Hatziapostolou & Paraskakis, 2010	"Directly related to assessment criteria and learning outcomes" (p. 111). Constructive.			Personal	Timely, motivational, and manageable
Wang & Morgan, 2008	n/a	n/a	n/a	n/a	Prompt
Schlitz et al., 2009	"Specific and tailored" via a rubric (p. 136)	n/a	n/a	n/a	
Tanner & Jones, 2007	Recognized a need for differentiation.	n/a	n/a		Students noted appreciation for promptness, individual, and a differentiation between FT and FP, though no construct was offered by the researchers.
Mao & Peck, 2013	I: statement of correctness	D: diadect direction			

Task-Specific

As noted by Hattie and Timperley (2007), feedback should relate to faulty interpretations, therefore "FT is more powerful when it is about faulty interpretations, not a lack of information" (p. 91). FT may simply denote correct or incorrectness, but can also "include directions to acquire more, different, or correct information" (Hattie & Timperley, 2007, p. 90).

Butler and Winne (1995), Espasa and Menses (2010), Hatziapostolou and Paraskakis, (2010), Schlitz et al. (2009), Mao and Peck (2013), and Tanner and Jones (2007) recognized FT or some element of it as a feedback type. Butler and Winne (1995) defined "outcome feedback" as the knowledge of results without any additional information; this feedback provides the learner with feedback about correctness. Hatziapostolou and Paraskakis, (2010) referenced a direct relationship between feedback and the assessment criteria as well as a need for the feedback to be constructive.

Espasa and Menses (2010) and Coll et al. (2014) noted two main elements of feedback, "verification (gives the resolution of the doubt and the correct answer) and elaboration (gives information about how to improve their work to achieve learning objectives)" (Espasa and Menses, 2010, p. 284). Espasa and Menses (2010) defined feedback as "information on how to improve work and how to take learning further" (p. 289). Hattie's (2003) definition includes all activity in response to a learner's process, whereas Espasa and Menses (2010) limit feedback to activity that supports improvement of learning.

None of the researchers provided information refuting FT as a feedback type. Rather, it can be inferred from the literature that FT may be too broad, incorporating a response indicating correctness [coined outcome feedback by Butler and Winne (1995)] and elaboration that may support instructional needs.

Schlitz et al. (2009) recognized the usefulness of a rubric to provide FT. Tanner and Jones (2007) noted that students preferred a differentiation between FT and FP.

The following is an example of task-specific feedback: “The definition of task-specific feedback provided here is well substantiated by numerous researchers in the field. Be sure to include an example to breathe life into this abstract construct.”

Task Process

FP, feedback on the process used to create, complete, or learn, typically involves instructional strategies (Hattie & Timperley, 2007). Furnborough and Truman (2009) referenced “retrospective and future gap-altering feedback” (p. 400), which corresponds to FP (Hattie & Timperley, 2007). This type of feedback serves to help the student improve their learning process. Additional terminology regarding FP as a feedback type that occurred in the literature review included:

- Cognitive Feedback, which was based on Bruswik’s (1956) lens model that linked cues (used through the cognitive process) to achievement (Butler & Winne, 1995),
- Didactic (Mao & Peck, 2013), and
- Interactive, Retroactive, and Proactive Regulation (Espasa & Menses, 2010).

Tanner and Jones (2007) found that students understood and preferred a differentiation between FT and FP from instructors. Each of these researchers either reiterated elements already included in FP or provided an alternate name that does not expand or improve upon the feedback type. Given this, it seems a fair assertion that the literature presented fails to challenge or provide additional information to the FP feedback type presented by Hattie and Timperley (2007).

The following is an example of task process feedback: “The organization of the section on task process aids the reader in understanding its background. To help identify connections between different processes, consider using a mindmap tool (such as mindmeister.com) to brainstorm and organize your information.”

Self-Regulation

FR involves “interplay between commitment, control, and confidence…. It addresses the way students monitor, direct, and regulate actions toward the learning goal…[implying] autonomy, self-control, self-direction, and self-discipline” (Hattie & Timperley, 2007, p. 93). Butler and Winne (1995) detailed FR in their SRL model, reinforcing the work of Hattie and Timperley (2007). A clear difference between the two bodies of work should be noted as Hattie and Timperley (2007) separated FP from FR, providing a clear distinction for future researchers.

The following is an example of self-regulation feedback: “The use of research to substantiate your conclusions regarding the role of self-regulation implies a commitment to thorough research on this topic.”

Self-Related

The final level of feedback identified by Hattie and Timperley (2007), FS is feedback directed to the student's personal sense of self. Though the example above may make the student feel good, it fails to address the student's work. Hatziapostolou and Paraskakis (2010) identified a need for feedback to be personal, which may or may not be FS. In making feedback personal, there is an opportunity for it to relate to the student and not the student's work.

The following is an example of self-related feedback: "Your persistence and dedication are admirable."

Type Effectiveness

Overall, Hattie and Timperley (2007) found that

> FS is the least effective, FR and FP are powerful in terms of deep processing and mastery of tasks, and FT is powerful when the task information subsequently is useful for improving strategy processing or enhancing self-regulation (which it too rarely does). (pp. 90-91)

Feedback levels and their influence on performance provide a foundational understanding of feedback.

FR may be one of the more complex and important levels of feedback, as the self-regulation process influences whether a student applies energy or gives up on the learning process. The category of FR resulted in the greatest contribution from the literature, as

Butler and Winne (1995), Espasa and Menses (2010), and Furnborough and Truman (2009) addressed the interrelatedness of feedback and self-regulation.

Self-Regulated Learning

Self-Regulated Learning Model

Butler and Winne (1995, p. 248) proposed a model of self-regulated learning that illustrates the various response loops:

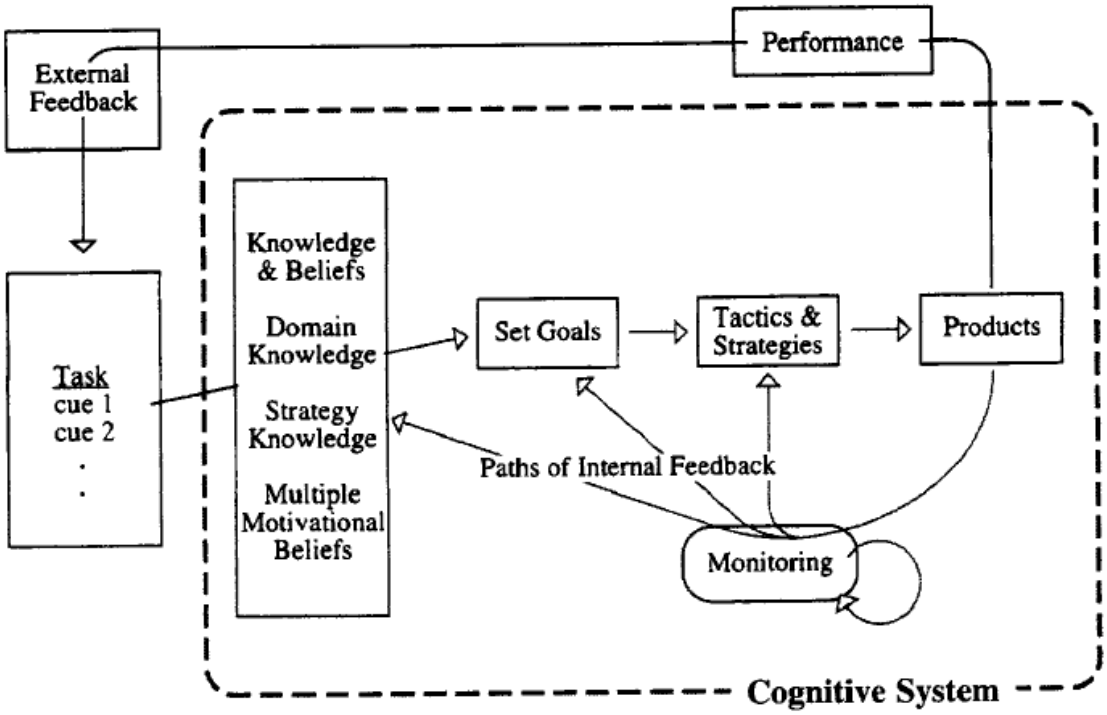

Figure 4. A model of self-regulated learning. From "Feedback and self-regulated learning: A theoretical synthesis," by D. L. Butler and P. H. Winne, 1995, *Review of Educational Research, 65*(3), p. 248. Reproduced with permission from the publisher.

Butler (2002) noted the recursive "cycle of cognitive activities" that self-regulated learners use to "analyze task demands", use "metacognitive knowledge", identify goals, and then apply appropriate strategic approaches, all the while monitoring outcomes and

leveraging feedback to identify gaps in need of resolution (p. 82). Butler (2002) identified five instructional targets in promoting SRL,

1. metacognitive knowledge about academic work,
2. strategies for analyzing tasks,
3. metacognitive knowledge about task-specific strategies,
4. skills for implementing strategies, and
5. strategies for self-monitoring and strategic use of feedback. (p. 82)

Though the focus of this model relied on students leveraging "effective use of task-specific strategies", Butler (2002) cautioned that successful students needed "explicit attention to how students adapt strategies reflectively and flexibly within recursive cycles of task analysis, strategy use, and monitoring (Butler & Winne, 1995; Harris & Graham, 1996)" (p. 82). Adaptability is the key to successful SRL.

Hendry, Bromberger, and Armstrong (2011) found that student perceptions support the use of feedback focused on SRL.

> Our results also show that a combination of a limited number of personalised, concrete comments (that explain how students could specifically improve their performance) and standards-based, 'checklist-like' feedback is perceived by most students to help them target their learning efforts effectively. (Hendry et al., 2011, p.9)

Finkelman, Hudesman, Flugman, and Crosby (2014) reported success on their SRL based Enhanced Formative Assessment Program (EFAP) that they implemented for twelve

years, illustrated in Figure 5.

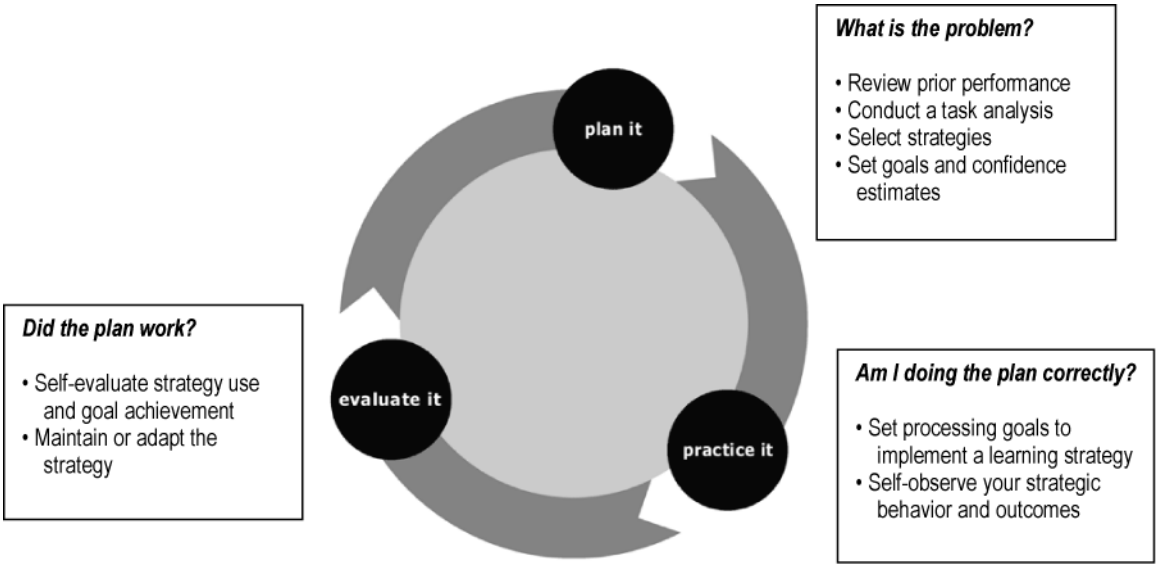

Figure 5. SRL-based EFAP model. From "An enhanced formative assessment and self–regulated learning program: From the classroom to the workplace," by J. Finkelman et al., 2014, *Austin Journal of Psychiatry and Behavioral Sciences, 1*(1), para. 8. Reproduced with permission from the authors and Creative Commons License.

The EFAP evaluation phase involved reviewing feedback received from instructors or supervisors on their strategies, referred to as FP by Hattie and Timperley (2007). Within their overall framework devoted to a framework of FR, the specific feedback was FP, both identified as the most powerful feedback types by Hattie and Timperley (2007). Their findings were "statistically and educationally significant", with preliminary evidence that skills transferred to classes that did not use the instructional model.

The majority of self-regulated activity occurs internally. External feedback is the one area where educators have input into this system. Focused attention on how this input can be optimized is the foundation of this study.

Self-Regulation Definition

Zimmerman (2002) defined self-regulation as "self-directive process by which learners transform their mental abilities into academic skills" (p. 65). Self-regulation involves active participants (Zimmerman, 1990 as cited in Schloemer & Brenan, 2006), goal-oriented, persistent effort and adaptable learning strategies (Wolters, 1998 as cited in Schloemer & Brenan, 2006), constant monitoring, directed learning, unique attributes noted as self-efficacy, self-awareness, and resourcefulness (Smith, 2001 as cited in Schloemer & Brenan, 2006). Schloemer and Brenan (2006) found that "Instructor feedback provides a reality check on student assessment and allows the instructor to help each student identify alternative strategies to improve learning" (p. 83). The researchers mentioned the potential use of FC and FP, though if applying Hattie (2003) feedback types, the focus should have been on FR for self-regulated processes.

"Expert teachers engage students in learning and develop in their students self-regulation, involvement in mastery learning, enhanced self-efficacy, and self-esteem as learners" (Hattie, 2003, p. 10). Bohm (Bohm & Nichol, 2004 and Bohm & Edwards, 1991) and Senge et al. (2004) identified self-awareness as critical to learning in their dialogue studies. Boys (1999), Howard (2002), Senge et al. (2004), Black (2005), Roberts (2005), and Innes (2006) concurred that dialogue required deep self-awareness.

Bembenutty (2011) incorporated Zimmerman (2000) to define self-regulated learning as "learners' beliefs about their capability to engage in appropriate actions, thoughts, feelings, and behaviors to pursue valuable academic goals while self-

monitoring and self-reflecting on their progress toward goal completion (Zimmerman, 2000)" (para. 4). Cantwell, Scevak, Bourke, & Holbrook (2012) applied an Epistemic Metacognitive Framework, defined as

> a constellation of beliefs, attitudes, and understandings about learning that we construct through reflection on experience, and which we use for establishing criteria for engagement with the task at hand….Most critically, these two elements (cognitive and affective) interact to establish the particular form of the regulatory decision. The model also incorporates a feedback loop, by which evaluations of the regulatory decision are managed through contingency appraisal processes that re-inform both the cognitive and affective elements, and through these influence the epistemic representation of learning. (para. 8)

Mindful of the cyclical nature of SRL, Bembenutty (2011) recognized that students "establish standards, set academic goals, regulate their beliefs and motivation, select learning strategies to be used, monitor their academic progress, and evaluate their progress toward goal completion" (para. 12). Bembenutty (2011) organized these activities into three phases,

1. Forethought phase, where learners set goals and plan.
2. Performance phase, where learners strategize to enact their plan.
3. Self-reflective phase, where learners reflect and adapt based on accomplishments.

These phases align with Hattie's (2003) three questions intended to guide feedback, "Where am I going?, How am I going? and Where to next?" (p. 2). The behavior of self-regulated learners supports attaining learner milestones within feedback. Biggs (2012) highlighted the importance of reflective practice, where learners invoke metacognition to identify errors and solutions in their work.

The Espasa and Menses (2010) study defined three types of feedback that elaborate on the performance phase of Bembenutty (2011):

- "The resolution of student doubts about learning content…(interactive regulation)" (p. 279) throughout the assignment process;
- Results communication - "seeks to improve results to achieve objectives during the teaching and learning process" (p. 279), provided after an assignment (Retroactive, & Proactive Regulation);
- Final results - consolidate and prepare for future learning, provided after the final assessment (Proactive Regulation)

Espasa and Menses (2010) found Interactive Regulation during the assignment process the most common type of feedback, "this feedback is basically characterised by information on how to improve work and how to take learning further", which aligns with FP and FR of Hattie and Timperley (2007). Problematically, Espasa and Menses' (2010) Interactive Regulation may conflict with Hattie's (Hattie & Timperley, 2007) presumption that feedback should be secondary to the initial learning. Interactive Regulation could be interpreted as part of the initial lesson, which would not be

considered feedback by Hattie and Timperley (2007). The feedback definitions of Espasa and Menses (2010) do not seem to further the body of work on feedback, but rather have presented additional elements regarding feedback on assignment progress for further evaluation.

Hattie and Timperley (2007) acknowledged that feedback comes in numerous forms from various sources, some sought and some not sought by the learner. It is that which is intentionally sought that aligns with self-regulation. Bryan and Clegg (2006) made "the case that innovative assessments should enhance and enable self-regulated learning and judgments, rather than merely act as instruments of justification, measurement and limitation" (p. 1). For the self-regulated learner, educators need to understand how to optimize feedback for its use to engage the learner's SRL.

Feedback within SRL

Consistent with Hattie and Timperley (2007), Butler and Winne (1995) acknowledged different types of feedback such as outcome and cognitive, but their work focused on the internal cognitive system with a limited discussion of how feedback relates to their model of self-regulated learning.

In alignment with Butler and Winne (1995) and FR of Hattie and Timperley (2007), Furnborough and Truman (2009) noted the complexity and importance of self-regulation, noting that "external and internal feedback are therefore interrelated; moreover, it can be argued that external feedback is unlikely to influence learning unless it is successful in stimulating internal feedback" (p. 401). In this statement, Furnborough

and Truman (2009) acknowledge the importance of FR and SRL in student use of feedback. Careless, Salter, Yang, and Lam (2011) noted that "students are only in a position to benefit fully from feedback processes when they are self-monitoring their own work at increasingly higher levels" (p. 398) and Biggs (2012) identified an important outcome of feedback to provide "relevant conditional knowledge to monitor their own learning and to become self-sufficient in learning after the institutional structures for supporting learning have been outgrown and removed" (p. 143).

Ferrel (2012) agreed with empowering students, with five of his seven recommended "good feedback practices" directly relating to self-regulation:

- Clarify what good performance is (goals, criteria, standards)
- Facilitate the development of reflection and self-assessment in learning
- Deliver high quality feedback to students: that enables them to self-correct
- Encourage dialogue around learning (peer and tutor-student)
- Encourage positive motivational beliefs and self-esteem…(p. 7).

Ferrel (2012 & 2013) based his findings on large British funded governmental programs, with conclusions that support the foundational ideas of this proposed study.

Similarly, Moller, Robinson, and Huett (2012) considered the next generation of distance education and noted the importance of feedback supporting a deeper understanding of learning.

Multilevel feedback supports the learning process. Evaluation will be focused on the student's analysis of information, synthesis of ideas, and formulation of

> cohesive arguments. Sometimes, getting the right answer is important, but ultimately, skillfully and logically processing the aspects of a challenge and successfully meeting it are more important. In other words, a learner who gets it wrong and understands why is often better off, from a learning perspective, than the student who gets it right, but cannot explain how or why. (Moller et al., 2012, p. 15)

Butler and Winne (1995) found that feedback served as an "inherent catalyst" to self-regulation, and that effective learners seek out external feedback (p. 246). The literature examined by Butler and Winne (1995)

> strongly suggests that learners' knowledge, beliefs, and thinking jointly mediate the effects of externally provided feedback. This mediation is the funneling through monitoring of information about various topics--task, self, epistemological characteristics of knowledge, goals, and cognitive tactics and strategies—to confirm, overwrite, add to, tune, or restructure extant knowledge and beliefs. That is, it is this mediation that offers an account of how knowledge is constructed in the process of learning. (p. 275)

Hence in their quest to investigate the role of feedback in self-regulated learning, Butler and Winne (1995) identified obstacles and influences in how learners used feedback:

- self-efficacy,
- self-awareness,
- beliefs (motivational, knowledge)

- existing knowledge,
- selected goals
    - learning (gaining expertise), or
    - performance (enhance perception of competence),
- tactics and strategies,
- lack of monitoring, and
- cognitive capacity.

Though these obstacles will vary with the learner, each of these is an area for additional research. For the purposes of this study, it is imperative to be aware of these obstacles in an optimized application of feedback.

Dialogue through Feedback as a Solution

Cramp (2011) found feedback interventions as a complex social practice requiring dialogue and mutual respect (p. 121). Dialogue can also be used to intervene against the obstacles identified by Butler and Winne (1995), most notably the role beliefs and preexisting knowledge play in the ability of a learner to accept new concepts and delve into a deep cycle of learning. This issue was addressed through the use of dialogue by Bohm and Nichol (2004), Shor and Freire (1987), and Senge et al. (2004), that encouraged participants to suspended assumptions and preconceived beliefs to delve into deep learning.

Given the definitions of feedback, it can be deduced that feedback is a type of dialogue. Espasa and Menses (2010) constrained feedback to interactions related to

improving learning, while Hattie and Timperley (2007) expanded the definition to include all interactions offered in response to a performance suggesting that not all feedback is aimed at improving learning. Blair and McGinty (2012), Moore (1997), Hattie and Timperley (2007), Tanner and Jones (2007), Wang and Morgan (2008), and Schlitz et al. (2009) noted the importance of two-way communication as a guideline for effective feedback. Hence, feedback is an element of dialogue when dialogue occurs in response to a performance after initial instruction.

A Case for Feedback

Other researchers provided general support for the existing body of work with their findings. Deng and Yuen (2009) noted, “Feedback or comments can foster deeper thinking and learning” (p. 95). Espasa and Menses (2010) noted that “of those who had received feedback, the percentage of the students who gained good, very good and excellent grades (78.9%) was significantly higher”, as well as their finding that “a significant relationship exists between feedback received after assignments and student results” (p. 286). Similarly, Fisher, Cavanagh, and Bowles (2011) found that students who received an intervention that consisted of receiving one-on-one feedback on a draft assessment “gained 7.1% overall in the final results of the subject” (p.235).

Hawk and Shah (2008) delivered practical suggestions for applying Butler and Winne’s (1995) cognitive model, specifically using current literature to define the characteristics of good feedback (p. 70), the functions of feedback (p. 71), student

reactions to anomalous feedback (p. 72), and self-regulated learning activities primed for feedback (p. 73).

Hawk and Shah (2008) noted four conditions from Juwah et al. (2004) that cultivate effective feedback,

1. clear task requirements,
2. time to complete task,
3. time to receive and incorporate feedback prior to final grading,
4. modeling of effective feedback provided (p. 73)

Hatziapostolou and Paraskakis (2010) relied on the work of Hyland (2000): "Feedback is an essential component in all learning contexts and serves a variety of purposes including evaluation of students' achievements, development of students' competences and understanding, and elevation of students' motivation and confidence" (p.111). Wambuguh and Yonn-Brown (2013) found a need for systematic, formative feedback. Given the essentiality of feedback, Hatziapostolou and Paraskakis (2010) referenced the research of Race (2006), Irons (2008), Juwah et al. (2004), and Race (2001) in noting that formative feedback should be: "timely, constructive, motivational, personal, manageable and directly related to assessment criteria and learning outcomes" (p. 111). While a direct relation to assessment criteria aligns with FT and constructive aligns with FP, a potential link could be made between personal and FS, though the actual intent of the researchers may have been individualized rather than self-directed feedback. The other elements of timeliness, motivational, and manageable elements relate

more to the characteristics of feedback better than feedback types. Hattie and Timperley (2007) recognized a need for timeliness, and low task complexity that could correspond to manageability. The relationship between confidence and feedback emerged in the work of Hatziapostolou and Paraskakis (2010) and Furnborough and Truman (2009). Furnborough and Truman (2009) found between confidence levels and the effectiveness of feedback, noting "students with high initial confidence levels tend to become successful long-term learners" (p. 412). This relationship could surely benefit from additional research.

As noted earlier, in an attempt to understand the internalization of feedback and obstacles in that self-regulated process, applying dialogic principles within the application of feedback is important. Without an explicit reference to dialogue, researchers who have studied and found the benefits of feedback types have appropriately incorporated the foundation of dialogue into options for optimizing feedback. Understanding the appropriate feedback type for an effective feedback interaction in a learning environment will set the framework for an effective feedback model. These key levels of feedback will be further investigated in the next section of this paper, where effective elements of feedback are identified.

Effective Elements of Feedback

Throughout Hattie's numerous publications and speeches, he identified several key effective elements of feedback noting the importance of context, specifically that feedback should address errors in understanding after the initial presentation of

information (Hattie & Timperley, 2007). This point differentiates feedback as a response to the learner's performance from the initial presentation of information in the lesson. The following effective elements of feedback should occur as a response to a learner's faulty interpretation rather than a lack of initial understanding. Table 3 includes a list of authors who expanded on the work of Hattie (Hattie & Timperley, 2007) providing a framework for feedback guidelines.

Table 3

Feedback Guidelines.

Feedback Guideline	**Research**	**Comments**
Task-specific	Tanner & Jones, 2007; Hattie & Timperley, 2007; Hatziapostolou & Paraskakis, 2010; Schlitz et al., 2009; Clark & Mayer, 2011; Nicol, 2010; Rudland et al., 2013.	
Self-regulation	Butler & Winne ,1995; Espasa & Menses, 2010; Tanner & Jones, 2007; Furnborough & Truman, 2009; Hattie, 2003; Careless et al., 2011, Embo et al., 2014; Ferrel, 2012; Nicol, 2010; Orsmond & Merry, 2013.	
Low task complexity	Gorsky et al., 2007; Hattie & Timperley, 2007; Rudland et al., 2013.	
Timing	Hattie & Timperley, 2007; Butler & Winne,1995; Tanner & Jones, 2007; Wang & Morgan, 2008; Hatziapostolou & Paraskakis, 2010; Schlitz et al., 2009; Hawk & Shah, 2008; Ferrel, 2012; Nicol, 2010; Rudland et al., 2013; Erdman & Chan, 2013.	Hattie & Timperley, 2007; Butler & Winne,1995 – both support delayed FP feedback
Positive and negative feedback	Furnborough & Truman, 2009; Hattie & Timperley, 2007; Nicol, 2010.	
Non-threatening environment	Tanner & Jones, 2007; Schlitz et al., 2009; Bohm & Edwards, 1991; Shor & Freire, 1987; Burbles, 2006; Hattie & Timperley, 2007; Clark & Mayer, 2011; Nicol, 2010.	
Praise	Hattie & Timperley, 2007; Kohn, 2012.	Hattie & Timperley, 2007 identified praise as the most common form of feedback
Two-way communication	Tanner & Jones, 2007; Wang & Morgan, 2008; Schlitz et al., 2009; Moore, 1997; Hattie & Timperley, 2007; Blair & McGinty, 2012; Careless et al., 2011; Ferrel, 2012; Orsmond et al., 2013.	
Technology enhanced	Wang & Morgan, 2008; Schlitz et al., 2009; Hatziapostolou & Paraskakis, 2010; Hattie, 2003; Hattie & Temperley, 2007; Careless et al., 2011; Ferrel, 2013.	
Self-reliance	Butler & Winne ,1995; Schlitz et al., 2009; Hattie & Temperley, 2007; Knowles, 1990; Orsmond et al., 2013; Timmers & Veldkamp (2011).	
Assessment	Hattie, 2003; Rudland et al., 2013.	

Task-specific. Hattie (2003) identified the need for learning context, specifically task specificity, “to take on this instructional purpose, feedback needs to provide information specifically relating to the task or process of learning that fills [that] gap” (p. 82). Tanner and Jones (2007), Nicol (2010), and Hatziapostolou and Paraskakis (2010) found that students benefited from individualized feedback with an explanation and discussion of the feedback. Specifically, Hatziapostolou and Paraskakis (2010) identified that feedback be “directly related to assessment criteria/learning outcomes” (p.113). Rudland et al. (2013) referred to this as a need for precise attention to specificity. Ferrel (2013) agreed, noting that “tailoring feedback to student requests is also more likely to have an impact than feedback that the student is not ready for – again targeting resources effectively” (p. 20). Task-specific feedback guarantees that the learner receives relevant information that allows focused attention on a “specific skill gap”, a guideline for deliberate practice identified by Clark & Mayer (2011).

To ensure that feedback was task-specific and individualized, Schlitz et al. (2009) produced rubrics to improve feedback communication.

> As a result, students seem to be having more “significant” learning experiences – that is, informal feedback from students indicates that they have found the rubrics to be very help in preparing for assignments and in understanding how assignments are graded, and they are appreciative of receiving immediate feedback on their performances. (Schlitz et al., 2009, p. 144)

Rubrics break down learning outcomes into very specific, itemized criteria that provide the learner details regarding the grading of their assignment. A well-written rubric transforms the assignment description into gradable criteria. This strong link between the assignment expectations and feedback based on those same criteria of rubrics support the need for feedback to be task-specific.

Hendry et al. (2011) noted that students found marked up and discussed samples of exemplary work more useful than a checklist. This specificity relates feedback to standards and helps students "target their learning efforts effectively" (Hendry et al., 2011, p. 9). "To be effective, feedback needs to be clear, purposeful, meaningful, and compatible with students' prior knowledge and to provide logical connections" (Hattie & Timperley, 2007, p. 104). Task specificity depends on clear goals of the learner; hence this feedback guarantees that the learner receives relevant information.

Self-regulation. As an integral component of the framework used in this study, this entire section is dedicated to self-regulation. Hattie (2003) found that expert teachers had a greater influence on student achievement than experienced teachers had, and found that, "expert teachers engage students in learning and develop in their students self-regulation, involvement in mastery learning, enhanced self-efficacy, and self-esteem as learners" (p. 10). Nicol (2010) recommended that feedback be transferable, "focused on processes, skills and self-regulatory processes" (p. 513). The importance of self-regulation was reiterated by Careless et al. (2011), when they found that "enhanced self-

regulative capacities is likely to lead to better quality learning and higher grades," which could lead to "increased engagement with relevant practices" (p. 406).

Low task complexity. Hattie and Timperley (2007) found that "feedback was also influenced by the difficulty of goals and tasks…[having] the most impact when goals are specific and challenging but task complexity is low" (p. 86). The current literature failed to include a significant review of task complexity in addressing feedback. This gap in the literature signifies the failure of researchers to address the complication of meeting and understanding the target student population needs regarding feedback effectiveness. Evaluating task complexity would require clear understanding of students' skills, abilities, prior knowledge, and perception of tasks.

The Gorsky et al. (2007) study investigated student dialogic behavior, concluding that students sought out teachers for help with difficult course material, and peers for moderately difficult material only after attempting to understand the material on their own. Understanding the dialogic behavior of learners helps identify when students reach out to their professors for instructional support. Understanding that learners tackling difficult subjects may have already exhausted their ability to understand the material should be taken into account to ensure an appropriate feedback response.

Timmers and Veldkamp (2011) found "that when the amount of elaborated feedback grows for incorrectly answered questions…the relative attention paid to the feedback decreases. These findings imply that task difficulty should be taken into consideration during the development of assessments for learning" (p. 929).

Though not directly addressing task complexity, Nicol (2010) recommended that feedback be limited to “two or three things that the student can do something about” (p. 512), similar to Rudland et al.’s (2013) description of good feedback as “possible” and “attainable” (p. 101). Limitation of the feedback comments aligns with the concept of task complexity, as the goal is to chunk the material into reasonably digestible amounts. Rudland et al. (2013) concurred, noting a need for feedback “to match the complexity of the task” (p. 101).

With the scant literature addressed here, the relationship between task complexity and feedback requires additional research. Rubrics may be an option to support delivering task-specific feedback, where task complexity could be simplified as complex criteria are broken down into detailed, manageable ones. Interestingly, Hattie and Timperley (2007) tied task complexity into timing of feedback. The task involved in the proposed study has low task complexity, ideal for optimizing the influence of feedback.

Timing. Feedback timing for effectiveness depends on whether the feedback is at the FT or FP level. According to Hattie and Timperley (2007) and Rudland et al. (2013), learners benefit from immediate FT and delayed FP. Butler and Winne (1995) had similar results in their literature, noting “if transfer of tactics for learning is the objective, delaying feedback to provide students time to reflect on how they learn may be more effective” (p. 268). The difference between the correctness of a response and the process of learning underlies this distinction. While FT provides feedback on the correctness of the learner, FP provides input on the learner’s process.

Van der Kleiij, Egge, Timmers, and Veldkamp (2012) found in a small sample that “students prefer immediate feedback to delayed feedback” and “paid more attention to immediate feedback” (p. 269). Student preferences are not a clear indicator of the effect of the timing or feedback, and Van der Kleiij et al. (2012) “did not find and effect of feedback on students’ learning outcomes” (p. 270). This small study should not be considered conclusive evidence on the topic of timing.

Erdman and Chan (2013) found no difference between immediate or delayed feedback, but rather saw the existence of feedback the key to memory retrieval.

Though Tanner and Jones (2007), Schlitz et al. (2009), Wang and Morgan (2008), Hatziapostolou and Paraskakis, (2010) did not take task complexity into account, they noted that students benefitted from timely feedback. Hatziapostolou and Paraskakis, (2010) added that timely feedback supports the student’s ability to recall task activity and future application. Hawk and Shah (2008) accept the general conclusions about the timing of feedback, these include: task specificity and timeliness, as related to providing feedback in time to apply learning to next task. Ferrel (2012) and Nicol (2010) concurred, noting that students need to be given opportunities to improve future performance based on feedback.

As recounted by Butler and Winne (1995), timing has been thoroughly addressed in the existing literature. Interestingly, the nuances of timing do not seem to be understood in the current literature that treated timely feedback as an accepted conclusion

(Tanner & Jones, 2007; Schlitz et al., 2009; Wang & Morgan, 2008; Hatziapostolou & Paraskakis, 2010; Entwistle, 2012; Erdman & Chan, 2013).

Positive and negative feedback. "Over all comparisons, it appears that the power of feedback is influenced by the direction of the feedback relative to performance on a task. Specifically, feedback is more effective when it provides information on correct rather than incorrect responses" (Hattie & Timperley, 2007, p. 85). Enhancing this finding with feedback levels, demonstrates the complexity of feedback. Hattie and Timperley (2007) found that negative feedback had the greatest influence when directed to the self (FS), especially when combined with task-specific feedback (FT). FT has the potential to benefit from both positive and negative feedback.

As is often seen in practice, Nicol (2010) and Wingate (2010) recommended balancing positive and negative comments. In a complex relationship of motivation, the effectiveness of FR depended on "commitment, mastery or performance orientation, and self-efficacy" (Hattie & Timperley, 2007, p. 98).

- If commitment is high, positive feedback increases motivation to learn more than negative feedback.
- If commitment is low, "we are more likely to learn as a function of negative feedback" (Hattie & Timperley, 2007, p. 99).
- The motivation increase from the negative feedback might be temporary and eventually lead to avoidance in the future, whereas positive feedback could lead to greater persistence and an increased long-term interest.

Furnborough and Truman (2009) noted that positive feedback would encourage proactive users of feedback to use "feedback as a learning tool by analyzing it and attempting to integrate it into the learning process… as well as boosting learners' confidence and creating a virtuous circle that spurs them on to greater achievements" (p. 412). Entwistle (2012) included positive reinforcement as a critical element that encouraged understanding. These results indicate a strong connection between confidence, commitment, and use of feedback in the self-regulatory process.

Timmers and Veldkamp (2011) researched learner attention paid to feedback provided by a computer-based assessment for learning (CoBAL). The results suggest that learners review feedback more than 50% of the time. Timmers and Veldkamp (2011) found "that the attention paid to feedback mainly focuses on feedback of incorrectly answered questions. Within this study incorrect answers are viewed as an opportunity to clarify misunderstandings" (p. 929). In support of additional research in this area, Wingate (2010) concluded,

> It is therefore important to explore a more effective delivery of feedback that avoids weaker students receiving an overwhelming amount of criticism on various topics at one time. To find ways of encouraging all students to use assessment feedback, it is also necessary to probe deeper into the reasons why some fail to respond to it (p. 531).

Though learner attention is drawn to incorrect responses, the research does not fully investigate the nuanced effects of positive and negative feedback.

Recent literature also failed to address the use of negative feedback, effectively ignoring a distinguishing characteristic of feedback. The fundamental beliefs of behaviorist learning theory address learning as a changed behavior controlled by external stimuli, where learning occurs due to a stimuli-response mechanism controlled by a teacher who should focus on learning objectives. Positive and negative feedback are easily incorporated into educational technology environments, where the feedback can be automated and consistent based on student performance. Behaviorism as a theoretical model has greatly influenced the traditional classroom; its value in understanding the role of positive and negative feedback would strengthen the body of work on feedback. Additional behaviorism literature review combined with feedback studies could help better understand the role of both positive and negative feedback for learners.

Non-threatening. Students tend to behave in ways that decrease risk in the classroom. They avoid answering a question unless they know they have the correct answer, which decreases learning opportunities. For optimum learning and openness to feedback, the learning environment should be non-threatening, safe, and open to differing perspectives. Tanner and Jones (2007) found that pupils valued an environment where they were free to make mistakes. Schlitz et al. (2009) noted that faculty in a faculty learning community needed an open safe environment to enhance collaboration. Nicol (2010) recommended non-judgmental feedback that focused on overall learning goals rather than performance goals. These findings correspond with those found in dialogue studies, highlighting the depth of learning instigated in bias-free environments where

participants are safe to share differing opinions and make mistakes without fear of ridicule (Bohm & Edwards, 1991; Shor & Freire, 1987; Burbles, 2006).

In addition to an environment free of bias and fear, Clark & Mayer (2011) noted the importance of a space void of distraction, which aligns with Moore's (1997) recommendation for a good physical environment for both the students and the instructor. Moore (1997) supported the need for a safe, non-threatening physical and emotional space to decrease transactional distance.

Potentially hazardous to the non-threatening learning environment, Hattie and Timperley (2007) found FS the most prevalent form of feedback, which is feedback aimed personally at the student. Specifically, FS without FT "directs attention away from the task to the self" (Hattie & Timperley, 2007, p. 96). FS not only detracts from the learning content, it could lead to an unsafe learning environment. None of the literature reviewed investigated FS or similar non-task related feedback that could lead to an environment not conducive to learning. Given the literature supportive of a non-threatening, safe and open learning environment, the prevalence of FS and its effect on the learning environment requires additional research.

Praise. Though often devoid of instructional value, Hattie and Timperley (2007) noted that praise is the most common form of feedback. Hattie and Timperley (2007) found that students liked praise, specifically for effort and achievement rather than for ability and behavior. Private praise was preferred by most, as some students identified it as a punishment if the praise occurred in front of a peer group that devalued education.

Interestingly, Hattie and Timperley (2007) indicated that “older students perceived praise after success or neutral feedback after failure as an indication that the teacher perceived their ability to be low” (p. 97).

The actual analysis by Hattie (Hattie & Timperley, 2007) found praise to be a complicated element of feedback. J. Hattie mentioned his frustration with praise, “I struggle with the dominance by teachers on the praise aspect...they cannot stop doing it and thence nullifying the effects [of feedback]” (personal communication, May 2, 2013). Kohn (2012) argued against praise, as “an effort to change someone’s behavior, typically someone with less power” (Kohn, 2012, para. 3). “Praise isn't feedback (which is purely informational); it's a judgment -- and positive judgments are ultimately no more constructive than negative ones” (Kohn, 2012, para. 4). Praise, especially its interference with feedback, was not addressed in the current literature reviewed here. Given its common use and complexity, this field could benefit from additional studies of current use of praise.

Two-way communication. Blair and McGinty (2012) found that students valued an opportunity to engage in dialogue with their instructors. In their year-long investigation of current feedback-dialogue practices, they concluded that the discussions deepened dialogue to rebalance the power structure between the instructor as expert and student as recipient. Careless, Salter, Yang, and Lam (2011) and Orsmod et al. (2013) recommended dialogic communication involving the learner, peers, and instructor.

Moore (1997) highlighted the importance of two-way communication for education programs while Hattie and Timperley (2007) and Ferrel (2012) noted the importance of both students and teachers giving and receiving feedback. “Teachers need to seek and learn from feedback (such as from students’ responses to tests) as much as do students” (Hattie & Timperley, 2007, p.104). Two-way communication provides an opportunity for an exchange of ideas. As with the student, feedback provides information to the teacher about how well they are meeting their intended goals.

> Listening to what prior knowledge they bring; listening to their understanding of the goals of learning; listening to where they are moving, from priors to goals; and, listening to their conceptions of confidence and accuracy in answering these questions…. This means not only being explicit to students about learning intentions (what we are learning, rather than what we are doing) but also being explicit about the goals of the lessons (what does success look like). (Hattie, 2013, p. 65)

In this context, two-way communication emphasizes the need for the teacher to receive feedback from the student regarding their interaction.

Tanner and Jones (2007) and Wang and Morgan (2008) found instances of two-way communication. The Tanner and Jones (2007) study use of video for reflection provided students and teachers alike an opportunity to reflect on the interaction for further growth. Wang and Morgan (2008) found that the use of an instant messaging system (IM) resulted in students feeling that the increased back and forth discourse

improved understanding of the material, though it is unclear if teachers felt an improved learning experience as well. Gomez et al. (2013) leveraged a digital ecosystem learning framework that applied a social constructivist framework and web-based model to improve dialogic feedback by creating a web-based tool that "provides a facility for students to respond to tutor feedback as well as tutors being able to see if students have comprehended the feedback correctly" (p. 49). The digital ecosystem technology supports two way communication around what Gomez et al. (2013) called "group self-regulated learning" (p. 42).

While the above technologies supported two-way communication and teacher reflection as well as student reflection, others either failed to address student feedback or used a technology that did not support feedback. Schlitz et al. (2009) discussed the need for collaboration within the FLC, but the educational technology used to transmit student feedback did not explicitly support two-way communication.

Two-way communication seems to be an important element of collaboration and dialogue, in addition to its role in feedback. Limited information regarding two-way communication within this current literature highlights an area in need of additional review.

Technology enhanced. Hattie (2003) focused on the role of teachers and the need for excellent teachers "who are thinking, reflective, enthusiastic, passionate, and knowledgeable about the content" and "encourage their students to share in seeking answers to our three feedback questions" (p. 4), but there seems to be a great opportunity

to use technology to provide the feedback students need to help guide them as they navigate through the feedback questions. Hattie and Timperley (2007) referenced Hattie's 1999 "detailed synthesis of 74 meta-analyses…[that] demonstrated that the most effective forms of feedback provide cues or reinforcement to learners; are in the form of video-, audio-, or computer-assisted instructional feedback; and/or relate to goals" (p. 84). Technology has paved the way for an instructional model known as adaptive instruction that adapts the instruction based on the progress of the learner (Clark & Mayer (2011). One such adaptive instruction, "directive lessons", "follow a sequence of 'explanation-example-question-feedback'. These architectures, commonly designed for perform procedure training goals, incorporate highly structured practice opportunities designed to guide learning in a step-by-step manner" (Mayer & Clark, 2007, p. 27). Adaptive instruction is one of many ways that technology can enhance feedback.

Current literature identified numerous educational technologies that enhanced the student feedback experience (Careless, Salter, Yang, and Lam , 2011; Tanner & Jones, 2007; Schlitz et al., 2009; Wang & Morgan, 2008; Gomez et al., 2013; Hatziapostolou & Paraskakis, 2010). Careless, Salter, Yang, and Lam (2011) identified "technology-assisted dialogue with the aim of promoting student autonomy and reflective interaction" as an effective element for feedback (p. 405). In the Tanner and Jones (2007) study, students found the technology enhanced the interaction, deepened age appropriate reflection, and were fun. Schlitz et al. (2009) found technology allowed their group to create web-based rubrics that will "enhance performance-based assessment, [during] the

development of a culture of assessment" (p. 146). Wang and Morgan (2008) concluded that IM improved course facilitation by: "promoting cooperation among the students, and active learning, and secondarily, prompt feedback and contact with the instructor" (p. 20). Hatziapostolou and Paraskakis, (2010) found the OFES tool effective in communicating student feedback, which resulted in improved student reception of feedback and student motivation.

While technology can improve the learner's experience, Mayer and Clark (2007) highlighted the need to follow the contiguity principle by making sure that feedback is placed on the same screen as the question. Contiguity avoids requiring "the learner to page back and forth between the question and the feedback, adding cognitive load to learning" (p. 83). In addition to placing information strategically for best consumption, Ferrel (2013) noted the importance of technology to support accessibility. Technology provides a space to return and reflect on the feedback that can be presented in numerous forms, such as audio, video, and text.

Many support the notion of Hattie and Timperley (2007) that technology has the capacity to enhance how a student receives and interacts with feedback. Evidence found in current literature indicates that continued use of technology-driven feedback could improve student learning.

Self-reliance. As a bridge to self-regulated learning, students need to incorporate proactive behavior in assessing the three feedback questions on their own. Hattie and Timperley (2007) noticed "students, too often, view feedback as the responsibility of

someone else, usually teachers, whose jobs it is to provide feedback information by deciding for the students how well they are going, what the goals are, and what to do next" (p. 101). Butler and Winne (1995) noted that "self-generated feedback is rich" as it contains "current states of knowledge, goals set, the productivity of strategies or tactics employed, the rate of progress towards goals, and affective content in reaction to perceptions about achievements and progress" (p. 264). Though self-reliance could be incorporated into an area of self-regulation, specifically focusing on a student's self-reliant behaviors emerged as a separate element.

In accordance with Hattie, Butler and Winne (1995) found that effective learners seek out external feedback. Timmers and Veldkamp (2011) recognized the effectiveness of feedback to improve performance, and also recognized the need for learners to be "willing and able to use it" (p. 923). Orsmond et al. (2013) noted the feedback should encourage self-reliance by focusing on the assignment process, encouraging self-assessment, and encouraging a proactive rather than a reactive approach to feedback.

Schlitz et al. (2009) discovered that access to rubrics in an online learning management system, "resulted in the instructor becoming more coherent, clear, and interactive in developing course learning and assessment activities that are compatible with course objectives, and, in turn, has enabled students to become more proficient and self-directed learners" (p. 144). Hence, the rubric with task-specific criteria became a tool of self-reliant learners in self-directed learning.

Self-reliance emerged as a separate defining factor of successful learners. This independent characteristic aligns with the autonomous, adult learner, the target population of the proposed study (Knowles, 1990). Self-reliance may be connected to a learner's familiarity with content and connection to personal goals, as well as general cognitive skill set. Learners with strong critical thinking skills and high self-efficacy may exhibit more self-reliant behaviors, whereas those with cognitive deficiencies may struggle to identify those successful tools.

Assessment. There seems to be a clear connection between assessment and feedback (Rudland et al., 2013). In his meta-analysis, Hattie (2003) referenced studies by Crooks (1988) and Black and Wiliam (1998) that have found "little evidence that classroom assessment has assisted in the learning process" though Black and Wiliam "highlighted the potential of assessment to provide feedback" (p. 3). The focus here is on feedback, not assessment, but it seems that there needs to be a shift in the learning community to this often forgotten, critical key to learning. Typical assessment fails to address the four levels of feedback. Assessment needs a change that

> provide[s] information and interpretations about the discrepancy between current status and the learning goals at any of the three levels: about tasks, about the processes or strategies to understand the tasks, and about the regulation, engagement, and confidence to become more committed to learn. (Hattie & Timperley, 2007, p. 101)

Rather than focus on the assessment results as a motivator to improve without addressing the three feedback questions, feedback needs to be seen as an instructional instrument. With a change in assessment, effective feedback could become a routine experience for learners.

Entwistle (2012) argued that quality learning seems to be seen by students as grades on assessments rather than the ability to apply their learning to solve complex problems within their chosen field. Rather than results-driven assessment, there seems to be a need to fine tune assessments to address the three feedback questions. With this change, feedback can be seen as an instructional instrument rather than an after-the-fact correction.

Effectiveness of Feedback for Learning

In support of Hattie and Timperley (2007) findings on the influence of feedback on learning, Butler and Winne (1995), Deng and Yuen (2009), Espasa and Menses (2010), Furnborough and Truman (2009), Hatziapostolou and Paraskakis, (2010), Wang and Morgan (2008), Schlitz et al. (2009), Cramp (2011), and Tanner and Jones (2007) found evidence of the effectiveness of feedback for learning.

Self-efficacy. Butler (2002) acknowledged the work of Borkowski (1992) and Schunk (1994) regarding the need "to promote students' positive self-perceptions of competence and motivational beliefs" (p. 82), also known as self-efficacy (Bandura, 1994). Butler (2002) noted that improved self-perception would support self-efficacy, which in turns supports student engagement. "Thus, to promote self-regulated learning,

teachers must assist students to develop positive perceptions of self-efficacy and productive attributional beliefs" (Butler, 2002, p. 83). Again applying the work of Borkowski (1992) and Schunk (1994), Butler (2002) defined productive attributional beliefs as a student's beliefs about their success and failure, noting that attribution to controllable factors supported strategic performance.

Bembenutty (2011) emphasized the role of self-efficacy, "students with high self-efficacy may decide to continue working on an important assignment even when test anxiety arises and/or temptation to stop calls for attention" (para. 7). For students with low self-efficacy, not only are they susceptible to distraction from outside sources, their internal, negative self-doubt may also interfere with performance (Bembenutty, 2011). Within a complex web of influences, self-regulation influences and can be influenced by learners',

- "outcome expectations" (para. 8),
- "intrinsic interest" and "extrinsic interest" (para. 9),
- "future time perspective" (para. 10), and
- "effort regulation" (para. 11).

Hawk and Shah (2008) also noted a need for conscious recognition of "emotional attachment to self-image and beliefs" needs to be addressed to avoid a negative impact on the effectiveness of feedback.

Connect to previous experiences. Butler (2002) concluded that students entered the classroom with knowledge and skills that teachers needed to build upon to promote

self-regulation. Though focused on learning strategies, this concept aligns with foundational theorists Friere and Shor (1987), Peter (2010), Moore (1997), and Merrill (2002) who acknowledged that learning stems from connections to students' previous experience.

Collaboration. Butler (2002) used strategic content learning (SCL) to promote SRL behavior, noting that "the instructional model designed to promote SRL" supported "reflective engagement in cycles of self-regulated learning" (pp. 83-84). To encourage student engagement in task analysis, problem anticipation, and strategy identification, SCL involved teachers and students working together "to co-construct strategies with students" (p. 84).

Collaboration has been noted as a key to learning by others as well (Senge et al., 2004; Bohm & Nichol, 2004; Mao & Peck, 2013). Senge (2006) realized the "potential of collaborative learning – that collectively, we can be more insightful, more intelligent than we can possibly be individually" (p. 242). Mao and Peck (2013) found that feedback in the writing process did not immediately improve writing or SRL skills, though "the subsequent collaborative writing process, peer assessment teams scored significantly higher on the five-page team paper than the teams that only received a score from the teaching assistants as the feedback to improve their twopage individual paper" (p. 82). Whether it was a deepened reflection or increased engagement in responding to the feedback, Mao and Pack (2013) attributed the improved performance to the collaboration. Nicol (2010) agreed.

> For students to learn they must do something with transmitted information, analyse the message, ask questions about it, discuss it with others, connect it with prior understanding and use this to change future actions. The same is true for feedback comments. While the quality of the comments is important, the quality of the students' interaction with those comments is equally, and perhaps more, important. (Nicol, 2010, p. 503)

Rather than create a template for further collaboration, the ultimate purpose of SCL is for students to "learn how to construct personally effective strategies for meeting varying task demands" (Butler, 2002, p. 84). In essence, SCL uses collaboration as a springboard for future independent strategy use.

Constructivist learning principles. SCL instructional principles relied "on an integration of constructivist and sociocultural learning theories" (Butler, 2002, p. 84). The constructivist principles coincides with many key elements of Butler and Winne's (1995) model of SRL, requiring teachers to

- engage students in meaningful work,
- surface students' existing knowledge and beliefs,
- engage students in interactive discussions about learning processes, and
- ask students to articulate revised and/or emerging understandings based on new experiences. (p. 84)

Knowledge and beliefs are a clear commonality between application of the constructivist principles and Butler and Winne's (1995) SRL model.

Sociocultural learning theory. Butler (2002) noted the influence of sociocultural learning theory on the SCL instructional principles, noting the social aspect of learning. According to Butler's (2002) review, sociocultural learning models acknowledge that language, social setting, and culture influence the tools of knowledge construction. Though collaboration and connecting learning to previous experience have been noted as an important aspect of learning, the sociocultural model application relies on a clear understanding of students' current skill set and building upon it. The instructional recommendations include:

- "identify students' current level of problem-solving performance",
- "provide scaffolded…support",
- "deconstruct supportive scaffolds as students" internalize the cognitive processes (Butler, 2002, p. 84).

These recommendations align with those of the liberation learning model put forth by Freire (Shor & Freire, 1987), noting the importance that instruction begin with the student.

Student-centered. Freire's (Shor & Freire, 1987) student-centered approach leveraged dialogue to engage the students in their learning process. Freire noticed that many people involved in education may be so wrapped up in academia that they are distanced from the concreteness of the lives outside of their institutions. He saw educators as often moving from knowledge to concrete, whereas the majority of people outside academia begin with the concrete. Acknowledging the concreteness that

instructors share in common with their students allows educators to invest in what Freire referred to as “situated pedagogy” and to improve student participation in the classroom dialogue (p. 103). Freire highlighted the efforts of a physics instructor who appropriately used this strategy in his Astronomy course, where the first lesson involved having the students go into their neighborhoods and ask people what the sky meant to them. In doing this, he began an examination of the sky with the concreteness of what people believed. This lesson exemplified how dialogue in conjunction with situated pedagogy can increase participation by challenging passivity and increasing student responsibility. Rather than sitting and passively listening to a lecture, the students have an active role in their learning. Not only did this physics lesson engage the students as active participants in their learning, it involved sharing the opinions of others, removing the risk and fear of being wrong, which clearly aligns with Butler’s (2002) sociocultural learning instructional recommendations.

Create shared meaning through dialogue. Butler (2002) “presumed that teachers and students connect to create learning opportunities when they establish a common context….both teachers and students work to construct a shared framework for understanding” (p. 85). Dialogue, known to lead to deep learning, is the practice of creating shared meaning. Bohm (1991) believed that the “essence” of dialogue “is learning” (p. 2). In this sense, dialogue enhances learning situations. Although suspending thought may seem counterproductive to learning, it encourages deliberate thinking rather than reactive thought that often thwarts engaged learning. Applied in a

classroom setting, dialogue could offer a way for lessons to be fresh and individualized every term. Rather than adhere to a set lesson plan, instructors could use course objectives as an outline and let the students influence how to fill in the details.

The use of dialogue could transform tired and boring adult classrooms into collective, interactive, and engaged sites of learning. Competing for grades could become unnecessary as learning would become the ultimate goal. Bohm (2004) saw dialogue as "a common participation, in which we are not playing a game against each other, but with each other. In a dialogue, everybody wins" (p. 7). Though he wrote about the application of dialogue as a means of improving conversations, his words easily translate to classroom learning.

Employing dialogue encourages a quiet space where people can process information in a new way. Bohm (2004) compared suspending assumptions to withholding a reaction. Instead of allowing thought's reaction to incoming information influence behavior, people engaged in dialogue resist that influence and analyze it in a new light. Bohm believed that suspension helped "make proprioception possible, to create a mirror so that you can see the results of your thoughts" (p. 29). Thought constantly lies at the source of problems and then tries to solve them without awareness of its influence, and this cycle continues unless one takes a moment to actively stop it. Suspension offers people an opportunity to be aware of thought's influence.

> We do not notice that our attitude toward another person may be profoundly affected by the way we think and feel about someone else who might share certain aspects of his behavior or even of his appearance…The kind of attention required to notice this incoherence seems seldom to be available when it is most needed. (Bohm et al., 1991, p. 3)

People may find that they are often unaware of the cause of their attitude. With the automated, imperceptive process of thought suspended, small groups of people have a chance to interact, learn about one another and converse in a trusting, unbiased atmosphere. Establishing a safe environment through the use of dialogue can encourage adult learning.

Dialogue for collaborative learning. Senge et al. (2004) explained,

> When we're learning something new, we can feel awkward, incompetent, and even foolish. It's easy to convince ourselves that it's really not so important after all to incorporate the new – and so we give up. This is our own psychological 'immune system' at work. (p. 35)

Bohm (2004) found that dialogue sessions consisting of 20 to 40 people created a microculture where collective meaning begins, and that thought becomes more powerful than resistant individual thought. Senge's (2006) research supported Bohm's microculture idea in team learning. Senge investigated how teams learn, "as opposed to individuals in teams learning," distinguished from individuals succumbing to conformity resulting from group pressure (p. 221). Senge realized the "potential of collaborative

learning – that collectively, we can be more insightful, more intelligent than we can possibly be individually" (p. 242).

Dialogue sessions allow a team to come together to "practice" dialogue and develop the skills it demands. The basic conditions for such a session include:

1. Having all members of the "team" (those who need one another to act) together;
2. Explaining the ground rules of dialogue;
3. Enforcing those ground rules so that if anyone finds himself unable to "suspend" his assumptions, the team acknowledges that it is "discussing" not "dialoguing;"
4. Making possible, indeed encouraging, team members to raise the most difficult, subtle, and conflictual issues essential to the team's work;
5. Creating practice fields where participants have opportunities to come together and learn how to dialogue is crucial in creating effective, learning communities. (Senge, 2006, p. 242)

Orsmond and Merry (2011) identified a need for dialogue between those receiving and those giving feedback, noting that without dialogue "students never become fully aware of the potential contribution of feedback to their learning and tutors never fully appreciate how their feedback is being used" (p. 134).

Dialogue also helps build learning communities, as Senge (2006) illustrated with West Des Moines public schools. Superintendent Omotani of West Des Moines public

schools used community dialogues to improve the education conversation more than ten years ago. Typical “immovable walls” questions arose, “teams of teachers and administrators and community members” worked out details, and “two processes, dialogue and implementation – again, reflection and action – were moving in parallel, and feeding each other” (p. 308). The dialogues provided a space for participants to discuss everything involved in the education of the students including resources, teacher training, school hours, objectives, and a myriad of other topics. The schools actually responded by increasing the number of days that students met in the school year, a typical immovable scenario. This community consisting of three low-income schools improved student performance and reduced achievement gaps. Omotani credited the dialogue forums, “It was definitely the result of those conversations. It was all about developing a capacity to talk together in very diverse groups, developing a collaborative network of people who were supportive of one another, and through this tapping people’s deep caring for kids” (Senge, 2006, p. 308). Though Omanti’s experience was not formally designed, the results align with those found by others applying the principles of dialogue. The active use of dialogue creates a more harmonious environment where the group learns something new together in an organic, encouraging manner.

Participants may feel empowered with the focus on the idea of the group learning together. Bohm (2004) believed that dialogue provided groups an opportunity to arrive at common meaning, to make “something in common” – a new kind of learning (p. 3). Dialogue may improve team learning where individual opinions are suspended while the

group works to create new meaning. Bohm (2004) observed that certain thoughts play greater roles than others, these he categorized as “absolute necessity” (p. 25). He found that all serious arguments involved different beliefs of what are absolutely necessary or unyielding viewpoints. The clash of two absolute necessities results in an emotional charge such as anger, hate, or frustration.

> As long as that absolute necessity remains, nothing can change it, because in a way each person says that they have a valid reason to stick to what they’ve got, and they have a valid reason to hate the other person for getting in the way of what is absolutely necessary. (Bohm, 2004, p. 26)

These arguments would be better served if the participants used dialogue to suspend their assumptions and analyze their value systems that produced the absolute necessity. Bohm found that people avoided conversations about issues of absolute necessity, but through sustained dialogue people loosened up, began to question and explore what is absolutely necessary. Dialogue “gets to the root of our problems and opens the way to creative transformation” (p. 27). This process opens groups to a new resourcefulness unexplored in typical group interaction. World and work views regarding issues of absolute necessity hinder learning in any environment. Bohm saw that liberation from thought created a freedom that “makes possible a creative perception of new orders of necessity – because we’re driven by impulses from thought” (p. 27).

According to Bohm (2004), the collective participation in dialogue created an opportunity for the participants to do the following:

1. Actively engage in thinking with the group, not defend opinions
2. Build trust with the group and the process
3. Suspend and analyze opinions
4. Listen to everybody's opinions, and help suspend them
5. Understand how it feels to be "sharing common content" (p. 30).

In the collective space where groups met the above conditions, Bohm labeled this "participatory consciousness" (p. 30). He believed that by attaining this state, the participants had set their individual opinions, bias and assumptions aside and achieved true dialogue, a communion of minds sharing something in common. This allowed for an opening of communication between the collective and individual harmoniously "in which the whole constantly moves toward coherence" (p. 31).

Repeatedly, Butler (2002) integrated dialogue and collaboration throughout the recommendations for instruction based on an integrated view of constructivist and sociocultural learning theories. Mindfulness offers an avenue to deep learning through dialogue and its feedback component.

Mindfulness. Seigel (2010) defined mindfulness as "a form of mental activity that trains the mind to become aware of awareness itself and to pay attention to one's own intention" (p.86). Butler (2002) found that mindfulness led to improved transfer, noting the importance of having SCL students articulate strategies. SCL applied in one-on-one scenarios does not meet the greater need of the classroom, where instructors do not have

the resources for that individualized level of instruction. A focus on feedback would improve the application of SCL principles.

Senge (Senge et al., 2004; Senge 2006) identified deep learning based on sensing, presencing and realizing. Realizing includes space for collection of and response to feedback (Senge, 2006). In alignment with Senge's findings, Butler and Winne (1995) found that feedback served as an "inherent catalyst" to self-regulation, and that effective learners seek out external feedback (p. 246). Espasa and Menses (2010) found data that supports, the "relevance of feedback in favouring self-regulatory competences within distance teaching and learning practices" (p. 289).

Mayer and Clark (2007) recommended deliberate practice, noting that it that demands "concentration" (p. 235). In alignment with elements identified throughout current literature, the recommend that deliberate practice follow these guidelines: "(1) practice that focuses on specific skill gaps; (2) explanatory corrective feedback; (3) practice in distraction-free environments; as well as (4) practice that builds skills that will transfer from learning environments to work environments" (p. 235).While many authors identified a connection between feedback and SRL, Bembenutty's (2011) collection of works fails to include feedback as an important element of SRL and its cyclical nature. Indeed, feedback is a critical area for instructors to intervene and support the SRL process yet there is a gap between seeing a connection and manipulating it to improve student performance. Instead, most contributors focus on self-reflective practice as it

relates to motivation, use of strategies, professional training, and technology. The importance of feedback, its role, its effective application, requires attention.

SRL Model Benefits from Feedback Types

Butler and Winne (1995), Deng and Yuen (2009), Espasa and Menses (2010), Furnborough and Truman (2009), Hatziapostolou and Paraskakis, (2010), Wang and Morgan (2008), Schlitz et al. (2009), Ferrel (2013), and Tanner and Jones (2007) found evidence of the power of feedback to support learning and improved performance as noted by Hattie and Timperley (2007). Regarding feedback types, Butler and Winne (1995), Espasa and Menses (2010), Hatziapostolou and Paraskakis, (2010), Schlitz et al. (2009), and Tanner and Jones (2007) provided support for FT, Butler and Winne (1995), Espasa and Menses (2010), Furnborough and Truman (2009), and Tanner and Jones (2007) provided support for FP, Butler and Winne (1995), Espasa and Menses (2010), and Furnborough and Truman (2009) provided support for FR, while the literature review offered no support or discussion of FS. Butler and Winne (1995) differentiated outcome feedback from FT, suggesting a need for FT to be broken down into a response of correctness and a response including instructional resources. FR received incredible attention as Butler and Winne (1995) provided a thorough review supporting their SRL model that now needs empirical testing. The model does not conflict with Hattie and Timperley (2007), but rather delves into this particular feedback type and its relation to self-regulated learning.

Hawk and Shah (2008) noted, “Little attention has been given to how the task feedback research might apply to self-regulation and the types of activities that can generate opportunities for feedback on self-regulation” (p. 67). To that end, the researchers integrated numerous learning models such as,

- Behaviorist and cybernetic models of learning,
- Cognitive models of learning,
- Social learning models (Bandura, 1997; Vygotsky, 1978, 1986; Wink & Putney, 2002),
- Experiential learning models such as the Kolb’s (1984) experiential learning cycle,
- Conversational learning (Baker, Jensen & Kolb, 2002),
- Liberation models of learning (Freire, 1970, 1973; Freire & Faundez, 1989; Hooks, 1994),
- Adult learning (Merriam & Caffarella, 1999), and
- Team-based learning (p. 68)

Each of these models relies on the importance of feedback loops, specifically social learning and conversational learning models that explicitly reinforce the value of feedback in learning.

Toit (2012) labeled task (FT) and process (FP) as “constructive feedback”, concluding that it has the power to “enhance self-regulatory skills that will ultimately lead to improved performance” (p. 38). Toit’s (2012) study falls short due to its sole

reliance on secondary, rather than primary sources. The emphasis of this review on learning-promoting-feedback provides an opportunity to break down an instructional interaction to improve its use as an educational tool. This investigation provided clearly defined feedback types, their role in supporting learning, and numerous holes in the research needing further investigation. Applicable recommendations from this review of feedback include the following:

- Adopt FP, FR and FS as generally accepted feedback types.
- Create and offer comprehensive faculty training regarding effective use of feedback based on the following feedback guidelines:
    - Feedback needs to be task-specific.
    - Feedback needs to support SRL.
    - Feedback needs to address low complex issues.
    - Feedback timing needs to be cognitively appropriate, where simple tasks benefit from FC promptly and difficult tasks that require FP benefit from a delayed response.
    - Feedback timing needs to provide learners the ability to process and revise prior to submitting for a grade.
    - Feedback should include appropriate application of positive and negative feedback, noting that FC may benefit from both, but that adding negative FS has an even greater effect.
    - Feedback needs to occur in a non-threatening environment.

  - Feedback should avoid FS and educators need to be aware of the effects of praise.
  - Feedback should be two-way, where the instructor uses feedback to improve instruction.
  - Feedback is most useful when combined with self-reliant students; therefore self-reliance should be encouraged and nourished.
  - Feedback delivered via technology offered an effective medium and additional benefit that improved the student access.

This review also revealed a need for additional research.

- Feedback type FT should be split into two feedback types:
  - FC, feedback that indicates correctness, and
  - FE, feedback that elaborates on the correctness of the task.
- The relationship between confidence levels and feedback effectiveness needs to be studied.
- The potential influence of using an automated dialogue coder, Multiple Episode Protocol Analysis, which could influence online dialogue should be reviewed.
- The ideal structure for feedback communication should be identified.
- Within the identifiable feedback guidelines, the following areas need further review.

- Rubrics should be considered to support delivering task-specific feedback, especially where task complexity could be simplified as complex criteria are broken down into detailed, manageable ones.
- The effect of praise as it interferes with the effectiveness of feedback needs thorough review.
- Two-way communication seems to be an important element of collaboration and dialogue, in addition to its role in feedback. Limited information regarding two-way communication within this current literature highlights an area in need of additional review.

The notion that dialogue encourages deep learning through collaboration persists. An open, collaborative space of diverse opinions and mutual inquiry fosters self-regulated learning. Such an environment supports dialogic communication through feedback, thereby encouraging deep learning.

Conclusion

The overwhelming theme of this literature review regards the importance of feedback in student learning, specifically within the SRL model. Building on Butler and Winne's (1995) SRL model, Hattie and Timperley's (2007) four feedback types, and the evidence for separation of FT into FC and FE, the five proposed feedback types added to the SRL model will deepen the understanding of the learning cycle.

Applying distinct, research-informed feedback types to the SRL model should vastly improve the operationalization of the SRL model for the learner supporting

community. This study intended to validate feedback type categories within actual feedback and identify a connection between feedback and performance, as seen in the modified SRL model in Figure 6.

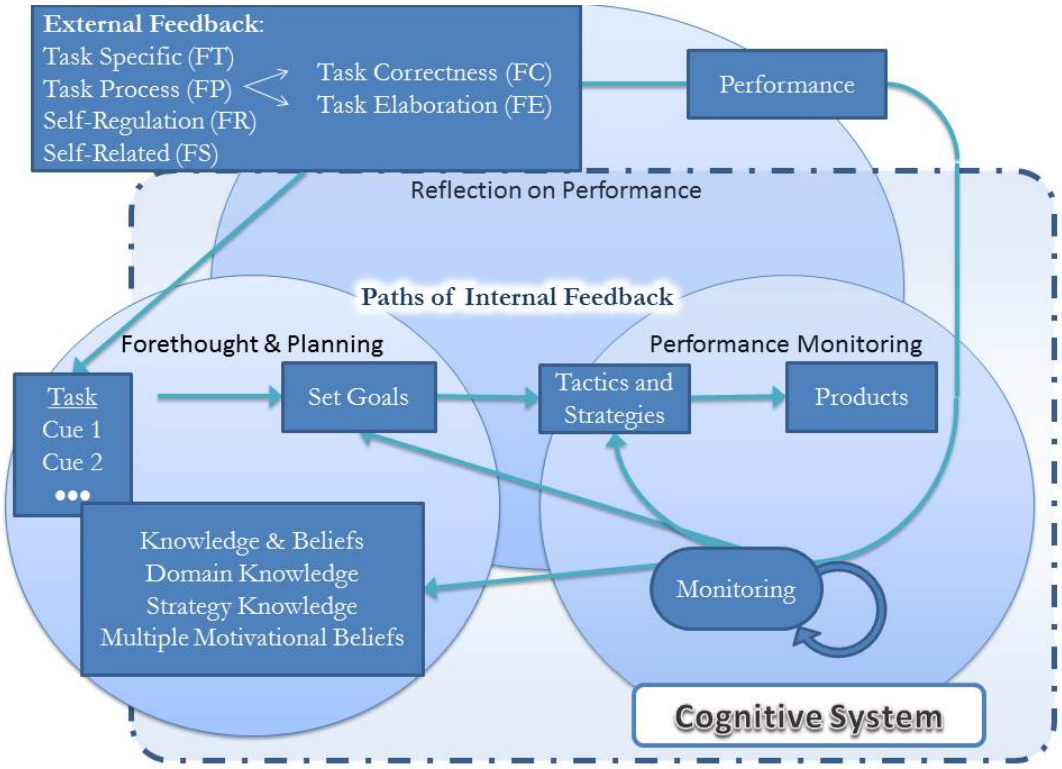

Figure 6. Modified SRL model. Adapted from "Feedback and self-regulated learning: A theoretical synthesis," by D. L. Butler and P. H. Winne, 1995, *Review of Educational Research,65*(3), p. 248. Adapted with permission from the publisher.

According to this review, the online, adult learner benefits from feedback, immersed in the principles of dialogue. With the application of Waypoint to provide feedback through an educational technology, the performance effect of feedback can be measured in collected graded assignments.

Chapter 3: Research Method

Introduction

My review of the relevant literature provided background information and indexed the need for a study relating the proposed feedback type frequency to performance. In the previous chapter, I presented feedback types, the components that contribute to optimizing feedback effectiveness, and their importance in an SRL model. To expand upon the simple dichotomy of internal and external feedback within Butler and Winne's (1995) SRL model, I developed a method to measure the use and effectiveness of feedback types. With my study, I sought to understand the effectiveness of the five feedback types by assessing actual feedback instances and identify a connection of feedback with student performance.

Purpose of the Study

Within appropriate pedagogical models, educational technologies can support learning principles and enhance the student experience. Technology has been found to enhance feedback; therefore to fill the identified gap of the relationship between feedback type and effect of feedback on SRL that leads to a change in student performance, I evaluated feedback observations provided to students via a web-based interactive rubric tool. In this chapter I describe the research design, rationale, and methodology and include an overview of the study's population; sampling procedures; data collection; instrumentation and operationalization of constructs; threats to validity; and ethical procedures.

Research Questions

This study addressed the following research questions and associated hypotheses:

1. How well did the five feedback types describe feedback observations used by the teachers in this study?
    a. At what frequency did online teachers provide the proposed five feedback types using a web-based tool to communicate feedback on assignments?
    b. What percentage of feedback observations contained overlap in the five feedback types? That is, what percentage of feedback observations could be categorized as more than one feedback type? What percentage of feedback observations were not included in the five feedback types?
2. Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, was there a significant relationship between score change and feedback types used?
    a. H_0: There is no score difference associated with the use of feedback type.
    b. H_1: There is a score difference associated with the use of FC.
    c. H_2: There is a score difference associated with the use of FE.
    d. H_3: There is a score difference associated with the use of FP.
    e. H_4: There is a score difference associated with the use of FR.

f. H_5: There is a score difference associated with the use of FS.

Research Design and Rationale

I used a quantitative approach to categorize observations of instructor feedback on student assignments and measured a change in student performance associated with five feedback types. To assure consistency with the current literature on feedback, I included the five feedback types FC, FE, FP, FR, and FS.

Applying quantitative measures, I tested to see if the categorizations of the five feedback types aligned with actual feedback that instructors provided to students at the university-of-study. This quantitative analysis provided an initial validation of the feedback types for future studies. In addition to validating the categories, I also used quantitative measures to compute the difference in performance after the learner received feedback. I calculated the odds ratio in this case-control design to identify a relationship between the use of feedback types and performance.

Methodology

Population

I retrieved the feedback and performance data from the Waypoint Outcomes (an online grading technology) graded assignments archives of participants enrolled in online courses during the Fall 2012 term. The Waypoint Outcomes staff and I randomly selected graded assignments from the Fall 2012 term, which are part of the existing pool of graded assignments collected during of the 2012-2013 school year.

The population included instructors at the university-of-study who were fully-online, adjunct faculty, 85% of whom held a Ph.D. or terminal degrees and 15% of whom held Master's degrees. Faculty attended an onboarding training that included the use of Waypoint to score student assignments.

Sampling and Sampling Procedures

Historical data in the form of graded assignments provided the feedback data and grammar criterion scores I used for analysis. I requested this data from the Waypoint Outcomes specialist. Using an algorithm to randomly select graded assignments from all Fall 2012 courses, staff at Waypoint Outcomes and I gathered the data into pdfs. I reviewed and cleaned the data of any identifying marks that would include student or university-of-study identification.

I randomly selected the graded assignments from all graded assignments from the Fall 2012 term within a case-control study. The case-control sampling provided a framework for selecting cases (graded assignments) that lead to a meaningful sample (Hosmer, Lemeshow, Sturdivant, 2013). Breslow (2005) suggested planning "the ideal cohort study" by including "cohort identification…consideration of potential confounders and methods of statistical analysis" (p. 291). For this study, the ideal cohort of graded assignments contained feedback observations from the instructor to the student regarding the grammar criterion in the Week 4 assignment as well as criterion scores for the Week 4 assignment and the Week 6 assignment for the same student.

Data included teachers' comments from the Week 4 assignment and the criterion scores from the Week 4 and Week 6 assignment using Waypoint Outcomes from the Fall 2012 term. I used the data to calculate the odds ratio that exposure to a feedback type influenced a score change. The Waypoint Outcomes online platform is integrated with the university-of-study's Learning Management System. Waypoint Outcomes is used by the university-of-study's faculty to mark-up student work, communicate feedback, and apply a rubric for grading.

I derived The data used for analysis from the Week 4 and the Week 6 assignments. The study focused on the Week 4 feedback observations associated with the grammar criterion of the rubric; the scoring levels are noted in Figure 7:

The assignments graded using Waypoint Outcomes used the same rubric criterion across all written assignments, similar to the one in Figure 7.

	Meets Expectation 4	Approaches Expectation 3	Below Expectation 2	Limited Evidence 1
APA	Few to no APA errors.	Significant number of APA errors.	Numerous APA errors.	APA style not evident.

Figure 7. Rubric levels

The educational technologies used by the university-of-study in this setting provided me an opportunity to address educational technology as it relates to communicating feedback. The Waypoint Outcomes scores are likely not to be normally distributed. These data are categorical ordinal variable, not continuous. According to Agresti (2010), ordinal response variables such as these will have an upper and lower

limit, known as “ceiling” and “floor effects” (p. 5). Agrestic (2010) warns against using ordinary regression modeling with this type of data, which supports the use of a case-controlled logistic regression model. Agresti’s analytical approach is conservative, which is the approach I followed in this study.

Sample size calculation. Applying the G*Power calculator (Faul et al., 2009) to compute the required sample size to support a +/- margin of error of 5% (α err prob = 0.05), a confidence level of 95% [Power (1-β err prob)=0.95], odds ratio of 2 leads to a total sample size of 148. This sample was used to measure the odds ratio of exposure to feedback types and improvement of the performance as measured by an increase in the rubric score on the grammar criterion from the first assignment (Week 4) to the second assignment (Week 6).

The sample of 148 students were randomly selected from all of the Fall 2012 term that met the case-study sampling qualifications to obtain the required 296 assignments. The graded assignments were collected from historical data, so attrition was not an issue. This ensured that sufficient graded assignments were available for the study.

Data Collection. A Waypoint Outcomes specialist and I created the data set from the Waypoint Outcomes archives. 148 Week 4 and Week 6 graded assignments from the Fall 2012 term that met the required qualifications for the case-control were selected at random. The steps that were taken to create the data set involved the Waypoint Outcomes staff and me logging into the Waypoint Outcomes platform for the university-of-study’s Fall 2012 term. There we randomly selected Week 4 and Week 6 assignments for

individual students. We reviewed the rubric to ensure that a grammar criterion and score are available for Week 4 and 6 as well as Week 4 feedback observations pertaining to the grammar criterion. I removed any identifying marks in the assignments, including university-of-study, student, and instructor names as well as references to individuals within the assignment.

A unique identifier replaced identifying information to accommodate the need to track individual assignments for a comparison of Week 4 to Week 6 performance. The task completion time depended on available resources.

Data. I saved the historical data as pdf versions of assignments. The pdf included the annotations of feedback observations and scored grading rubric with summative feedback for the grammar criterion that the instructor provided to the student during the Fall 2012 term. The feedback observations related to the grammar criterion of 148 Week 4 assignments were coded and 148 scores from Week 4 and 148 scores from Week 6 were recorded. Estimating an average of five feedback observations per assignment (MacWilliams and Malan, 2013) related to one specific topic, equated to a total of 740 items to categorize and then record. In addition to the 740 categorizations and recordings, 296 scores needed to be recorded in the tracking document, for a total of 1776 input activities.

Labels for tracking individuals. Assignments were labeled to track individuals, where A4 and A6 represented data collected from Student A at Week 4 and Week 6 respectively. This labeling allowed a comparison of Week 4 and Week 6 performance

scores. After the two data sets, Week 4 and Week 6, were analyzed, the labels were stripped from the data set.

Labels for tracking observations. Feedback observations were coded with the abbreviations for the five feedback types as indicated by the Operationalization of Constructs (Table 4) job aid: task correctness (FC), task elaboration (TE), task process (FP), self-regulation (FR), and personal or self-related (FS) based on the operational definitions.

Missing observations. Assignments that did not contain feedback observations were eliminated from the analysis. This was a qualification of the control-case selection method.

Random selection. In preparation for feedback coding, the pdf assignments were randomly selected by the Waypoint Outcomes specialist and me.

Data entering. As the assignments were coded, the coding results were entered into a password-protected Google document worksheet.

Validate accuracy of protocol. To ensure accurate data entry, the double entry method was employed. Data results were entered into the password-protected Google document worksheet twice. This double entry method was found to significantly reduce data entry errors (Atkinson, 2012; Barchard, Scott, Weintraub, & Pace, 2008). This method doubled the input activity from 1776 to 3552 input activities.

Consent. I received permission from a Waypoint Outcomes supervisor to use the data and for their support in retrieving and cleaning the data. Institutional Review Board

(IRB) approval 05-29-15-0057675 was obtained from Walden University prior to any collection of data.

Table 4

Operationalization of Constructs

Construct Defined	**Construct Operationalized**	**Examples**
Feedback – a response that informs a learner regarding the discrepancy between task performance and the intended task performance (Hattie, 2003).	Annotated comments provided by the instructor to the student within the paper as well as summative feedback from the rubric.	8. set the tone for a very tired individual… Good use of details to support your observations. (Hemerda)
Correctness (FC) – feedback that responds to whether the item was performed correctly (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010; National Research Council, 2004; Butler & Winne, 1995).	Comments provided by the instructor to the student that note correct or incorrect quality of an element of the student's performance.	Your topic sentence and concluding sentence are clear and go together well.
Elaborated Correctness (FE) – feedback that elaborates on what made the performance correct or incorrect (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010).	Comments provided by the instructor to the student that provide detail regarding what made an element of the student's performance correct or incorrect.	You used a lot of details. I count seven different things you like about dogs.
Task process (FP) – feedback that responds to the strategic process of performing the task, such as locating resources and proofreading (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to the strategy behind the task performance.	Did you check your spelling? See if you can find two misspelled words.
Self-regulation (FR) – feedback that responds to commitment, control, and confidence (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to elements of the student's self-regulating behavior.	When you compare two things, write about both of the things you are comparing.
Personal or self-related (FS) – feedback that responds to the student as a person or student's sense of self rather than the task at hand (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to qualities related to the student.	Your paragraph makes me wonder if you have a dog who is playful, strong, cute, and cuddly.
Grammar criterion - one of several criteria used by the university-of-study in its assignment rubric.	Feedback regarding sentence and paragraph structure; grammar and spelling; writing style; and APA.	Consult APA Manual 6th ed for details on margins and line spacing.

Data Analysis Plan

To analyze the feedback data collected from the Waypoint Outcomes platform, the operational definitions located in Table 4 were used to identify and categorize the feedback as task correctness (FC), task elaboration (TE), task process (FP), self-regulation (FR), and personal or self-related (FS).

Resulting data. The quantitative data provided results, such as a) frequency of FC, b) frequency of FE, c) frequency of FP, d) frequency of FR, e) frequency of FS, and f) frequency of non-categorized feedback types. Attention was focused on the use of the five feedback types.

To assess a relationship between performance and use of the feedback (type and quantity), performance score of the assignment from Week 4 was compared to the performance score of week 6. Specifically, a logistic regression was calculated using the improved performance/no improved performance as the binary outcome and the five feedback types used in the Week 4 graded assignment as the variables of interest. (Other covariates could be course, course level, and degree level.)

Research questions. This study addressed the following research questions and associated hypotheses:

1. How well did the five feedback types describe feedback observations used by the teachers in this study?

a. At what frequency did online teachers provide the proposed five feedback types using a web-based tool to communicate feedback on assignments?

b. What percentage of feedback observations contained overlap in the five feedback types? That is, what percentage of feedback observations could be categorized as more than one feedback type? What percentage of feedback observations were not included in the five feedback types?

2. Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, was there a significant relationship between score change and feedback types used?

    a. H_0: There is no score difference associated with the use of feedback type.

    b. H_1: There is a score difference associated with the use of FC.

    c. H_2: There is a score difference associated with the use of FE.

    d. H_3: There is a score difference associated with the use of FP.

    e. H_4: There is a score difference associated with the use of FR.

    f. H_5: There is a score difference associated with the use of FS.

Analysis plan. Table 5 details the statistical instrument used to support each research question.

Table 5

Research Question with Corresponding Analytic Strategy

Research Question	Analytic Strategy
How well do the 5 feedback types describe feedback observations used by these teachers?	
At what frequency are online teachers providing the proposed five feedback types using a web-based tool to communicate feedback on assignments?	The research question counts instance of feedback observations that contains distinct characteristics of the modified feedback types, FC, FE, FP, FR, and FS. Descriptive statistics (frequencies and percentages) were used.
What percentage of feedback observations contains overlap in the five feedback types? That is, what percentage of feedback observations can be categorized as more than one feedback type? What percentage of feedback instances are not included in the five feedback types?	Chi-Square Goodness of Fit was applied to determine if there are significant differences in the frequency of each type of feedback. This statistical measurement calculated how well the observed values matched what would be expected based on chance.
Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, is there a significant relationship between score change and feedback types used?	A logistical regression with exposure variables as the five feedback types in Week 4 measured for an odds ratio for an improvement in score from Week 4 to Week 6. Feedback types were forced into the dominant category to meet the need for mutual exclusivity.

Chi-square. The Chi-square measures the difference between observation and expected values. These five categories were tested as comprehensive labels for all observations of feedback data.

Table 6

Chi-square Calculations

n=100	FC	FE	FP	FR	FS
Expected	20	20	20	20	20
Observed	FC	FE	FP	FR	FS

$$x^2 = \sum\left(\frac{(FC-20)^2}{FC} + \frac{(FE-20)^2}{FE} + \frac{(FP-20)^2}{FP} + \frac{(FR-20)^2}{FR} + \frac{(FS-20)^2}{FS}\right)$$

Logistical Regression. The use of logistical regression is intended to identify an odds ratio for the frequency of feedback type at Week 4 to the improved performance from Week 4 to Week 6.

Table 7

Logistical Regression

Exposure:	Frequency of each feedback type (5 variables)
Binary Outcome:	Week 6 Score - Week 4 Score = Improved or Not Improved Performance

Threats to Validity

Internal validity. Potential threats to internal validity (Neuman, 2007) that could interfere with this study include:

- Selection bias: I assumed that the instructors providing feedback may have a particular characteristic that affects their use of feedback. These traits serve as limitations to the application of the results of the study to the use of feedback by this particular group of instructors at this university-of-study. Random sampling of assignments should diminish this concern.
- History: I assumed that there may have been an unrelated event that occurred that interfered with the provision of feedback or scoring by instructors during the timeframe of the particular course. Given the protection of privacy, there was no way to inquire as to events that may have interfered with the feedback. There is no evidence to suggest that the university-of-study changed their resources supporting feedback, so it can be assumed that there was no external event that may have interfered with feedback performance.
- Causation: I assumed that all changes in performance cannot be directly linked to the feedback (type and frequency), as there are several other influencing factors including:
    - Normal maturation, where students improve as they progress through the course may occur over the two-week period between the assignments. Presumably, this would be consistent for all students, regardless of feedback type, but not equally.
    - Lack of a control group, where students receive no feedback.

  - Treatment contamination, where students may receive feedback from sources outside of the assignment not collected a part of this study. This feedback may come through a private video, email, or phone conversation with the instructor, a tutor, a peer, or other source.
  - Learner process, where learners may or may not read or internalize given feedback.

- Reliability of achievement measure: I assumed that the rubric was not a reliable measure of achievement. The rubric has not been validated as a reliable assessment tool. However, its consistent use by instructors provided the appropriate measure needed for this study without additional validation.

Potential internal validity threats (Neuman, 2007) that can be mitigated through checks and avoid limiting the application of the study results included:

- Experimenter expectancy: I assumed that familiarity with the graded assignments may lead to prejudicial review. The random selection of assignments ensures that I was not familiar with the assignments. I taught four of the hundreds of courses available during the data sampling timeframe of Fall 2012.

External validity. External validity requires qualitatively sound information that applies to the real world. To ensure validity, I aligned the instruments with the research questions, the research questions with the problem, and all of the elements in between. I

have outlined the following potential threats to validity to address potential validity concerns:

- Feedback categories may have been unclear in the assessment material. Clear job aids were to mitigate this threat.
- The sample included graded assignments from a typical fall semester, though this should not lead to an assumption that the online student and faculty population is representative of all students and faculty.
- Though instructors are required to use standardized processes for grading, including the standard rubric and grading tool, there may be instructors who do not follow this protocol. Rubric scoring may not be consistent.
- Evidence of feedback does not guarantee student use of said feedback.

Ethical Procedures

I received consent from a Waypoint Outcomes supervisor. All references to the university-of-study were scrubbed from the data. Institutional Review Board (IRB) approval was obtained from Walden University prior to any collection of data.

Role of the Researcher. In 2012, I worked as a faculty member at the university-of-study. I am studying educational technology and its use in delivering feedback in online learning. I currently oversee curriculum development delivered through educational technologies, including the use of feedback via Waypoint Outcomes. The university of my current employment is owned by the same parent company that owns Waypoint Outcomes. There is no direct or indirect supervisory relationship between

Waypoint Outcomes and my department. This study is for my educational pursuit and has not been solicited by my current or previous employer or anyone associated with this study.

The intent is to clarify feedback types with a comprehensive model and identify the potential relationship between feedback type and performance for future study.

Summary

This study intended to expand on the knowledge and use of feedback. Beginning with its identification of the feedback online, adjunct instructors used during the Fall 2012 term at the university-of-study, this study relied on categorizing feedback into five feedback types and then applied statistical measures in an attempt to identify a correlation between the feedback type frequencies and the change in performance score. By applying a combination of descriptive statistics, Chi-Square and the logistical regression, this study is rich in statistical measures aimed at refining the understanding of the relationship between feedback type and performance outcomes.

The study used historical data from an online university. The sampling of assignments was randomly selected from all courses taught during the Fall 2012 term.

I added unique identifiers to the graded assignments for tracking and removed all identifying information from the graded assignments to protect the privacy of the university-of-study, instructors, and students.

I focused on the grammar criterion of the standardized rubric to avoid variability of assignment, therefore feedback observations and scores related to this particular

criterion. Assignments that lack feedback pertaining to the grammar criterion were discarded.

Using the constructs from Table 4, feedback observations were identified, categorized, coded, and the data was recorded twice in a password -protected Google document spreadsheet.

The Operationalization of Constructs Table 4 supported accuracy and validity, though several potential threats to validity have been identified. Random sampling helped avoid most threats. Though standardized criterion within standardized rubric use is expected by the university-of-study, this does not guarantee standardized use by faculty.

There are several outcomes that have been anticipated, though all cannot be acknowledged here. Preparedness benefitted this study as much as its grounding in research and my flexibility to address unexpected issues. I painstakingly addressed the required elements of a proposal and excitedly collected the data and dove into its analysis to enlighten the study of education on the use and effect of feedback.

Chapter 4: Results

Introduction

This study was intended to relate proposed feedback type frequency to student performance in order to expand the feedback component of Butler and Winne's (1995) Self-Regulated Learning (SRL) model.

Purpose of the Study

Within appropriate pedagogical models, educational technologies can support learning principles and enhance the student experience. Technology has been found to enhance feedback; therefore to fill the identified gap of the relationship between feedback type and effect of feedback on SRL that leads to a change in student performance, I evaluated feedback observations provided to students via a web-based interactive rubric tool.

This section will focus on the results of the study as well as review the research design and rationale; methodology including the population, sampling procedures, data collection, and instrumentation and operationalization of constructs; and threats to validity encountered and ethical procedures implemented.

Research Questions

This study addressed the following research questions and associated hypotheses:

1. How well did the five feedback types describe feedback observations used by the teachers in this study?

a. At what frequency did online teachers provide the proposed five feedback types using a web-based tool to communicate feedback on assignments?

b. What percentage of feedback observations contained overlap in the five feedback types? That is, what percentage of feedback observations could be categorized as more than one feedback type? What percentage of feedback observations were not included in the five feedback types?

2. Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, was there a significant relationship between score change and feedback types used?

    a. H_0: There is no score difference associated with the use of feedback type.

    b. H_1: There is a score difference associated with the use of FC.

    c. H_2: There is a score difference associated with the use of FE.

    d. H_3: There is a score difference associated with the use of FP.

    e. H_4: There is a score difference associated with the use of FR.

    f. H_5: There is a score difference associated with the use of FS.

Table 8

Research Question with Corresponding Analytic Strategy

Research Question	Analytic Strategy
How well do the 5 feedback types describe feedback observations used by these teachers?	
At what frequency are online teachers providing the proposed five feedback types using a web-based tool to communicate feedback on assignments?	The research question counts instance of feedback observations that contains distinct characteristics of the modified feedback types, FC, FE, FP, FR, and FS. Descriptive statistics (frequencies and percentages) were used.
What percentage of feedback observations contains overlap in the five feedback types? That is, what percentage of feedback observations can be categorized as more than one feedback type? What percentage of feedback instances are not included in the five feedback types?	Chi-Square Goodness of Fit was applied to determine if there are significant differences in the frequency of each type of feedback. This statistical measurement calculated how well the observed values matched what would be expected based on chance.
Comparing the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment, is there a significant relationship between score change and feedback types used?	A logistical regression with exposure variables as the five feedback types in Week 4 measured for an odds ratio for an improvement in score from Week 4 to Week 6. Feedback types were forced into the dominant category to meet the need for mutual exclusivity.

Data Collection

In conjunction with a Waypoint Outcomes data specialist, I constructed the archival data set. The randomly selected 149 Week 4 and Week 6 graded assignments from the Fall 2012 term needed to meet the required qualifications for the case-control, including feedback observations from the instructor to the student regarding the grammar criterion in the Week 4 assignment, and criterion scores for both the Week 4 and the Week 6 assignments. To ensure an opportunity for the performance score to improve from Week 4 to Week 6, I added the qualification of an imperfect Week 4 criterion score.

Sampling

I created the data set by accessing the Waypoint Outcomes system, running a report of course sections for the university-of-study, and then selecting courses that contained both Week 4 and Week 6 assignments. The Waypoint Outcomes data specialist used that report to generate a list of the corresponding course identifying numbers, listed in random order, from the Fall 2012 term. I uploaded the course report from Waypoint Outcomes to Google Drive as a spreadsheet and added columns to track course number and title, instructor initials, instructor gender, number of students enrolled, student gender, student initials, student identifying code (e.g. A, AA, AAA), week number, score of Week 4, presence of annotations within graded assignment, date, feedback categories (FC, FE, FP, FR, FS). I then added a second iteration of the Week 4 score, presence of annotations within graded assignment, date, and feedback categories for the double-entry method (Atkinson, 2012; Barchard, Scott, Weintraub, & Pace, 2008).

I logged into the Waypoint Outcomes platform for the university-of-study and searched for the sections in random order as they appeared in the report provided by the Waypoint Outcomes data specialist. Upon finding the course, I opened the course's Week 4 assignment and used the outcomes data chart to identify and select assignments with imperfect grammar criterion scores. Once in the course assignment, I downloaded the student preview that included a link to the annotated graded assignment and the scoring rubric as pdfs naming the files based on a naming convention that combined the student identifying code and the week number (eg. A4, AA4, AAA4). I next input the grammar criterion score into the password-protected Google document spreadsheet along with the course number and title, instructor initials, instructor gender, number of students enrolled, student gender, student initials, student identifying code (eg. A, AA, AAA), week number, score of Week 4, presence of annotations within graded assignment, and assignment date. I repeated this process for Week 6. For annotated Week 4 graded assignments, I used the link within the student preview to access and save the documents as pdfs following a naming convention that combined the student identifying code, the week number, and FB (eg. A4FB, AA4FB, AAA4FB). I did not duplicate this process of accessing and saving annotated graded assignments for Week 6 because grammar criterion scores were the only data I collected for Week 6.

Methodological Variations

The grammar criterion had two variations; both focused on scoring grammar and use of APA formatting conventions. Once all of the documents were saved, I cleaned the data with the drawing tool of the Adobe Acrobat software to black out all identifying

marks in the assignments, including references to the university-of-study, course number, student, and instructor. During the data cleaning process, I used the Adobe Acrobat comment tool to highlight feedback comments and categorize them according to the Table 4 constructs.

Several feedback comments provided advice or corrections, which were not specifically detailed in Table 4. Since the advice was used as an elaboration of why the performance was correct or incorrect, I categorized those feedback instances as FE. Feedback observations were fairly easy to identify as FC, FE, FP, FR, or FS. Some observations led me to consider how clear the distinction was between FE and FP when FE provided instruction for the student to correct an error. Considering that FP instances suggest resources or relate to the student's process, I decided that the instruction regarding a particular task was FE. Unexpected feedback observations included the instructor thanking the student for their effort; I categorized these instances as FR due to their influence on motivation. I made these decisions after reviewing 6 graded assignments, which led me to stop progression, start over, and review all of the previously reviewed documents to ensure consistent interpretation.

I entered the initial data of feedback categories and grammar criterion scores into a Google password-protected spreadsheet. After cleaning them, I printed the pdf documents as Adobe pdf to permanently redact the potentially identifying information. I then re-entered the feedback category counts and grammar criterion scores into the spreadsheet per the double-entry method (Atkinson, 2012; Barchard, Scott, Weintraub, &

Pace, 2008). During the re-entry process, I verified that categorized feedback comments related only to the grammar criterion.

The case-control requirements insured that there were no instances of missing data. All feedback observations fell into the FC, FE, FP, FR, FS categories.

Random sampling of sections and assignment selections within the case-control requirements did lead to the sample including assignments from courses that I taught. I included the assignments and feedback observances in the data set.

This task took approximately six weeks from my initial access of the Waypoint Outcomes platform to the final second entry of data. The need for the course identifying number report to ensure that the selected assignments corresponded to the Fall 2012 term delayed the process about two weeks.

Demographics

The sample included 31 different courses representing numerous subjects across various programs. The courses covered the following topics: management, organizations, principles, strategy, leadership, planning, research, healthcare, public policy, accounting, history, and marketing. The main themes of course topics were calculated by putting the course titles into wordle.net that created a word cloud with the word size increased related to the word count. Figure 8 replicates the word cloud and Table 9 lists the most frequent course names from the data set.

Figure 8. Word cloud. Created from the course titles used in the study.

Table 9

Top Five Frequent Course Titles

Course Name	Section #s
Applying Leadership Principles	47
Composition II	10
Modern Organizational Theory	10
Effective Organizations: Theory and Practice	8
Introduction to Sociology	8

Courses within the sample included 23 undergraduate and 8 graduate level courses that were randomly selected from a pool of 86 courses, which is representative of the number of undergraduate and graduate level programs available in the Fall 2012 term. The level of courses in the overall pool is unknown as the report only included the course identifying numbers generated by the Waypoint Outcomes system.

Of the 149 students, 66 were male, 70 were female, and 13 were unknown; this represents 43 and 47 percent of the sample population respectively. Of the 35 instructors, 17 were female, 16 were male, and 2 were unknown; this represents 49 and 46 percent of the sample population respectively. Gender of the students and instructors was selected based on the typical gender associated with the name.

The demographics collected from the sample are not known about the university-of-study. These data items were tracked based on the recommendation of my dissertation committee methodologist at the time.

Results

The total sample of 149 exceeded the proposed sample size of 148. The data sample originated from randomly selected course sections taught at the university-of-study during the Fall of 2012 within the Waypoint Outcomes server. As expected, the scores were ordinal and not normally distributed. These conditions supported the use of a case-controlled logistic regression model (Agresti, 2010).

Descriptive Overview

I reviewed 149 Week 4 assignments. Per the case-control qualifications, all of these assignments included the grammar criterion score and feedback from the instructor. 104, 70%, of those assignments included the student's original assignment marked up with feedback using the WP annotation tool in addition to the rubric with the score and feedback.

Assumptions

Internal validity supports assertions about causality. Potential internal validity threats (Neuman, 2007) that could interfere with this study and limit the application of the study results include:

- Selection bias: I assumed that the instructors providing feedback may have a particular characteristic that affects their use of feedback. These traits serve as limitations to the application of the results of the study to the use of feedback by this particular group of instructors at this university-of-study. I randomly sampled instructors across the university who taught in the Fall of 2012, which diminished the potential of selection bias.
- History: I assumed that there may have been an unrelated event that occurred that interfered with the provision of feedback or scoring by instructors during the timeframe of the particular course. Given the protection of privacy, there was no way to inquire as to events that may have interfered with the feedback. There was no evidence in the assignment feedback observations to suggest that the university-of-study changed their resources supporting feedback, so it can be assumed that there was no external event that may have interfered with feedback performance. No evidence of a historical event was evident in the data.
- Causation: I assumed that all changes in performance cannot be directly linked to the feedback (type and frequency), as there are several other influencing factors including:

  - Normal maturation, where students improve as they progress through the course may occur over the two-week period between the assignments. Presumably, this would be consistent for all students, regardless of feedback type, but not equally.
  - Lack of a control group, where students received no feedback. The case-control qualifier required that feedback be present. Use of a control group would assess the effect of improvement in performance due to normal maturation and other factors not identified in this study.
  - Treatment contamination, where students may receive feedback from sources outside of the assignment not collected as part of this study. This feedback may come through a private video, email, or phone conversation with the instructor, a tutor, a peer, or other source. Evidence of contamination could include reference to additional communication. Feedback observations did not indicate a presence of contamination, though it cannot be discounted as a possibility.
  - Learner process, where learners may or may not read or internalize given feedback. This is a known weakness of this study and an overall concern that limits the effectiveness of the treatment.

- Reliability of achievement measure: I assumed that the rubric was not a reliable measure of achievement. The rubric has not been validated as a reliable assessment tool. However, its consistent use by instructors provided the appropriate measure needed for this study without additional validation.

Potential internal validity threats (Neuman, 2007) that could be mitigated through checks and avoid limiting the application of the study results included:

- Experimenter expectancy: I assumed that familiarity with the graded assignments may lead to prejudicial review. The random selection of assignments ensured that I was not familiar with the assignments. I taught four of the hundreds of courses available during the data sampling timeframe of Fall 2012. The courses I taught were included in the study. The method of cleaning, categorizing, counting, and double-entry of data led to a focus on the grammar criterion and categorization of feedback thereby decreasing the ability for prejudicial review.

External validity requires qualitatively sound information that applies to the real world. To ensure validity, I aligned the instruments with the research questions, the research questions with the problem, and all of the elements in between. I have outlined the following potential threats to validity to address potential validity concerns:

- Feedback categories may have been unclear in the assessment material. Table 10 was used as a job aid to mitigate this threat. I carefully followed the Operationalization of Constructs from Table 10 to categorize feedback. Upon review of the documents, several feedback comments provided advice or corrections, which were not specifically detailed in Table 10. Since the advice was used as an elaboration of why the performance was correct or incorrect, I categorized those feedback instances as FE.

Table 10

Operationalization of Constructs

Construct Defined	**Construct Operationalized**	**Examples**
Feedback – a response that informs a learner regarding the discrepancy between task performance and the intended task performance (Hattie, 2003).	Annotated comments provided by the instructor to the student within the paper as well as summative feedback from the rubric.	8. set the tone for a very tired individual… Good use of details to support your observations. (Hemerda)
Correctness (FC) – feedback that responds to whether the item was performed correctly (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010; National Research Council, 2004; Butler & Winne, 1995).	Comments provided by the instructor to the student that note correct or incorrect quality of an element of the student's performance.	Your topic sentence and concluding sentence are clear and go together well.
Elaborated Correctness (FE) – feedback that elaborates on what made the performance correct or incorrect (Tanner & Jones, 2007; Furnborough & Truman, 2009; Espasa & Mensese, 2010).	Comments provided by the instructor to the student that provide detail regarding what made an element of the student's performance correct or incorrect.	You used a lot of details. I count seven different things you like about dogs.
Task process (FP) – feedback that responds to the strategic process of performing the task, such as locating resources and proofreading (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to the strategy behind the task performance.	Did you check your spelling? See if you can find two misspelled words.
Self-regulation (FR) – feedback that responds to commitment, control, and confidence (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to elements of the student's self-regulating behavior.	When you compare two things, write about both of the things you are comparing.
Personal or self-related (FS) – feedback that responds to the student as a person or student's sense of self rather than the task at hand (Hattie & Timperley, 2007).	Comments provided by the instructor to the student that respond to qualities related to the student.	Your paragraph makes me wonder if you have a dog who is playful, strong, cute, and cuddly.
Grammar criterion - one of several criteria used by the university-of-study in its assignment rubric.	Feedback regarding sentence and paragraph structure; grammar and spelling; writing style; and APA.	Consult APA Manual 6th ed for details on margins and line spacing.

- The sample included graded assignments from a typical fall semester, though this should not lead to an assumption that the online student and faculty population is representative of all students and faculty.
- Though instructors are required to use standardized processes for grading, including the standard rubric and grading tool, there may be instructors who do not follow this protocol. Rubric scoring may not be consistent. Though consistencies varied among the instructors, use of the rubric and feedback mechanism appeared consistent from Week 4 to Week 6 where a single instructor scored both performance items.
- Evidence of feedback does not guarantee student use of said feedback, noted as an internal validity threat in learner process and causation.
- Gender of the students and instructors was selected based on the typical gender associated with the name.

Statistical Analysis Findings

Research question 1. The initial research question involved measuring how well the five feedback types described feedback observations used by the teachers in this study. 1065 instances of feedback were categorized. Instances involved comments regarding one singular performance item. If multiple sentences provided feedback on one item, the most prevalent feedback category was identified. Used most often, FE led the feedback categories with 890, 84%, of the instructor feedback instances. The other four categories were identified significantly less often. Table 11 includes the number of

instances of feedback observations that contains distinct characteristics of the feedback categories.

Table 11

Descriptive Statistics

Feedback Category	Count	Percentage
FC, correctness	86	8%
FE, elaboration	890	84%
FP, process	55	5%
FR, self-regulation	33	3%
FS, self-related	1	0%

The overwhelming use of FE may affect the results of this study in ways not associated with a performance effect. There are about ten times as many of one feedback category (FE) as any of the others, in fact 147 of the 149 subjects received FE.

The second part of that initial research question was to identify overlapping or missing feedback categories. No instances of feedback overlapped or fell outside the five feedback categories, though comments that included instruction were categorized as FE. The Chi-Square Goodness of Fit was applied to determine if there were significant differences in the frequency of each type of feedback. This statistical measurement calculates how well the observed values matched what would be expected based on chance.

Chi-square. The Chi-square tests the difference between observation and expected values. These five categories were tested as comprehensive labels for all observations of feedback data.

Table 12

Chi-square Calculations 5 Categories

$$x^2 = \sum\left(\frac{(FC-n/5)^2}{n/5} + \frac{(FE-n/5)^2}{n/5} + \frac{(FP-n/5)^2}{n/5} + \frac{(FR-n/5)^2}{n/5} + \frac{(FS-n/5)^2}{n/5}\right) = 2708$$

	FC	FE	FP	FR	FS	n=1065
Expected	213.00	213.00	213.00	213.00	213.00	
Observed	86	890	55	33	1	
Variance	-127.00	677.00	-158.00	-180.00	-212.00	
Squared	16129	458329	24964	32400	44944	
Dividend of Sqr/E	76	2152	117	152	211	2708

Applying GraphPad Software (2015) to confirm the above manual calculation provided the following results: Chi-squared equals 2708 with 4 degrees of freedom. The two-tailed P value is less than 0.0001.

The data set met the assumptions required for use of a chi-square, including that the data was categorized into theoretically based, mutually exclusive categories, with adequate sample size. A chi-square of 2708 is large and indicates a large discrepancy between the feedback categories used at the university-of-study and an equal distribution of the five categories.

I eliminated FE and FS from the chi-square calculation for additional goodness of fit.

Table 13

Chi-square Calculations 3 Categories

$$x^2 = \sum\left(\frac{(FC-n/5)^2}{n/5} + \frac{(FP-n/5)^2}{n/5} + \frac{(FR-n/5)^2}{n/5}\right) = 24.46$$

	FC	FP	FR	n=174
Expected	58	58	58	
Observed	86	55	33	
Variance	28	-3	-25	
Squared	784	9	625	
Dividend of Sqr/E	13.52	.16	10.78	24.46

Applying GraphPad Software (2015) to confirm the above manual calculation provided the following results: Chi-squared equals 24.45 with 2 degrees of freedom. The two-tailed P value is less than 0.0001. The chi-square value is significantly smaller than when all of the variables are included in the calculation, but the small p value confirms that the data is not equally distributed among the feedback categories. The significant chi-square value for the model indicates that the feedback type frequency has little, if any, effect on the outcome.

Research question 1 sought to answer how well the five-feedback types described feedback observation. Feedback that elaborated performance correctness (FE) was used in 84% of the 1065 instances of feedback. While no instances of feedback fell outside of the five categories, there seems to be an opportunity to further differentiate the types of feedback in FE and eliminate FS as a feedback type due to overwhelming high and low usage respectively. The Chi-Square Goodness of Fit analysis revealed that the feedback

types were not normally distributed and the frequency of feedback types did not affect the outcome.

Research question 2. Research question two compared the grade of the grammar criterion rubric for the Week 4 assignment with that of the Week 6 assignment to identify a significant relationship between score change and feedback types used. A logistical regression with exposure variables as the five feedback types in Week 4 measured for an odds ratio for an improvement in score from Week 4 to Week 6. Feedback types met the need for mutual exclusivity.

The use of logistical regression is intended to identify an odds ratio for the frequency of feedback type at Week 4 to the improved performance from Week 4 to Week 6. Pezzoli's (2015) Logistic Regression calculator was used to produce the results in Table 14.

Table 14

Logistical Regression with 95% Confidence Limits 5 Categories

Exposure:	Frequency of each feedback type (5 variables)
Binary Outcome:	Week 6 Score - Week 4 Score = Improved or Not Improved Performance

Variable	Coeff. (β)	StdErr (SE β)	Chi-square	p	O.R.	Low	High
FC	0.6712	0.3506	76	0.0556	1.9567	0.9841	3.8903
FE	-19.67581164	3.2673	2152	0.9987	0.0000	0.0000	
FP	-0.8452	0.4060	117	0.0374	0.4295	0.1938	0.9518
FR	0.0444	0.4509	152	0.9215	1.0454	0.4320	2.5297
FS	20.30261646	6.0664	211	0.9990	38389	0.0000	
Overall Model Fit			12.7263	0.0261			

Based on the calculated odds ratio, FC and FR feedback had a positive effect on performance. FE and FS were outliers, with FE having 84% and FS having 0% of the total data counts.

Given the outlier status of FE and FS, I removed those two categories and recalculated the chi-square (Table 13) and logistical regression with the remaining three categories. Pezzullo's (2015) Logistic Regression calculator was used to produce the results in Table 15.

Table 15

Logistical Regression with 95% Confidence Limits 3 Categories

Variable	Coeff. (β)	StdErr (SE β)	Chi-square	p	O.R.	Low	High
FC	0.6547	0.3506	13.52	0.0618	1.9246	0.9682	3.8260
FP	-0.8601	0.4055	.16	0.0339	0.4231	0.1911	0.9367
FR	0.1147	0.4457	625	0.7969	1.1215	0.4682	2.6864
Overall Model Fit			11.4905	0.0216			

The additional calculation solidified the results from Table 14 indicating that FC and FR feedback had a positive effect on performance.

Research question two sought to identify a relationship between the student performance score and the feedback type using a logistical regression. Based on the calculated odds ratio, feedback that indicated correctness (FC) and feedback that related to the self-regulatory process (FR) had a positive effect on student performance, whereas feedback that elaborated on the correctness (FE) and feedback related to the self (FS) had no effect on student performance.

Summary

The five feedback types were observed in the data. For this sample, FE was evident in 147 of 149 assignments at a rate of 99% and FS in only one of 149 assignments at a rate of 0.007%. The categories did not overlap, though the frequency of each type of feedback was not distributed equally. The predominance of FE, with no odds ratio effect, may have overwhelmed the effect of the other types of feedback, though FC and FR did indicate a positive effect on performance.

Clear alignment between a sound theoretical SRL model, current research, research questions, and methodology have led to a sample of data that indicates that two of five feedback categories studied improve student performance. While the use of FE and FP failed to improve the odds of improved performance, FS was statistically eliminated as a category of feedback, and FC and FR were identified as improving student performance.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Grounded in Butler and Winne's (1995) Self-Regulated Learning (SRL) model that involves a comprehensive monitoring system of internal feedback and its relationship to learner performance, this study measured the effect of feedback types on student performance. While the SRL model acknowledges the complex elements that influence how a learner incorporates feedback into the learning cycle, instructors need clarification to ensure the external feedback provided is most useful to the learner.

Purpose of the Study

Within appropriate pedagogical models, educational technologies can support learning principles and enhance the student experience. Technology has been found to enhance feedback; therefore to fill the identified gap of the relationship between feedback type and effect of feedback on SRL that leads to a change in student performance, I evaluated feedback observations provided to students via a web-based interactive rubric tool.

The study used a quantitative approach to categorized observations of instructor feedback on student assignments and measured a change in student performance associated with five feedback types. To maintain consistency with the current literature on feedback, I included the five feedback types FC, FE, FP, FR, and FS.

Interpretation of the Findings

Descriptive Statistics

Courses within the sample included 23 undergraduate and 8 graduate-level courses that were randomly selected from a pool of 86 sampled sections, which is representative of the number of undergraduate and graduate level programs available in the Fall 2012 term. I did not know the actual level of courses in the overall pool because the report only included the course identifying numbers generated by the Waypoint Outcomes system.

Of the 149 students, 66 were male, 70 were female, and 13 were unknown; this represents 43 and 47 percent of the sample population respectively. Of the 35 instructors, 17 were female, 16 were male, and 2 were unknown; this represents 49 and 46 percent of the sample population respectively. Gender of the students and instructors was selected based on the typical gender associated with the name, hence those categorized as unknown had gender-neutral names. While I do not know if the students and faculty represent the overall pool at the university-of-study during Fall 2012, the equal representation of female and male students and faculty suggest that any changes found in performance were not associated with the gender of the participants.

Self-Related Feedback (FS)

Contrary to the meta-analysis of Hattie and Timperley (2007), my study did not find FS as a significant and noteworthy category of feedback. Hattie and Timperley (2007) identified FS as a dangerous form of feedback, though their assertions were not

corroborated by other researchers in my literature review. Only one instance of FS was identified in the 149 reviewed assignments. It is possible that this type of feedback is limited in the online environment among adult learners.

Task-Specific Feedback (FT)

Observations in this sample supported my decision to separate FT into FC and FE in accordance with the findings of Espasa and Menses (2010) and Coll et al. (2014). Though FE observations dominated the type of feedback used in this sample, the logistic regression did not indicate a positive relationship between its use and improved performance. In my proposal, the FT category was deemed too broad. Given its domination, it is possible that FE continues to be too broad. As indicated in the sampling process, comments that included instruction were categorized as FE. This categorization may have contributed to the conflation of FE and FP.

Process Feedback (FP)

In contradiction to the findings of Furnborough and Truman (2009), Hattie and Timperley (2007), Butler and Winne (1995), Mao and Peck (2013), Espasa and Menses (2010), and Tanner and Jones (2007), the results of my study did not support a positive influence of FP and improved student performance. There are numerous factors that may have led to the diminished effect of FP in this sample. One factor could be that the courses were only eight weeks long, not long enough for student to reference the resources and use them to improve their process in the one week between when the Week 4 feedback could be reviewed and the Week 6 assignment was due. Another factor could

be the overwhelming use of FE, which may have had an influence on how students attended to instances of FP. With FE, the student is given the answer or instruction on how to correct the performance without needing to adjust their process.

Self-Regulatory Feedback (FR)

The data analysis in this sample supported the power of FR to influence student performance as noted by Hattie and Timperley (2007) and Butler and Winne (1995).

Effective Feedback Types

This study found a positive relationship between the use of FC and FR and student performance. My findings aligned with those of Butler and Winne (1995), Espasa and Menses (2010), and Furnborough and Truman (2009), who all emphasized that FR supports the interrelatedness of feedback and self-regulation, the theoretical backbone of this study. Interestingly, contrary to Hattie and Timperley's (2007) findings regarding the power of FT, especially when combined with FE and FP, I found no relationship between FE, FP, and improved student performance.

In agreement with Butler's (2002), Butler and Winne's (1995), and Harris and Graham's (1996) focus on student adaptability within the recursive cycles of SRL, this study suggests that feedback supporting student internal self-regulatory processing (FR) is more influential than direct task support.

The work of Hendry et al. (2011) suggested that students prefer FE and FP, but my sample failed to show that those types of feedback improved performance. There may be a difference between what students prefer and what helps them.

The results of this study contradict the findings of Finkelman, Hudesman, Flugman, and Crosby (2014) who reported success with their SRL-based Enhanced Formative Assessment Program (EFAP) which relied on a recursive framework of FR using FP as the specific feedback type. Similarly, Schloemer and Brenan (2006) identified the potential effectiveness of FC and FP within an FR framework. It is unclear what leads to the discrepancy between a focus on process and regulatory elements, though self-regulation's involvement at an internal level could lead researchers to avoid focusing on a potentially difficult task. Process and elaboration of what learners need to do to correct their performance do not rely on instructors understanding the student at a level necessary to fully understand self-regulatory attitudes, beliefs, and skills.

As Hattie (2003) succinctly noted, "Expert teachers engage students in learning and develop in their students self-regulation, involvement in mastery learning, enhanced self-efficacy, and self-esteem as learners" (p. 10). The result of this sample supports Hattie's (2003) statement, yet I found that instructors overwhelmingly rely on FE in their feedback statements.

Moller et al. (2012) and Toit (2012) concluded that process feedback (FP) supports a student's deep understanding of learning and enhances self-regulatory skill though, findings not supported by the results of this study. Though feedback regarding process may be useful, this sample did not show that FP improved performance.

Self-Regulated Learning Model

The modified SRL model that I created from Butler and Winne's (1995) SRL model as depicted in Figure 9 clearly illustrate the internal processing for learners.

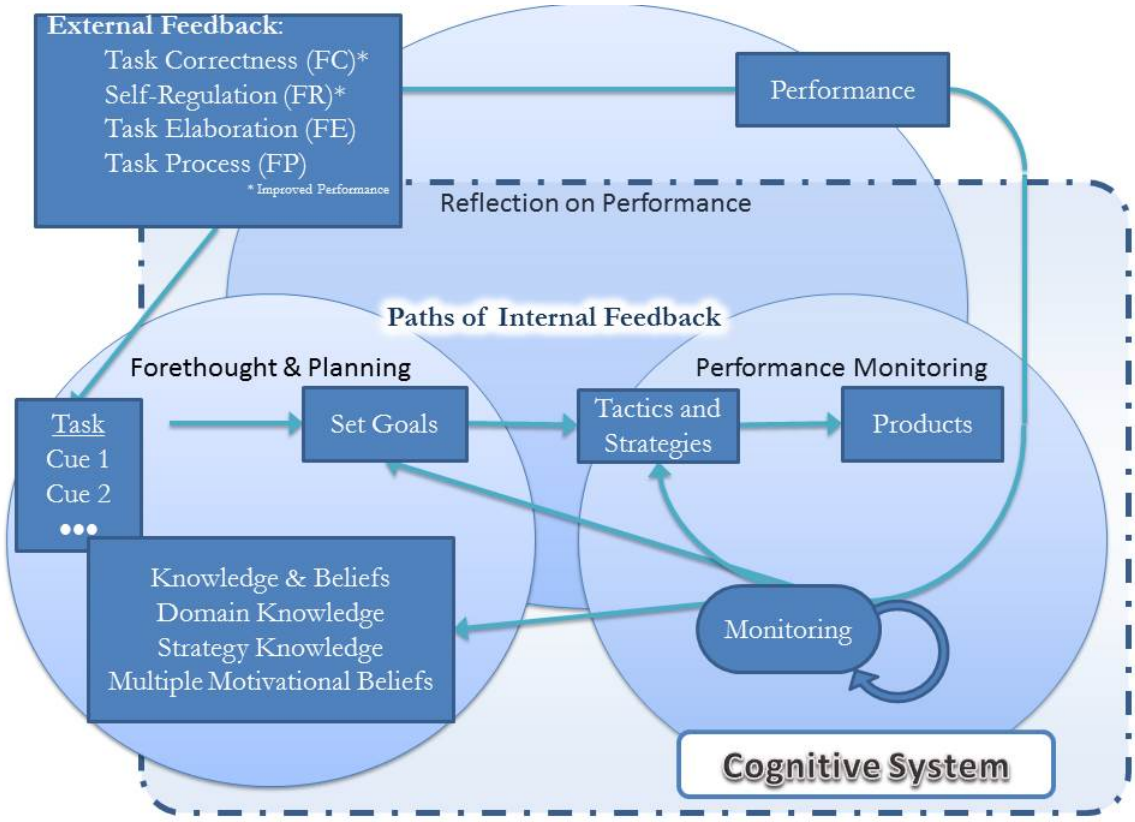

Figure 9. Modified SRL model. Adapted from "Feedback and self-regulated learning: A theoretical synthesis," by D. L. Butler and P. H. Winne, 1995, *Review of Educational Research,65*(3), p. 248. Adapted with permission from the publisher.

Discussion

Though the findings of this study focused on the categorization, use, and performance improvement related to feedback categories, a review of the feedback guidelines from the literature review may highlight additional insights.

Task Specific

Task-specificity did not specifically elicit an improvement in performance within the sample. Given that FC resulted in improved performance, the need for task-specificity by Hatziapostolou and Paraskakis (2010), Rudland et al. (2013), Tanner and Jones (2007), Nicol (2010), Hattie and Timperley (2007), and Ferrel (2013) was supported, though FC simply noted correctness and excluded further explanation. In agreement with Schlitz et al.'s (2009) recommendation for use of a rubric to support task-specificity, all assignments in this study used a rubric. Though not a validated assessment tool, the rubric was used consistently for the Week 4 and Week 6 comparison.

Praise

Interestingly, feedback observations in the sample that may be considered as praise were limited to either a general comment on correctness or encouragement of future effort. These were categorized as FC or FR; both resulted in improved performance. Contrary to Kohn's (2012) observations of praise, the instances noted in the sample were written and private and task specific, which he may not consider praise.

Technology-Enhanced

Waypoint Outcomes provides a platform for online delivery of feedback, supporting technology-enhanced feedback and dialogue as noted by Hattie and Timperley (2007), Careless, Salter, Yang, and Lam (2011), Tanner and Jones (2007), Schlitz et al. (2009), Wang and Morgan (2008), Gomez et al. (2013), and Hatziapostolou and Paraskakis (2010). The Waypoint Outcomes system follows Mayer and Clark's (2007)

contiguity principle by placing the feedback on the same screen with the assignment. Following Ferrel (2013), the online availability of the feedback supports the use of screen readers and other accessibility tools.

Preferred Versus Effective

As noted above, Hendry et al. (2011) found that students prefer FE and FP, yet this study revealed that those types of feedback failed to improve performance. There may be a difference between what students prefer and what helps them. While students may feel best supported when given elaboration on the correctness of their performance and resources to help their process, these may be superficial support mechanisms that give students the perception of help that does not lead to improved performance. The deep work of dialogue to effect change in the students' internal self-regulatory processes that include their beliefs and motivations may be most effective.

Guidelines not Measured

Several guidelines for effective use of feedback from the literature review were not measured or observed in this study, including task complexity, timing, positive and negative feedback, non-threatening, two-way communication, self-reliance, and assessment. This study categorized and counted feedback observations, which did not assess the individual elements that support why feedback supports learning.

Limitations of the Study

A limitation of this study is the lack of insight into student use and reflection of feedback. The entire premise of studying feedback relies on the assumption that students

reviewed, reflected, and adjusted their behavior based on received feedback. Butler and Winne (1995), Hattie and Timperley (2007), Furnborough and Truman (2009) noted the complexity and importance of self-regulation where the effectiveness of the external feedback relies on its ability to stimulate internal feedback. Similarly, Careless, Salter, Yang, and Lam (2011) found that students need to self-monitor to benefit from feedback.

Another limitation of this study is the lack of two-way communication in the Waypoint Outcomes system. Students submit assignments demonstrating their performance on a required task and instructors score the work and provide feedback. Unfortunately, the system does not support follow-up questions from the student on that feedback nor does it support the student providing the instructor with feedback. Blair and McGinty (2012), Moore (1997), Hattie and Timperley (2007), Tanner and Jones (2007), Wang and Morgan (2008), and Schlitz et al. (2009) found that two-way communication supported effective feedback.

Internal validity. Internal validity supports assertions about causality. Potential internal validity threats (Neuman, 2007) that could interfere with this study and limit the application of the study results include:

- Selection bias: I assumed that instructors providing feedback may have a particular characteristic that affects their use of feedback. These traits serve as limitations to the application of the results of the study to the use of feedback by this particular group of instructors at this university-of-study. I randomly

sampled instructors across the university who taught in the Fall of 2012, which diminished the potential of selection bias.

- History: I assumed that there may have been an unrelated event that occurred that interfered with the provision of feedback or scoring by instructors during the timeframe of the particular course. Given the protection of privacy, there is no way to inquire as to events that may have interfered with the feedback. There was no evidence in the assignment feedback observations to suggest that the university-of-study changed their resources supporting feedback, so it can be expected that there was no external event that may have interfered with feedback performance. No evidence of a historical event was evident in the data.
- Causation: I assumed that all changes in performance cannot be directly linked to the feedback (type and frequency), as there are several other influencing factors including:
    - Normal maturation, where students improve as they progress through the course may occur over the two-week period between the assignments. Presumably, this would be consistent for all students, regardless of feedback type, but not equally.
    - Lack of a control group, where students receive no feedback. The case-control qualifier required that feedback be present. Use of a

control group would assess the effect of improvement in performance due to normal maturation and other factors not identified in this study.

  - Treatment contamination, where students may receive feedback from sources outside of the assignment not collected a part of this study. This feedback may come through a private video, email, or phone conversation with the instructor, a tutor, a peer, or other source. Evidence of contamination could include reference to additional communication. Feedback observations did not indicate a presence of contamination though it cannot be discounted as a possibility.
  - Learner process, where learners may or may not read or internalize given feedback. This is a known weakness of this study and an overall concern that limits the effectiveness of the treatment.

- Reliability of achievement measure: I assumed that the rubric was not a reliable measure of achievement. The rubric has not been validated as a reliable assessment tool. However, its consistent use by instructors provided the appropriate measure needed for this study without additional validation.

Potential internal validity threats (Neuman, 2007) that could be mitigated through checks and avoid limiting the application of the study results included:

- Experimenter expectancy: I assumed that familiarity with the graded assignments may lead to prejudicial review. The random selection of assignments ensured that I was not familiar with the assignments. I taught four

of the hundreds of courses available during the data sampling timeframe of Fall 2012. The courses I taught were included in the study. The method of cleaning, categorizing, counting, and double-entry of data led to a focus on the grammar criterion and categorization of feedback thereby decreasing the ability for prejudicial review.

External validity requires qualitatively sound information that applies to the real world. To ensure validity, I aligned the instruments with the research questions, the research questions with the problem, and all of the elements in between. I have outlined the following potential threats to validity to address potential validity concerns:

- Feedback categories may have been unclear in the assessment material. Clear job aids were used to mitigate this threat. I carefully followed the Operationalization of Constructs from Table 10 to categorize feedback. Upon review of the documents, several feedback comments provided advice or corrections, which were not specifically detailed in Table 10. Since the advice was used as an elaboration of why the performance was correct or incorrect, I categorized those feedback instances as FE.
- The sample included graded assignments from a typical fall semester, though this should not lead to an assumption that the online student and faculty population is representative of all students and faculty.
- Though instructors are required to use standardized processes for grading, including the standard rubric and grading tool, there may be instructors who

do not follow this protocol. Rubric scoring may not be consistent. Though consistencies varied among the instructors, use of the rubric and feedback mechanism appeared consistent from Week 4 to Week 6 where a single instructor scored both performance items.

- Evidence of feedback does not guarantee student use of said feedback, noted as an internal validity threat in learner process and causation.
- Gender of the students and instructors was selected based on the typical gender associated with the name.

Recommendations for Further Research

Given the high usage of FE, I recommend that those interested in continuing to study feedback categories dive into the FE observations to identify differentiators.

As noted by Biggs (2012) and the National Research Council (2004), students need deliberate, reflective practice to invoke metacognition to identify errors and solutions to improve their work. The results of this study support Ferrel's (2012) self-regulation related "good feedback practices" that included FC and FR through dialogue. As noted in the introduction, dialogue functions as an ideal form of communication for deep learning (Bohm & Nichol, 2004; Shor & Freire, 1987; Senge, Scharmer, Jaworski, & Flowers, 2004; Blair & McGinty, 2012; Craig, Gholson, Brittingham, Williams, & Shubeck, 2012; D'Mello & Graesser, 2012). Whether face-to-face or virtual, participants benefit from dialogic interactions. Dialogue should be an underlying, fundamental concept of engagement in the online learning space. The review of literature delved into

the need for self-awareness and the use of dialogue to attain that awareness to understand deep learning. Perhaps dialogue is the avenue that can help fit the gap of what the research indicates as performance improving feedback and the type that instructors are using.

Positive Social Change

The Institute of Education (Ferrel, 2013) and Wolsey (2008) found inconsistent and diverse use of feedback. Though this study was an initial step in validating the definitions of these feedback types and identification of a potential performance effect within a small sample of feedback from the university-of-study Fall 2012 term, the potential significance of improving the understanding of feedback's role, its categorization, and its use as an effective catalyst within SRL for the field of education is astounding. With this initial understanding that FC and FR may elicit improved performance, the next step is an experiment that tests the application of FC and FR. If the results concur with this study, educators could harness the feedback effect toward positive change in the self-regulatory processes of students.

The implication of targeting FC and FR could not only improve student learning, it could optimize automated feedback systems that support online software found in popular self-paced learning systems such as MOOCs and competency-based programs. Learning management systems have the ability to get to know students intimately. With such detailed knowledge, a system has a unique opportunity to motivate, encourage, support, and challenge students with minimal effort. Though focused automation could

revolutionize learning for independent learners, it also holds potential to transform the student-teacher relationship. With more time to instruct, the possibilities for what teachers could accomplish seem endless.

This study initiated a clarification in understanding the external component of feedback in the SRL model. As the one opportunity for those who hope to support learners in their pursuits, optimizing the use of feedback is key. With appropriate use of dialogue, suspension of assumptions, and other tactics that require learners and teachers to engage in communication, deep learning processes are fostered.

Conclusion

Influencing learners' self-regulation to support improved performance requires instructional feedback that positively affects internal processes. This study found that faculty at the university-of-study overwhelmingly provided elaboration feedback, which failed to improve student performance. Statements acknowledging task correctness and those supporting internal self-regulatory processes increased student performance scores. Identifying correctness may be fairly simple, though influencing self-regulatory process relies on a deep understanding of students' attitudes, beliefs, and skills.

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