

**TEACHER MINDSET AND THE NATURE OF FEEDBACK PROVIDED TO
STUDENTS IN THE PENNSYLVANIA KEYSTONE COURSES**

by

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This study explored the nature of feedback strategies that teachers of Pennsylvania's Keystone courses (Algebra I, biology, and literature) used to prepare their students to meet the minimum proficiency standard on the corresponding Keystone exam, taken at the end of the course. Teachers reported highest usage of the following feedback types: teacher-to-student dialogue; review of homework, quizzes, and tests; and written work that explains student thinking or learning. Teachers reported lowest usage of self-assessments, pretesting, and online assessments.

The study also explored the relationship between teacher mindset, related to beliefs about intellectual capacity and effort, and the feedback that teachers provided to students throughout the course. The relationship between the nature of feedback teachers provided during the course and the performance of the enrolled student population on the Keystone exam was explored. While no statistically significant relationships were found among the variables, implications for educational practice are discussed through a lens of professional practice. Teacher perceptions about challenges that interfered with student success on the end-of-course exam are noted. The researcher used survey research to conduct the study.

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PREFACE

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1.0 INTRODUCTION

The process of learning something new requires effort by both the learner and the teacher. Effort involves planning, perseverance, and the utilization of tools, resources, and strategies to improve and build upon what the learner already knows. At the center of the learning process between the teacher and the learner is constructive feedback. Feedback is an important component of the teaching and learning process. Teachers and learners use feedback from each other to improve upon their actions that advance learning outcomes. Formative assessment strategies consist of many types of feedback commonly used by teachers to determine the degree to which students are mastering the planned learning objectives. Students receive feedback from teachers in a variety of forms without necessarily knowing much about the teacher's use of feedback, including formative assessment strategies.

The experience of the student is one that involves receiving verbal and written praise, as well as constructive criticism about performance on homework, quizzes, tests, essays, and other course assignments. Students may also receive feedback about matters related to learning and the learning environment such as behavior, attendance, organization, and attitude. It is also important to acknowledge that students receive feedback from peers, which may or may not involve activities planned by the teacher. Considering all feedback that students receive, each student determines what feedback to pay attention to and upon which to take action. Student responses to feedback in the form of actions to improve are what propels the learning process along a positive

trajectory. Carol Dweck (2006) describes a growth mindset as when individuals embrace behaviors that facilitate a positive momentum in a cycle of improvement as having a growth mindset.

This dissertation explores the nature of feedback and the impact that growth mindset theory may have in the teaching and learning process. The following sections review the literature about feedback and mindset, as well as the literature about intelligence and brain research, which served as the foundation for Dweck's mindset theory.

1.1 DEFINITION OF TERMS

A broader audience may not recognize a number of terms used within the body of this research. Definitions for the following terms are implicit throughout the study.

1. **Local Education Agency (LEA)** – A public school entity that provides free and appropriate education to school-aged children in accordance with state law.
2. **Academic year** – A year's span of instruction that begins with the first day of school and ends with the last day of school for students and teachers.
3. **Keystone course** – A course of study that aligns with the Pennsylvania Core Standards for Algebra I, biology, or literature and is designated by the LEA as the course to which end-of-course Keystone exam results are accounted.
4. **End-of-course exam** – A culminating exam to be administered to students at the end of a course of study.

5. **School Performance Profile (SPP)** – A school report card, of sort, that communicates a school’s academic achievement and growth results among other measures of quality to stakeholders.
6. **Feedback** – A process where teachers provide commentary on student work with the intent to validate knowledge, clarify misconceptions, and redirect the course of learning in effort to improve future academic performance.
7. **Teacher Mindset** – Refers to the predominate mindset, either growth or fixed, that represents a teachers believes about the extent that a person can develop their own abilities and intelligence. According to Carol Dweck (2006) a person with a growth mindset embraces the notion that people can develop their own abilities and intelligence quite a bit, and a fixed mindset does not. A person with a predominately fixed mindset about learning typically believes that a person’s abilities and intelligence is largely constant, typically inherited, and cannot be improved very much regardless of the amount of effort that is exerted (Dweck, 2006).

1.2 REVIEW OF THE RESEARCH LITERATURE

The following review of research literature begins with a discussion about intelligence and the way it is shaped by the learning process. It is not something inherited at birth that remains constant throughout a person’s lifespan. This represents a shift in belief about intelligence.

The terms growth mindset and fixed mindset became popular following the publishing of Carol Dweck’s book *Mindset: The New Psychology of Success* (2006). The concept of a growth mindset relates to a shift in beliefs about intelligence, which emerged alongside brain research. A

number of claims about learning and the brain, which emerged from the field of educational neuroscience, are described in detail. Some claims come from a dissertation by Tracey Tokuhama-Espinosa who categorized common claims according to their acceptance among researchers in the fields of neuroscience, psychology, and education (Tokuhama-Espinosa, 2008). While Tokuhama-Espinosa investigated numerous claims within her research, only well-established claims that are relevant to the research on mindsets and feedback are discussed within this review. The review also explains that the literature suggests that educators use caution when considering popularized claims that profess to be research-based or more notably brain research-based.

After this review of literature, the motivational context of the study will be discussed, introducing the research questions at the end of Chapter 2. Chapter 3 describes the survey research methodology used to conduct the study, and Chapter 4 presents the results. Chapter 5 concludes the dissertation with insights and recommendations from the researcher through a lens of professional practice.

The review of literature concludes with an emphasis on the importance of meaningful dialogue among educators about the purpose and value of learning amidst an environment of accountability and high-stakes testing. Research question six explores the challenges that teachers encounter as they prepare students for end-of-course exams. Meaningful dialogue about learning goals and ways to best gauge student progress toward achieving learning goals is essential to guarding against what Gunzenhauser (2003) refers to as the default philosophy of education.

1.3 THE SHIFT IN BELIEF ABOUT INTELLIGENCE

The foundations for measuring intellectual ability can be traced to 1905, when the measuring scale of intelligence was used and published by Alfred Binet and Theodore Simon to differentiate children who were cognitively impaired from those who were not (Boake, 2002). Use of this test and a number of its variations held strong throughout much of the twentieth century for various purposes. While much controversy has been associated with intelligence tests, the validity of a general intelligence measure, often referred to as *g* or *g factor*, was established with the Minnesota Study of Twins Reared Apart and the replication of those results in a study with a sample of more than 500 Dutch seamen (Deary, 2012). The results of these studies provided substantive evidence that psychological assessments of mental ability reliably measure a general intelligence factor (Johnson, Bouchard, Krueger, McGue, & Gottesman, 2004). They also point out that such a general intelligence factor does not necessarily relate to life outcomes nor does it suggest a biological basis (Johnson, Bouchard, Krueger, McGue, & Gottesman, 2004).

While ability in the form of a general intelligence factor may provide insight into the learning potential of individuals, it alone cannot predict the degree of success different individuals will have in different learning environments throughout life. Additionally, research from the past two decades suggests that not only can a person's intelligence improve under the right conditions, intelligence is generated by the learning process (Dweck, 2006; Gould, Beylin, Tanapat, Reeves, & Shors, 1999; Willis, 2010).

Later throughout this literature review, proper and consistent use of effective instructional practices, grounded by research, is discussed in relation to the teaching and learning process. Such practices include the facilitation of quality classroom dialogue (Resnick & Schantz, 2015),

providing good feedback (Nicol & Macfarlane-Dick, 2006), and using formative assessment to guide instruction and promote student self-regulation (Black & Wiliam, 1998; Clark, 2012; Wilson, Boyd, Chen, & Jamal, 2011). Such practices may shift beliefs about intelligence from something that is fixed to something that is developed. We can practice building and nurturing a growth mindset (Dweck, 2006).

1.4 NEUROMYTHS: WHY MUST EDUCATORS BE CAUTIOUS ABOUT POPULARIZED RESEARCH?

Within an era of accountability and high stakes testing, educators often look to research-based practices to deploy in schools with hope of improving student achievement. Unfortunately, unsupported claims have peppered popular literature that translated brain research poorly. One headlining topic among popular press books is brain-based teaching and learning. The application of neuroscientific claims “is seductive in many respects and there is little doubt that the very mention of the word neuroscience adds a veneer of scientific respectability to any curriculum innovation or brain-based package” (Purdy & Morrison, 2009, p. 107).

While technology was a catalyst for a burst in scientific research about the brain and how the brain learns in the 1990s, the translation of this research for consumption by educators is often less than clear and peppered with misinformation. For example, the book *Brain-based Learning: The New Science of Teaching and Training* by a prolific author on the topic, Eric Jensen, contained a mixed quality of information, and many suggested themes discussed in the book were based in educational practice and questionably linked to scientific brain research (Tokuhama-Espinosa, 2008). The book also dedicated a page to discussion about “left-brain” and

“right-brain” dominant learners (Jensen, 2000a, p. 19) which was classified as a baseless claim by a panel of researchers who worked with Tokuhamo-Espinosa to clarify the degree to which popular brain-based learning claims had scientific merit. People do not use a dominant right or left side of the brain; neuroscientists remind us that we use one whole, integrated brain that happens to have right and left hemispheres that work together (Tokuhamo-Espinosa, 2008). This claim about left and right brain dominant learners may have roots in studies from the 50s, 60s, and 70s where assumptions were made about the brain based upon observed behaviors rather than actual observation of brain function. An assumption was made about brain lateralization of language skills, meaning that language function is stronger on one side of the brain than another. This assumption is often traced back to lesion studies as far back as 1865 in which language functions were affected more severely when subjects suffered damage on the left side of their brain. This led to a behavior-based assumption that the left hemisphere of the brain dominates language skills for most people (Williams, 2010). People overgeneralized and misrepresented this assumption when making the claim that students who are strong in language skills are ‘left-brained learners.

Another neuromyth within the popular brain-based line of learning products was Brain Gym™. Brain Gym™ claimed to be an effective way to enhance the learning potential in young children by making simple body movements and pressing particular spots on one’s body in order to enhance the activation of areas in the brain that were associated with learning (Geake, 2008). While cardiovascular exercise is known to provide cognitive function benefits and exercise is generally good for the brain as it is for the body, to claim that specific exercises and movements increase learning potential by activating particular areas in the brain is baseless (Geake, 2008). However, such perceptual motor programs continued to be used in Australian schools for years

despite the fact that no empirical evidence found it to improve learning, and its theoretical underpinnings were criticized by neuroscientists (Stephenson, 2009).

1.5 RESEARCH CONTRIBUTIONS FROM THE FIELD OF EDUCATIONAL NEUROSCIENCE

The notion of intelligence as a malleable human attribute emerged, in part, from research within the field of educational neuroscience. The field of educational neuroscience rests at the nexus among neuroscience, psychology, and education. The OECD (Organisation for Economic Co-Operation and Development) characterized educational neuroscience, as “the new learning science” (OECD, 2007, p. 152). Other terms frequently used within the literature to identify this intersection of fields include the following: neuroeducation, brain-based education, cognitive neuroscience, cognitive neuropsychology, and mind, brain, and education science. The distinguishing characteristic of educational neuroscience research is that it emphasizes the application of empirical scientific research to teaching practices (Tokuhama-Espinosa, 2008).

Tokuhama-Espinosa conducted a meta-analysis of 2,266 documents from 387 different peer review journals and other sources within the area of educational neuroscience. Each of the 79 claims was reviewed and categorized by a panel of recognized leaders within the fields of neuroscience, psychology, and education using the Delphi technique (Tokuhama-Espinosa, 2008). The sorting of categories adhered to the recommendation of the OECD for classifying information about learning and the brain. They are as follows: what is well established; what is probably so; what is intelligent speculation; and what is popular misconception or a neuromyth (OECD, 2002). Within the panel’s survey framework, 85% - 100% of the panel experts had to

agree that there was sufficient supporting evidence for a claim to be categorized as ‘what is well established.’ For a claim to be categorized as ‘what is probably so’ 70% - 84% of the panel experts agreed that there was sufficient evidence to support a claim. The claims discussed in the following sections were categorized as either ‘what is well established’ or ‘what is probably so’ by the panel experts, and they support concepts related to improving intelligence through learning.

1.6 LEARNING STRENGTHENS THE BRAIN

Experts consider the brain to be a system that is constantly changed by experience (Tokuhamas-Espinosa, 2008). To begin to understand the complexity of the human brain, it is important to realize that it refers to much more than cortical tissue. Within the cortical tissue there are approximately one trillion neurons, or brain cells, with roughly 10 trillion connections among them. These cells and their connections create an astonishing brain where different parts with different functions communicate with one another along multiple pathways regardless of their proximity to one another (Rose & Meyer, 2002).

Imaging technology enables neuroscientists to observe integrated brain activity. When presented with different kinds of tasks, images of the brain reveal that there are smaller networks of brain activity which perform specialty functions using one or more parts of the brain (Rose & Meyer, 2002). As the human being engages with life, his or her habits and experiences influence the brain’s growth, function, and efficiency. Neuroscientists witness the impact of life engagement on the brain as microscopic changes to the physical structures and activity patterns.

Psychologists and educators observe the same impact on the brain as subtle and nuanced behavior differences involved with various aspects of life, including learning.

Social contexts affect brain adaptation throughout time because the brain changes with each experience. “The brain is a social organ; 70% of the brain is built after birth by experience, and those experiences primarily are those in relationships with other people” (Cozolino, 2009).

Another claim that is well established by neuroscientists, psychologists, and educators is that human brains are highly plastic and develop throughout a person’s lifespan (Tokuhamas-Espinosa, 2008). Plasticity, often referred to as neuroplasticity, is the ability of the brain to rewire itself as a result of experience (Sousa, 2010). It rests upon the premise that ‘neurons that fire together wire together’ describing a repetition effect that was first theorized in the late 1940s by D. O. Hebb and Jerzy Konorski and is discussed ubiquitously throughout the literature (Bates, 2012; Begley, 2007; Buzsáki, 1998; Diamond & Hopson, 1998; Doty, 2006; Goodman & Shatz, 1993; Hebb, 1949; Konorski, 1949; Sousa, 2010; Szmalec, Duyck, Vandierendonck, Mata, & Page, 2009; Willis, 2006, 2008; Zieliński, 2006).

The neurobiological process of plasticity involves the highly dynamic expansion and reduction of brain cell connections within and across various networks because of ongoing experience, which seemingly supports a ‘use it or lose it’ phenomena. Experiences, which promote plasticity, certainly include learning, especially with respect to skill acquisition. The basic building blocks of neuroplasticity in the brain consist of neurons, axons, and dendrites. Neurons store information; axons transmit information, and dendrites receive information (Diamond & Hopson, 1998; Willis, 2006). While we are born with most of the neurons we will have in our lifetime, dendrites grow and multiply throughout life (Willis, 2011).

The growth of dendrites occurs while we learn. This growth strengthens both the neurons and the networks between them as we practice, or continue to experience, learned skills over time (Willis, 2006). A common phrase found within the literature to describe the growth and strengthening of these cell parts is ‘practice makes permanent’ (Willis, 2011).

Practice can be mental as well as physical. Athletes take advantage of the benefits of mental visualization of performance. Musicians also practice mentally. One study examined the physiological explanation for why mental practice can be so effective. A study conducted by Pascual-Leone at Harvard Medical School found that mental practice during the learning of a five-finger piano exercise activated some of the same central neural structures required for the physical movements. This resulted in reorganization in the brain similar to subjects who practiced physically. The study concluded that using a combination of mental and physical practice leads to greater performance improvement than physical practice alone, and can reduce the time needed for physical practice (Pascual-Leone, 2006).

Dendrites grow when we learn; they also shrink when we neglect to practice. Remember the ‘use it or lose it’ phenomenon? Just as the brain grows and shapes its networks with experience, it also prunes them when they do not seem to be very useful to the human (Willis, 2006).

The research evidence on neuroplasticity which emerged early in the 2000s, challenged previous beliefs that neural networks changed very slowly and even more slowly once a person became middle-aged. Findings instead showed that the brain changes as a result of environmental input at a faster pace than originally thought and has the potential to continue to change throughout life (Sousa, 2010).

Another concept closely related to neuroplasticity is neurogenesis. Neurogenesis refers to the growth of new neurons in the brain, particularly in the hippocampus, the part of the brain involved with learning and processing memories (Sousa, 2010; Travis, 1998). While adult neurogenesis clearly contributes to cognitive function, the exact function of the newly formed neurons is less clear. It is suggested that perhaps neurogenesis supports long-term adaptation processes rather than for acute functions (Kempermann, Wiskott, & Gage, 2004). Some researchers think that the process of learning may be a catalyst for neurogenesis. In a study of rats, the number of adult generated neurons doubled in response to training on learning tasks that involved the hippocampus (Gould, Beylin, Tanapat, Reeves, & Shors, 1999). This research interests advocates in the field of neuroeducation who believe that teachers may serve their students well by helping them to understand how their brain grows and learns, as well as what kinds of behaviors lead to overall good brain health (Sousa, 2010).

1.7 PRIOR KNOWLEDGE PROMOTES NEW LEARNING

“Connecting new information to prior knowledge facilitates learning” (Tokuhamas-Espinosa, 2008, p. 272). The claim that connecting new information to prior knowledge assists the learning process relates to another claim that deals with the brain’s interest in detecting and organizing information into patterns. “Human brains seek patterns upon which they predict outcomes, and neural systems form responses to repeated patterns of activation (patterns being individually defined)”(Tokuhamas-Espinosa, 2008, p. 271).

Some researchers contend that memories are stored in the brain according to a system of patterns. Upon evaluating new information as relevant, the brain generates patterns in a manner

that either connects the new information to prior knowledge, or chunks the information according to some system of patterning that it has used before. Patterns essentially become the pathways for memories to be stored and recalled. To learn new information, one must connect the content to some kind of preexisting set of memories. “Patterns are paths for memories to follow” (Willis, 2006, p. 15).

Researchers observed the process of patterning and connecting new information to prior knowledge when examining how people learn to read. Reading skills are most effectively and efficiently learned when instruction corresponds to the brain’s patterning process (Willis, 2008). If there were no organization by the brain provided by patterning, information would not be processed by brain regions where memories are connected to existing information and later coded into long-term memories which build reading skills (Coward, 1990). Coward (1990) designed a model that explains how the brain can be understood as a ‘pattern extraction template’ where layers of patterns are extracted increasingly into more complex patterns over time from various sensory input and their relationships to prior knowledge (Coward, 1990). This suggests somewhat of a ‘rich get richer and poor get poorer’ phenomenon for learning, whereas the activation of prior knowledge promotes more dendrites to sprout, connecting new memories to old ones, making the brain more efficient in its ability to recall memories and repeat actions associated with learned skills (Willis, 2006). Contrarily, when new information, such as a new word, was presented and did not stimulate an existing memory or category link, brain scans showed no activity in the memory processing regions (Coward, 1990).

Patterning and connecting new information to prior knowledge, however, are not the only necessities of the brain for learning. These strategies require the brain to consider the information relevant in the first place.

1.8 CONTEXT INFLUENCES LEARNING

In addition to prior knowledge, the research that environment and motivation also influence learning is also well established (Tokuhama-Espinosa, 2008). These factors make up the context of learning which is separate from, but can be as influential to the learning process as the general intelligence factor. Without denying that a general intelligence factor is at play within the context of learning, it is important to note that learning environments also make a difference with respect to intelligence. A learner experiences all sorts of stimuli within the environment. Subconsciously, learners constantly filter stimuli through the brain's reticular activating system (RAS) (Willis, 2010). If a learner perceives danger, threatening consequences, or embarrassment, all related sensory information is channeled to the lower, reaction-oriented parts of the brain associated with fight, flight, or freeze responses and never make their way to the prefrontal cortex associated with reflective, cognitive processes (Willis, 2010). Once such stressors are removed from the learning environment, the RAS can be activated in a manner which promotes increased attention and focus on learning tasks, especially when novelty or change within the environment is detected in a manner that stimulates curiosity (Willis, 2010). Novelty, considered a form of low-level stress for most learners, is likely to heighten the attention networks, assisting the learning process. However, extreme stress erodes the potential for learning to occur (Tokuhama-Espinosa, 2008). Another claim, that has been categorized by researchers as probable, speaks directly about learning environments, "Good learning environments—defined within this survey as being those which are safe, offer intellectual freedom, paced challenges, ample feedback, a level of autonomy, respect, and include active learning activities—are better than learning environments that do not have these characteristics"(Tokuhama-Espinosa, 2008, p. 274).

1.9 FEEDBACK ASSISTS LEARNER SELF-REGULATION

Feedback can be evaluative or constructive in nature. While evaluative feedback in the form of grades on curricular tests, quizzes, and assignments that make up report card grades can be helpful in determining when more instruction or effort is necessary to achieve the goal of earning a particular grade in a course, it does little to guide learner engagement. It does not promote the self-regulation of learning that builds in a cumulative way toward the achievement of proficiency within a content area. Instead, quality constructive feedback, that is designed and delivered with the intent to help learners achieve particular goals, produces significant benefits to student learning and achievement across all content areas and levels of education (Black & Wiliam, 1998). In order to benefit from feedback in a significant way, however, Sadler (1989) claimed that it is essential that students first understand the goals or standards expected of them, second they should be able to compare their own current performance to the expectation of good performance, and third they need to know what actions to take so that they may successfully close the gap between their current performance and the good performance standard.

In order for students to compare their current performance to an expected standard of performance, it is essential that they know how to assess their work in a similar manner to that of their teacher (Sadler, 1989). Therefore, it is recommended that teachers emphasize self-assessment skills with their students in addition to improving the quality of feedback they provide to them (Boud, 2000; Yorke, 2003).

Nicol and Macfarlane-Dick (2006) developed seven principles of good feedback practice that facilitates self-regulation. A synthesis of the research literature on feedback and self-regulation led them to derive the following principles. Good feedback practice is that which

1. helps clarify what good performance is;

2. facilitates the development of self-assessment (reflection) in learning;
3. delivers high quality information to students about their learning;
4. encourages teacher and peer dialogue around learning;
5. encourages positive motivational beliefs and self-esteem;
6. provides opportunities to close the gap between current and desired performance; and
7. provides information to teachers that can be used to help shape teaching (p. 205).

The first principle addresses the need for teacher feedback that promotes dialogue about what the learning goals are, allows for student ownership of the learning goals, and offers opportunity for students to assess their own progress toward the learning goals (Black & Wiliam, 1998; Sadler, 1989). While students may set their own learning goals in relation to the expectations, the teacher must direct feedback to the student to ensure consistency with the expectations of curricular standards and assessment criteria.

The second principle calls for feedback to support reflection and self-assessment throughout the learning process. Cowan (2006) suggests four ways that may be accomplished. First, students may specify the type of feedback they would like to receive when handing in work. Second, teachers can ask that students identify their own strengths and weaknesses within their work in relation to standards or criteria before submitting it to the teacher for feedback. Third, students may select work to include in a portfolio of their learning accomplishments. Last, students may identify the anticipated achievement milestones for a particular task, so that they can reflect upon them as they monitor their own learning progression (Cowan, 2006).

Principle three emphasizes the importance for a teacher to provide external feedback to students so they may troubleshoot and self-correct their own performance. The teacher's feedback serves as a calibration tool for student self-regulation. Principle three dovetails with principle four which calls for dialogue between the teacher and student, as well as among fellow students about the feedback provided. Such dialogue is critical to ensure that students understand what the feedback means and know what to do to reduce the gap between their current

performance and the desired achievement goals (Nicol & Macfarlane-Dick, 2006). Dialogical feedback strategies may include providing feedback using short papers in class, having peer discussion about feedback received on a previous assignment, providing feedback to peers and responding to peer feedback before submitting an assignment, or discussing performance criteria and standards before starting a group project (Nicol & Macfarlane-Dick, 2006).

Principle five acknowledges the fact that student beliefs about intelligence and learning play a role in how they respond to teacher feedback and how they may assist or impede the student's commitment to self-regulated learning (Dweck, 1999; 2006). Teachers who facilitate an environment that encourages growth and effort through plentiful low-stakes formative assessments have a prime opportunity to provide feedback that encourages positive motivational beliefs and a clear learning roadmap for self-regulated learning (Nicol & Macfarlane-Dick, 2006).

Recognizing that merely providing good feedback does not work in an isolated manner, principle six reiterates the importance of providing students with opportunities to reduce the discrepancy between their current level performance and the desired level of performance (Nicol & Macfarlane-Dick, 2006). Learning happens because of student action. Students must respond to the feedback in a manner that moves them forward in the learning process in order for the teacher's feedback to make a difference (Sadler, 1989). In other words, feedback must lead to changes in student behavior (Yorke, 2003).

Good feedback is not only beneficial to students, but it is useful to teachers as well. Principle seven alludes to the cyclical nature of good feedback whereas teachers also can self-regulate their teaching, using feedback from formative assessments to inform decisions about future teaching (Nicol & Macfarlane-Dick, 2006).

1.10 FORMATIVE ASSESSMENT EMPOWERS LEARNERS AND TEACHERS

Efforts to improve the quality of American public education in a manner that leads to better performance on national and international tests have fallen short of the desired outcomes. As educational reform advocates call for higher standards, greater accountability, and tougher tests, Black & Wiliam (1998) contend that not even all reform efforts combined have resulted in effective policy because of the absence of one key ingredient: formative assessment. While assessment generally refers to activities designed to evaluate learner performance at the end of learning activities, formative assessment is a tool used to shape the teaching and learning process in a manner that prepares students to be more successful on a final or summative assessment. The terms formative and summative to describe assessments are indicative of the manner in which they are used rather than descriptive of an assessment type. A single assessment may be both summative and formative in nature if it evaluates the result of one unit of learning while simultaneously informing instructional practice for learning the next body of content.

Without the use of formative assessments, teacher feedback is reduced to social and managerial functions at the expense of learning function (Black & Wiliam, 1998). The body of research on formative assessment is broad and bountiful (Black & Wiliam, 1998; Nicol & Macfarlane-Dick, 2006). Rather than to elaborate on the topic in full, the research, in summary, clearly indicates that the development and usage of sound formative assessment practices lead to increases in achievement (Black & Wiliam, 1998; Clark, 2012; Nicol & Macfarlane-Dick, 2006; Wilson et al., 2011;).

Formative assessment takes form in classrooms with great variety and degrees of effectiveness. Activities that are formative in nature include the checking of homework, review of quizzes and classroom assignments, verbal responses within the context of dialogue,

performance exemplars, and computer-assisted formative assessments (Black & Wiliam, 1998; Clark, 2012; Nicol & Macfarlane-Dick, 2006; Wilson et al., 2011; Resnick & Schantz, 2015). Despite evidence of its effectiveness in improving learning outcomes, Black & Wiliam (1998) claim there is a ubiquitous ‘poverty of practice’ with respect to meaningful formative assessment. A number of obstacles impede the effective practice of formative assessment within the classroom. Certainly, teacher and student attitudes about intelligence and learning ability are at play with the motivation to use formative assessment constructively; however, the managerial load of maintaining fidelity throughout the feedback cycle can be overwhelming, tiresome, and even unrealistic for teachers who face pressure to cover numerous curricular standards, provide marks that communicate the degree of student mastery to parents, tend to the social and emotional needs that students carry into classrooms, and keep up with the bureaucratic expectations of administration and accountability (Wilson et al., 2011).

Acknowledging the competing priorities that teachers juggle in the name of learning, computer-based practice tests show promise in improving student performance while managing the laborious tasks of accommodating individual student assessment needs, checking student responses on the practice tests for accuracy, and providing clear and timely feedback for students to use moving forward in the learning process (Wilson et al., 2011).

1.11 COMPUTER-BASED FORMATIVE ASSESSMENT

The impact of computer-based formative assessment on student learning noted in a large study of students in their first-year of a geography course (Wilson et al., 2011). The researchers examined both the self-reported student perception of how useful computer-based practice tests were in

their own learning experience and the degree to which use of the computer-based practice tests were associated with higher summative assessment performance. The computer-based practice tests came from a reputable geography software product called WEarth. The results of the two-year study found that over 95% of participating students reported that the use of the computer-based practice tests helped them to their own strengths, weaknesses, and critical areas that need to be addressed to improve performance. Comparing student performance in the course and on summative assessments, findings showed a significant difference in the performance of WEarth users and non-users. Students who utilized the WEarth practice tests earned much higher grades on midterm and final examinations. The greatest difference in performance occurred with multiple choice items; however, students who utilized the practice tests also performed better on short and long answer questions. The researchers claim that these results suggest that use of the WEarth computer-based practice tests was associated with an improvement in learning of the course content (Wilson et al., 2011).

1.12 UNIVERSAL DESIGN FOR LEARNING

Computer-based formative assessment offers an additional benefit for teachers who must accommodate a diversity of learning and assessment needs among various students. Computer-based instruction and assessment often contain tools for students to accommodate their own needs and preferences through audio capabilities, print enlargement, and colored highlighting tools that empower them to perform at their best. Such enhancements to computer-based assessments meet the challenge of providing equal access to learning through the principles of Universal Design for Learning (UDL).

Because learner differences span characteristics well beyond those categorized as disabilities, advocacy for learners with special needs seems to have set the stage for three important paradigm shifts within education: availability, accessibility, and accountability for all learners (Rose & Meyer, 2002). Universal Design for Learning emerged from the principles of Universal Design (UD).

Universal Design (UD) was the brainchild of Ronald Mace. He suggested that professionals working in fields responsible for the design of buildings and other physical spaces consider the different needs of all possible users during the design phase of development rather than as a reactive response post construction, which often resulted in added expense and compromise to aesthetics. Mace and his colleagues established standards for universal design within the field of architecture as the concept became more widely received (Center for Universal Design, 1997). Examples of UD include curb cuts in sidewalks that not only accommodate wheelchairs, but also are helpful for people using baby strollers and skateboards. Closed captioning for the hearing impaired is another example that has also benefited people trying to watch television in crowded, noisy places. Additionally, universal symbols for signage communication (such as restroom symbols) assist not only persons with reading difficulties, but also younger children and speakers of different languages (McGuire, Scott, & Shaw, 2006; Hall, Meyer, & Rose, 2012). A variety of rendered UD applications emerged within the field of education in hope of simplifying, streamlining, and meeting the needs of many different learners. The most prominent were those categorized by the Center for Applied Special Technology (CAST) as Universal Design for Learning (Rose & Meyer, 2002).

As the intent of UD was to plan for the use of public spaces by different types of users during initial design stages, Universal Design for Learning (UDL) promotes a preventative

approach to the design of instruction and learning rather than one that is reactionary to student failure (Basham, Israel, Graden, Poth, & Winston, 2010). The principles of the UDL framework emphasize the development of learning environments and activities that serve a diverse population of learners who are as unique as their fingerprints. UDL emphasizes the need to first develop clear learning goals that are meaningful and attainable (Rose & Meyer, 2002). Learning goals, and their corresponding instructional objectives, serve to articulate the intent of planned learning experiences (Smith, 2012). The UDL framework offers a set of principles and guidelines that help educators consider and accommodate learner variability when planning for learning to occur (Smith, 2012). The Center for Applied Special Technology (CAST) intentionally developed the principles of UDL in a manner that acknowledges the fact that learning depends upon the workings of three neural networks in the brain: the recognition, strategic, and affective brain networks (CAST, 2011; Rose & Meyer, 2002).

To accommodate learner differences related to the recognition network, UDL's first principle states that curriculum and assessment should provide for multiple means of representation (Smith, 2012). This may mean that instruction is planned in a manner that diverse learner needs are met by providing visual cues to draw attention to important concepts, making printed text available in digitized formats that allow for enlargement, the conversion of text to speech, or for providing expanded learning opportunities that enable learners to increase their prior knowledge about a topic through hypertext links that offer scaffolds for complex terminology and concepts.

The second principle of the UDL framework calls for curriculum and assessment to provide learners with multiple means of action and expression. This principle is important for consideration because learners bring variability to the learning environment with respect to their

preferences for learning, as well as their experiences with learning, and their capabilities for learning new material and skills (Smith, 2012). Educators who are mindful of the second principal afford students with flexibility in the manner that they make use of their brain's strategic networks. This might be addressed by providing opportunities for students to practice with embedded supports, receiving ongoing and relevant feedback about their progress, and demonstrate their attainment of goals and objectives in more than one way (Rose & Meyer, 2002).

Providing multiple means of engagement within a curriculum is the third principle of UDL. This principle encourages educators to help learners find meaning and relevance within learning experiences. (Smith, 2012). Simply adding learner choice and self-assessment throughout the course of instruction can usually help learners find meaning and relevance within a curriculum. Learners tap into their brain's affective networks when emotional significance connects with learning experiences. By offering students choices about which tools to use, which level of challenge to choose, which topic to explore, or within which context to engage, teachers can help students tap into their own reservoir of motivation to achieve learning goals (Rose & Meyer, 2002).

The UDL framework serves as a guide for educators to embrace the challenge of planning and providing quality instruction and feedback that is accessible to all learners who are unique in a variety of ways (Jiménez, Graf, & Rose, 2007).

1.13 CLASSROOM DIAGNOSTIC TOOLS (CDT), COMPUTER-BASED FORMATIVE ASSESSMENT TOOL IN PENNSYLVANIA

The Classroom Diagnostic Tools (CDT) is a collection of web-based formative assessments that span an array standards-based content starting with 3rd grade and extending into high school grade levels. Data Recognition Corporation, the same company that developed Pennsylvania's state exams, developed them. The CDTs are free of charge to all Pennsylvania educators. The diagnostic assessments are organized by content areas represented by Pennsylvania's high-stakes tests: the Pennsylvania System of School Assessments (PSSA) and the Keystone exams. The CDTs offer to provide teachers with a snapshot of student knowledge and skills in relation to the high-stakes assessment anchors and eligible content. They not only provide a look at the level of student achievement at a particular point within a standards-aligned course, but the diagnostic design also offers insight about how and why students may be struggling or where students may be extending themselves beyond the expectations of a particular course or grade level (Pennsylvania Department of Education, 2015). Student growth charts become available when the CDT for a given content area is utilized multiple times within a given academic year.

Rather than administering the CDTs for the purpose of determining how students might perform on the high-stakes tests at the end of an academic year, educators are advised to use the CDTs in a formative nature, taking advantage of the opportunities to empower students to set their own academic goals and take ownership of their own learning through the use of suggested materials and resources as well as accompanying metacognition templates. Teachers are encouraged to use the reporting features to conference with students and parents about areas of strength, areas that are ripe for current learning goals and areas where prerequisite knowledge may be lacking and warranting some form of intervention (PDE, 2015).

According to the Pennsylvania Department of Education's January Assessment Update (2016), usage of the CDT assessments continues to increase. During the 2014-2015 academic year, students completed over 1.4 million CDT assessments within the areas of reading, writing composition, science, and mathematics (PDE, 2015).

1.14 THE IMPORTANCE OF DIALOGUE WITHIN THE EXPERIENCE OF FORMATIVE ASSESSMENT

The prevalence of high-stakes testing can easily distract both teachers and students from the true purpose of learning. Anxiety about achieving desired test results may overshadow authentic learning goals. Testing may occur and reoccur only for its own sake and teaching to the test becomes a side effect from the overemphasis of test results. Gunzenhauser (2003) refers to such a phenomenon as the default philosophy of education. Such a philosophy of education is described as lacking reflection and a scarcity of meaningful dialogue about learning goals among educators. It places an overemphasis on the high-stakes tests and test results rather than focusing on the purpose and value of education (Gunzenhauser, 2003).

To safeguard against the default philosophy of education within the context of high-stakes accountability testing, educators are urged to maintain dialogue as a means to gain greater control over educational outcomes (Gunzenhauser, 2003). Educational entities may establish internal accountability measures to serve as the focal point of conversation within the educational community rather than results on high-stakes assessments. Formative assessment offers one alternative to record evidence of learning progress and gather information used to develop future learning goals. The high-stakes assessments taken at the end of the year may then

be perceived as a regulatory hoop to jump through rather than the do-or-die style evaluation edict that is pervasive within the default philosophy of education.

If educators and students embrace the opportunity to engage in dialogue about the purpose of learning, learning goals, and the learning process, schools have a vehicle for prioritizing internal accountability over the external accountability that accompanies high-stakes test results. Therefore, we do not need to succumb to the polarized rhetoric of political debate explained in the next chapter. Instead, we may choose to focus on the value and purpose of learning rigorous content and achieving high performance standards.

1.15 MOTIVATION IMPACTS LEARNING

An individual's motivation to learn something new or persevere in the learning process is another component that influences the ability to learn and problem solve. Motivation is closely related to emotions (Dweck, 2006), and Tokuhama-Espinosa's panel of experts rated the claim that "Emotions are critical to decision making" (Tokuhama-Espinosa, 2008, p, 274) as 'probably so.' Some researchers attribute motivation to the influence of dopamine, which produces pleasurable feelings within the body. This dopamine-response effect explains that we feel good about being accurate during a learning experience because the levels of dopamine increase in response to learning that we have made accurate predictions; however, when we receive feedback that our predictions or answers are incorrect, the levels of dopamine are reduced causing us to feel not quite as good (Willis, 2010). This could potentially explain why some students seek out and crave the feedback of teachers while others avoid it at all costs. If teachers

can strategically provide non-judgmental, constructive feedback to help students meet specific goals, students are likely to have a higher degree of motivation to learn new content and skills.

1.16 MINDSETS SHAPE LEARNER ENGAGEMENT

People have different beliefs about intelligence, and these beliefs have an impact on engagement patterns and academic achievement (Blackwell, Trzesniewski, & Dweck, 2007; Cury, Elliot, Fonseca, & Moller, 2006; Dweck & Leggett, 1988). Some people believe that a person's intelligence is a constant and can be classified as smart, average, or dumb (Dweck, 2006). Scientists who have proven that the brain grows stronger with learning, however, have debunked such a belief. The brain is more akin to a muscle that changes and becomes stronger when the person is engaged in the learning process (Dweck, 2006). Many of the well-established research claims about learning and the brain have been utilized by Dweck (2006) and her colleagues to formulate mindset theory and design programs and workshops to help people understand the shift in belief about the degree of intelligence as something a person is born with to something that is developed through learning. Intelligence, among other things, is something that most always can be changed. Their programs describe and emphasize that intelligence is more like a product created by the brain as it forms new connections and grows stronger when people practice new things they learn (Dweck, 2006; Willis, 2010). Dweck (2006) states that, "the growth mindset is based on the belief in change" (p.213).

Growth mindset is one of two kinds of mindsets categorized by differing beliefs about intelligence; the other is the fixed mindset (Dweck, 2006). The fixed mindset relates to the entity

theory of intelligence which is characterized by a belief that intelligence is unchangeable. The growth mindset, associated with the incremental theory of intelligence, is characterized by a belief that intelligence is developed and changeable based on the degree of effort exerted.

A number of studies have supported claims that people who embrace a growth mindset have a distinct advantage over those who maintain a fixed mindset by earning higher grades, performing better on achievement tests, and exhibiting greater degrees of resilience when faced with challenges and setbacks (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Cury, Elliot, Fonseca, & Moller, 2006; Dweck & Leggett, 1988; Good, Aronson, & Inzlicht, 2003). Research has shown that these types of mindsets influence learner responses to academic challenge. Learners with fixed mindsets are more likely to give up or withdraw from academic challenges they believe they are not intelligent enough to tackle; whereas, those with a growth-oriented mindset engage in tasks promoting skill acquisition and utilize effort to overcome difficulty (Dweck & Leggett, 1988). While some studies compared people with a present state of growth or fixed mindsets to their respective academic performances (Henderson & Dweck, 1990); others specifically applied the teaching of incremental theory as a motivational or intervention strategy. Good, Aronson, and Inzlicht (2003) found that such an intervention with adolescents resulted in significantly improved achievement test scores. Aronson, Fried, & Good (2002) taught incremental theory to college students. When comparing this treatment group to two control groups: one that received instruction on Howard Gardner's (1983) multiple intelligences theory, and one that received no treatment at all, students in the treatment group subsequently earned higher grades than participants in the other two groups.

Two studies by Blackwell, Trzesniewski, and Dweck (2007) examined the trajectories of mathematics grades of junior high students over a two-year period. The first study of 373, 7th

grade students found that those who possessed a growth mindset experienced an upward trajectory in math grades over the two-year period. Analysis of variables associated with this result showed that students whose beliefs are associated with the incremental theory of intelligence are more likely to develop mastery goals focused on learning rather than performance, are more willing to put more effort into their learning, and are less likely to report reasons of helplessness when asked to explain the cause of a potential failure (Blackwell, Trzesniewski, & Dweck, 2007).

The second study specifically examined the impact of an incremental theory intervention on the math performance of 99, 7th grade low-achieving students in New York City. Seventy-nine percent of the students in the study were eligible for free lunch. All participants in the study, divided into experimental and control groups, participated in workshops about the physiology of the brain, study skills, and anti-stereotypic thinking. Students in the experimental group, however, received additional instruction on the plastic nature of the brain known as brain plasticity. They learned about how memory works by forming new connections in the brain when they exert effort with study and practice. They learned that they were in control of these processes that occur in their brains. Within just one semester the declining trajectory of math achievement for many students in the experimental group stopped while the trajectories of those in the control group continued to decline. Students in the experimental group, who began the study with more of a fixed mindset, experienced a reverse in their trajectory following the intervention. Furthermore, these trends continued throughout the two-year period while students progressed through junior high school, suggesting the intervention offers longevity with its impact (Blackwell, Trzesniewski, & Dweck, 2007). Several studies point to the possibility that motivational beliefs associated with growth and fixed mindsets may be more influential in the

prediction of achievement in challenging situations where success is difficult, acknowledging that students with fixed mindsets may succeed equally with their growth-minded peers as long as the academic tasks are not challenging for them (Blackwell, Trzesniewski, & Dweck, 2007).

1.17 SUMMARY OF THE REVIEW OF RESEARCH LITERATURE

Chapter 1 discussed the concept that human beings have the capability to learn more than they already know, the capacity to increase their ability to learn, and even to improve their general level of intelligence according to literature within the fields of neuroscience, psychology, and education. In agreement with the research discussed, I am interested in exploring the nature of feedback that teachers provide students throughout the duration of a course and whether or not there is any relationship between the nature of teacher feedback and the mindset about intelligence and learning. The study will be conducted within the context of Pennsylvania's Keystone courses that include an end-of-course Keystone exam that is considered a high-stakes exam because it is tied to school and teacher accountability measures, as well as a potential future graduation requirement.

2.0 CONTEXT OF ACCOUNTABILITY IN EDUCATION

Within an era of accountability and high stakes testing, educators look to research-based practices to deploy in schools with hope of improving student achievement. The process of adopting research-based practices and implementing them with fidelity can be problematic when there is not clarity in the measurement of its effectiveness to enhance the academic achievement of a diverse student population (Edyburn, 2010). Too often, educators latch onto popularized educational products that boast claims to improve student learning (Geake, 2008). Without careful review of the empirical evidence that substantiates such claims, educators risk criticism for wasteful spending on gimmicks that simply do not work (Stephenson, 2009). The demand for education reform, however, persists. In addition, educators are often left to their own devices to meet increasing demands made by national and state governing parties in order to keep their jobs and the respect of the communities they serve.

Chapter 1 presented a review of the research literature about effective instructional feedback strategies. It also discussed how a teacher's beliefs about intelligence and mindset might shape the way in which he or she prepares students to meet academic standards measured by an end-of-course assessment. Chapter 2 will explain the context of a desire to improve the public education system through a uniform set of standards and assessments. It will then discuss a problem associated with the implementation of an exam proficiency-based graduation requirement in Pennsylvania. Stated research questions then serve the basis for remaining

chapters. Chapter 3 delineates a plan for conducting survey research to explore mindset characteristics of Pennsylvania's Keystone course teachers and the instructional feedback strategies they use with their students to prepare them for success on end-of-course exams. It will also discuss survey response rates and general information about the sample population.

2.1 CONTEXT OF THE PROBLEM

In response to disappointing performance on international benchmarking exams such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS), the National Governors Association Center for Best Practices (NGA) and the Council of Chief State School Officers (CCSSO) examined academic standards from top performing countries. They found striking differences between the standards used in the United States and those that were similar among top performing countries (Common Core State Standards Initiative, 2015). Concerned that American students were not performing as well as the top international testers, a coalition of state education chiefs and governors in 48 of the 50 states developed the Common Core State Standards (CCSS or Common Core) with hope that they will provide the catalyst for better instruction and learning in the United States. The CCSS rest on the premise that all students become college and career ready in order to compete in an increasingly global economy. In contrast to the myriad of individual sets of state standards adopted in conjunction with state-developed standardized tests under the No Child Left Behind Act of 2001 (NCLB), the CCSS aim to provide a consistent national focus on high expectations for all students in English language arts and mathematics, as well as the necessary skills to

collaborate and compete with peers in the U.S. and abroad, regardless of where they choose to live.

In 2015, the CCSS were operational in 43 states, four U. S. territories, the District of Columbia, and the Department of Defense Education Activity (CCSS Initiative, 2015). Implementation of the CCSS sparked resistance across the country as word spread about the sharp decline in student performance on the newly aligned standardized tests, designed to be more rigorous and representative of the true readiness level for entry into college and the workforce (Ujifusa, 2014). In its first year of implementation, the student body of New York City schools experienced a 21% reduction in the number of students who passed the new English exam and a 30% reduction on the new math exam in comparison to the easier test administered in the spring of 2013 (Hernandez & Gebeloff, 2013).

Critics of the Common Core sprouted grassroots efforts that encourage parents to refuse the new standardized tests by opting their children out of the assessments. Various opt-out groups claim that the tests are not valid, are detrimental to students of color, from impoverished backgrounds, and to those learning English as a second or subsequent language. They also claim that the high stakes tests promote cheating and that the associated data collection processes jeopardize student privacy (Common Core Critics, 2015). These critic groups mobilized resources through the World Wide Web, providing specific state-by-state instructions for parents to opt their children out of the tests, and their momentum has caught the attention of the media and politicians. In New York State alone, 20% (or more than 200,000) of students in grades three through eight had parents who opted them out of the state tests in 2015 (Harris, 2015). This was a significant increase from the 5% opt out rate in 2014.

Despite growing criticism and political pressure, supporters of the CCSS coalition held onto their core beliefs, “Until states have coherent systems of standards, course-taking requirements, assessments and performance indicators in place, students, educators, parents, policymakers and the public will not know whether the system is preparing all young people for postsecondary success” (Achieve, 2015, p. 3).

Forty-two of the 43 states that adopted the CCSS belonged to one of two assessment consortiums: Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced Assessment Consortium. Both consortiums promised the delivery of high quality, rigorous assessments designed to drive instruction of the CCSS at the level needed to achieve college and career readiness (Achieve, 2013).

Pennsylvania was the 43rd state. Pennsylvania maintained its contract with Data Recognition Corporation to develop, evaluate and handle the logistics of its state assessments. Data Recognition Corporation consulted with PARCC and Smarter Balanced Assessment Consortia to revamp its Pennsylvania assessments to bring them into alignment with the expectations of the CCSS.

Additionally, a number of states adopted College and Career Readiness (CCR) graduation requirements in literacy and math. Twenty-three states and the District of Columbia presently require students to complete courses aligned with the CCR standards in English language arts and mathematics (Achieve, 2015). Ten states and the District of Columbia mandate that students complete the required courses to earn a high school diploma. The others enroll all students in the CCR courses, but allow parental ‘opt outs’ for the graduation requirements. Students whose parents waived CCR graduation requirements have the opportunity to earn a non-CCR diploma with less demanding requirements in four states. Nine states afford students with the opportunity

to make personal modifications to the full set of CCR graduation requirements, typically by taking fewer advanced math and science courses, and still earn the same diploma as students who complete the full CCR course of study (Achieve, 2015).

In 2014, fourteen states had no statewide CCR graduation requirements in place although they adopted the CCR standards. Pennsylvania is one of them (Achieve, 2015).

Forty states evaluate the rigor of CCR course content in one way or another. End-of-course assessments are the most common form of such evaluation (Achieve, 2015). Pennsylvania is one such state that administers end-of-course assessments. They are the Keystone exams. The Pennsylvania Keystone exams measure students' proficiency in algebra, biology, and literature content. They were PDE's chosen courses to meet the high school-level federal accountability requirements in conjunction with the Common Core State Standards. Students take the exams at the end of each respective Keystone course, identified by each school district/local education agency (LEA) through the Pennsylvania Information Management System (PIMS), the system by which all Pennsylvania LEAs submit information about its students, teachers, and courses, among a number of other data required by federal and state reporting requirements (Pennsylvania Department of Education, 2015).

2.2 OVERVIEW OF THE PENNSYLVANIA KEYSTONE EXAMS

With the 2012-2013 academic year, the Keystone exams for algebra, biology, and literature replaced the 11th grade assessments in math, reading, and writing which were part of the Pennsylvania System of School Assessments (PSSA) required under NCLB. The graduating class of 2017 was to be the first cohort of students who were required to earn proficient scores on

each of the three end-of-course Keystone exams (22 Pa. Code § 4.24). However, lawmakers delayed that implementation date until the 2018-2019 academic year (PDE, 2016). The delay provided policymakers with an opportunity to pause and consider additional options for students to demonstrate postsecondary readiness (PDE, 2016). Less than 60% of 2015 graduates had earned the minimum proficiency score on each of the three Keystone exams, and many expressed concerns that project-based assessments, the primary alternative to each Keystone exam's proficiency requirement, were too costly and burdensome for students, schools, and the department of education to sustain (PDE, 2016).

Student performance on the Keystone exams is categorized according to four distinct performance levels. Descriptions of the four performance levels are included within the State Content Area Summary Reports are published by the Pennsylvania Department of Education (PDE) to communicate the state's exam results with the public after each test administration:

- **Advanced:** Superior academic performance indicating an in-depth understanding and exemplary display of the skills included in the Keystone Exams Assessment Anchors and Eligible Content (Pennsylvania Department of Education, 2011, p. 2).
- **Proficient:** Satisfactory academic performance indicating a solid understanding and adequate display of the skills included in the Keystone Exams Assessment Anchors and Eligible Content (Pennsylvania Department of Education, 2011, p. 2).
- **Basic:** Marginal academic performance indicating work approaching, but not yet reaching, satisfactory performance. Performance indicates a partial understanding and limited display of the skills included in the Keystone Exams Assessment Anchors and Eligible Content. The student may need additional instructional opportunities and/or increased

student academic commitment to achieve the Proficient level (Pennsylvania Department of Education, 2011, p. 2).

- **Below Basic:** Inadequate academic performance indicating little understanding and minimal display of the skills included in the Keystone Exams Assessment Anchors and Eligible Content. There is a major need for additional instructional opportunities and/or increased student academic commitment to achieve the Proficient level (PDE, 2011, p. 2).

High school graduation requirements, originally starting with the Class of 2017, called for Pennsylvania students to earn a proficient or advanced level score on the Keystone exams for algebra, biology, and literature or on a state-approved alternative assessment referred to as the project-based assessment for each corresponding content area (4 Pa. Code § 4.24). Additionally, the law accepted equivalent proficiency scores on Advanced Placement (AP) or International Baccalaureate (IB) exams (4 Pa. Code § 4.24); however, these options were not meeting the needs of students struggling to earn equivalent proficiency scores (PDE, 2016). Therefore, the delayed timeline for the Keystone exam proficiency graduation requirement until the 2018-2019 academic year was necessary (Niederberger & Crompton, 2016).

Students who do not earn the minimum proficiency score in a content area may retake the exam for that content area after participating in some form of supplemental instruction designed to better prepare the student for the exam. After failing an exam twice, or just once if receiving special education services, students were initially required to engage in a project-based assessment (PBA) that was developed and evaluated by the Pennsylvania Department of Education in lieu of passing the Keystone exam. The delay affected this requirement as well. With the delay in requiring proficiency on the Keystone exams for graduation, the use of the state's project-based assessments became optional for school districts, and the evaluation of any

project-based assessments would not be conducted by the Department of Education. The responsibility for evaluation would be absorbed by the school districts that opted to utilize PBAs (Pennsylvania Department of Education, 2016). Pennsylvania's graduation requirement of Keystone exam proficiency in each of the three content areas was delayed in conjunction with a directive to the Pennsylvania Department of Education to study issue and recommend to the General Assembly additional options for students to demonstrate postsecondary readiness in lieu of proficiency on each of the Keystone exams (PDE, 2016).

Public perception of the Keystone exam graduation requirement has been largely misrepresented by the media's emphasis on the two-year delay rather than on the fact that the delay only affects the graduation requirement portion of the law (Niedeberger & Crompton, 2016). Headlines, even from the Department of Education's own press release, communicated that the exams themselves were delayed when in fact many of the Chapter 4 requirements remained intact (PDE, 2016). Schools are still required to administer the Keystone exams for school and teacher accountability purposes, and the highest overall performance level earned by a student on each required Keystone exam is to be included on student transcripts beginning with the 2016-17 academic year (22 Pa. Code § 4.24). Furthermore, the fact that scores will be reported on transcripts, students are not permitted to retake any Keystone exam on which a proficient score was earned in effort to attain an advanced score.

Perhaps lawmakers recognized that the expectation of proficiency on each of the Keystone exams might be unfair for some students or unrealistic under some circumstances, a number of exceptions were defined within the law. Exceptions to the original Keystone exam proficiency requirement for graduation included students with disabilities who completed a special education program defined by the student's Individual Education Plan (IEP). Chapter 4

states that special education students are to receive a regular high school diploma after successful completion of such a plan. Additionally, students who passed courses and exams comparable to the Keystone exams were exempt from the Keystone exam proficiency graduation requirement. Comparable exams include Advanced Placement (AP) tests, International Baccalaureate (IB) exams, and out-of-state standardized assessments. While the Pennsylvania Secretary of Education established the passing levels of AP and IB tests, the decision to accept an out-of-state exam as fulfillment of a Keystone exam requirement is left to the discretion of the LEA. Lastly, an LEA's superintendent has the authority under the current law to grant waivers for up to 10% of the district's high school population on a case-by-case basis for reasons of good cause, and students who meet graduation requirements on the basis of IEPs do not count as part of the 10% of students who may receive waivers (22 Pa. Code § 4.51d).

Pennsylvania legislation also affords parents the right to exclude their child from participation in the state's Keystone exams if they claim the tests conflict with their religious beliefs (22 Pa. Code § 4.24). While parents have the right to opt-out their child from participating in a Keystone exam for reasons of religious objection, there was no opt-out provision for the project-based assessments to determine proficiency for the delayed graduation requirement. With all of the aforementioned exclusions to the Keystone exam graduation requirement, there was still a big problem. There were tens of thousands of students who were at risk of not graduating high school in 2017 because they were not proficient on one or more of the Keystone exams. The two-year delay was enacted to avert a crisis with Pennsylvania's graduation rate. When approving the delay, lawmakers required that the Department of Education investigate alternative measures of proficiency that would not be limited exclusively to the state's project-based assessment and prepare a report about the matter for the General

Assembly (PDE, 2016). In August of 2016, the PDE reported its Findings and Recommendations Pursuant to Act 1 of 2016.

PDE noted four key findings and made three recommendations for the revision of Pennsylvania's high school graduation requirements under Chapter 4 of the PA School Code.

The key findings are summarized as follows:

- 1) Almost one-half of graduating seniors in 2015 did not earn the minimum proficiency score on all three Keystone exams (Algebra I, biology, and literature) as the law is currently written (PDE, 2016).
- 2) High school exit exams, as researched in other states, are not the only ways to measure students' mastery of core content, nor are they the only indicators of students' postsecondary success (PDE, 2016).
- 3) Postsecondary success is uniquely characterized by the different interests, opportunities, and needs of a diverse student population. Postsecondary success means different things to different people, and therefore, additional measures of postsecondary readiness are worthy of inclusion in the state's graduation requirements (PDE, 2016).
- 4) Project-based assessments were found to be ineffective and inefficient alternatives to measuring proficiency in the three Keystone exam content areas (PDE, 2016).

In response to the four findings, PDE offered three recommendations to revise the state's graduation requirements.

- 1) Provide four unique options for students to demonstrate their postsecondary readiness prior to graduation (PDE, 2016).

- 2) Discontinue Pennsylvania's project-based assessments as an option to meet graduation requirements (PDE, 2016).
- 3) Change the reporting of Keystone exam scores on student transcripts to be a local decision rather than a state mandate (PDE, 2016).

The four options recommended for students to demonstrate postsecondary readiness no longer include the requirement for students to earn the minimum proficiency score on each of the three Keystone exams. Instead, PDE suggests that a composite proficiency score is earned on the three exams combined for its first recommended option. PDE's rationale for this option is that it is more in line with its own guiding principles that recognize that students do not need to be equally strong in all content areas (PDE, 2016). Therefore, a student may meet Keystone exam proficiency standards by scoring well enough on one or two of the exams to compensate for a lower, non-proficient score on another (PDE, 2016). For example, the minimum proficiency score on each Keystone exam is 1500. If a student earned a scaled score of 1506 on the algebra exam, a 1532 on the literature exam, and a 1484 on the biology exam, his composite score would be 4522 (the sum of the three scores). Because the minimum proficiency score is 1500, the composite proficiency score would be 4500, and our student example would exceed the minimum proficiency composite score, meeting the graduation requirement under option 1. PDE's recommended minimum proficient composite score is not 4500, however. It is actually 4476 because PDE's recommendation for option 1 includes adjusting the minimum proficiency score to accommodate the issue of measurement error and reduced the composite scaled score according to the measurement error from the 2014-2015 test administrations (PDE, 2016). Applying the recommendations for this first option increased the number of 2015 graduates meeting the requirement to 72% from fewer than 60% under the current law.

The second option pertains to additional assessment options for students. The current law allows for a pre-defined proficiency score equivalent for AP and IB exams. PDE recommends that option 2 expand the number of exams that are considered equivalent to Keystone exams by determining state-defined passing scores on subject specific SAT, PSAT, and ACT exams (PDE, 2016).

Option 3 focuses on graduation requirements for the Career and Technical Education (CTE) student. Acknowledging that postsecondary success looks different for CTE students, PDE recommends that these students be able to demonstrate their competency in the PA Keystone content areas through either Keystone exam proficiency or by earning passing grades in the designated Keystone courses that are typically Algebra I, biology, and 10th grade English. Option 3 also requires the CTE student to provide evidence of postsecondary readiness by earning a NOCTI/NIMS Skills or Competency Certificate, acquiring a valued industry-specific credential, proficiency evidence on benchmark assessments within their CTE program or study, or by providing a minimum of three pieces of evidence that he or she is prepared to engage in postsecondary activity consistent with goals in his or her career plan and portfolio (PDE, 2016).

The final recommended option for meeting the graduation requirements under Chapter 4 calls for students to provide three pieces of evidence that they are prepared to engage in postsecondary activities that are consistent with goals in their career plan and portfolio. This option is open to all students, not just Career and Technical Education students. Acceptable evidence includes items noted within all previous options, but expands the list of evidence to include adequate performance on the Armed Services Vocational Aptitude Battery (ASVAB) to enlist in the military, a guaranteed full-time employment letter, and earning a passing grade in a dual enrollment course (PDE, 2016).

These recommended options reflect PDE’s conclusion that current graduation requirements were too limiting in their definition of postsecondary readiness. The recommendations aim to recognize and acknowledge student achievements in areas that may not have implications for college. Within the report, however, PDE expressed a belief that low proficiency rates on is partly explained by a lack of alignment among local course curricula, classroom instructional practices, and the PA Core and Academic Standards (PDE, 2016). In effort to remedy such misalignment, PDE recommends the development of model curricula for the Keystone content areas of algebra, biology, and literature. It also recommends that voluntary common formative assessments be developed and used alongside the model curricula to monitor student progress toward mastery of the Keystone course content areas. The report further suggests that PDE have the authority to engage in a curricular review process that would require school districts to revise or replace their local curricula if found inadequate in the alignment with state standards (PDE, 2016). During public input sessions, district superintendents expressed the desire for PDE to provide more resources to help schools and teachers implement standards-aligned curricula (PDE, 2016).

2.3 STATEMENT OF THE PROBLEM

As the high school graduating class of 2019 approaches its commencement, the urgency remains for LEAs to prepare as many students as possible to earn proficient scores on the Keystone exams. Student achievement and growth measured by performance on Keystone exams remain large components of the Pennsylvania School Performance Profile (SPP) that is used to communicate the effectiveness of schools to the public and to comply with federal accountability

requirements. Furthermore, Educator Effectiveness, Pennsylvania's teacher evaluation system, requires that the SPP scores make up 15% of teacher evaluations, and teachers of the Keystone courses are evaluated on 3-year student growth composite scores that are derived from students' Keystone exam performance.

Large numbers of Pennsylvania students continue to struggle to demonstrate Keystone exam proficiency in all three content areas. Results from the May of 2015 Keystone test administration show that only 50.7% of students who completed coursework in Keystone Algebra I and took the end-of-course exam met the minimum proficiency level (Pennsylvania Department of Education, 2015). That leaves 49.3%, or 58,660 students who did not meet the minimum proficiency requirement. They failed the test. The results for biology and literature are also disappointing. The pass rate for 114,091 first-time testers, taking the exam at the end of the Keystone Biology course, was 58.8%. The results for the Keystone Literature exam are the highest of the three content areas with a pass rate of 68%, yet close to 36,000, or 32% of students were at risk for not graduating with their original cohort. These percentages are typical of the state pass rates for Keystone exams each spring. These figures represent students who would not have met the Keystone exam proficiency graduation requirement if Governor Tom Wolf had not signed Senate Bill 880 on January 20, 2016, pushing the implementation date back from 2017 to 2019 (Niederberger & Crompton, 2016).

Prior to the delay, non-proficient students began working on becoming proficient through a state developed and evaluated project-based assessment. The project-based assessment is a collection of standards-aligned activities that students complete online in the presence of an assessment proctor. A certified teacher is required to provide the necessary supplemental instruction the student requires to be able to complete the online activities, and it is acceptable

for the teacher to serve as the assessment proctor. As time was running out, many wondered if Pennsylvania could handle the project-based assessment load. Critics of the Keystone exam graduation requirements claimed the new requirements boiled down to another unfunded mandate that would be too expensive for the many cash-poor schools to provide additional instructional services to students who failed the exams (Niederberger & Crompton, 2016). Others believed that PDE was not prepared to handle its responsibility to evaluate the project-based assessments for the tens of thousands of students who needed to complete them for one or more subject area each year (Niederberger & Crompton, 2016).

Tens of thousands of Pennsylvania's high school students were at risk for not graduating, and that became a political quagmire. While the problem, at least in part, stems from the inadequate preparation of students as they engage in the Keystone courses, parents, community members, and educators rallied in opposition to using Keystone exam proficiency as a graduation requirement. Political rhetoric leading up to the signing of Senate Bill 880 included cries to abolish Keystone exam proficiency altogether as a graduation requirement while others pleaded for a delay, providing more time for schools to make the transition to the PA Core Standards.

Democratic Governor Tom Wolf supported the two-year delay of the Keystone exam proficiency graduation requirement as a way to encourage conversation about school accountability (Benshoff, 2015). Wolf perceives that the large number of non-proficient students in Pennsylvania is a problem that requires immediate attention. He supports flexibility with the new standards with the intent of solving the larger issue at hand (Benshoff, 2015). Following the Senate's unanimous approval of SB 880, the House held a hearing before its education committee on the issue in July of 2015. Most of the testimony from educators focused on their belief that the high-stakes tests were detrimental to the quality of education while imposing a

financial burden on taxpayers. Additionally, the General Assembly acknowledged the momentum to reconsider the use of proficient exam scores as a graduation requirement (Langley, 2015). The State Board of Education objected to the elimination of Keystone exam proficiency as a graduation requirement, however. Board chair, Larry Wittig, testified that students would lose the incentive to do their best on the exams if passing them is not mandatory for graduation (Langley, 2015). Despite the heated rhetoric, non-proficient students in the Class of 2017 continued their efforts to pass the exams or begin the process of successfully completing project-based assessments only to learn halfway through their junior year that Keystone exam results would not be an obstacle to receiving their diploma.

Moreover, the larger question remains. How do we address the fact that so many Pennsylvania students are not able to demonstrate the minimum proficiency requirements on a Keystone exam at the end of the corresponding course? It is this broader question that provided the motivational context for my research study.

2.4 RESEARCH QUESTIONS

Although educators in Pennsylvania were aware of their state's adoption of the Common Core State Standards in July of 2010 and approved its final revised version of the standards, PA Core Standards (PACS) in 2013, uncertainty about whether or not they would be overturned loomed amidst the political debate about the CCSS and the accompanying accountability through standardized testing. Since Pennsylvania's Chapter 4 regulations have been in effect since March 1, 2014, the political debate surrounding the Common Core movement and the recent delay of implementing the graduation requirement pertaining to Keystone exam proficiency was

a potential distraction to educators. The dialogue perhaps supported the belief, among those who resisted reform efforts, that ““this too shall pass,”” and legislative action across the nation led them to wonder more about what will happen tomorrow rather than to focus upon what is known today.

Regardless of the outcome from the debate about high school graduation requirements and Keystone exams, preparing students at a high level of college and career readiness is a priority that most agree upon. Even if a composite Keystone proficiency score graduation requirement is signed into law, twenty to thirty percent of Pennsylvania’s student population is expected to be at risk of not meeting graduation requirements if they are not enrolled in Career and Technical Education programs or have multiple pieces of evidence that they are ready to enter the military or workforce. Wondering how educators can make the most of what is available to them so that they may prepare a greater number of students to demonstrate proficiency on the Keystone exam, this study shall examine data related to the nature of feedback that teachers provide to students enrolled in the Keystone courses and the relationship to self-reported aspects of teacher mindset. The study shall also explore the teacher-reported reasons that more of their students are not passing the Keystone exams. The proposed inquiry explores possible answers to the following questions:

1. What is the nature of feedback that teachers of the Pennsylvania Keystone courses (Algebra I, biology, literature) are providing to students while enrolled in the course?
 - 1a. What types of feedback do teachers provide?
 - 1b. How frequently do they provide it?
 - 1c. How do teachers perceive their students utilizing the feedback they have been provided to prepare for the end-of-course Keystone exam?

2. What are the self-reported mindset-based characteristics, related to the research of Carol Dweck, of teachers and their teaching in the PA Keystone courses?
 - 2a. What are their self-reported beliefs about intellectual capacity?
 - 2b. What self-reported characteristics of their teaching practice support a growth mindset?
3. What are the relationships among a teacher's self-reported beliefs about intellectual capacity, classroom practices that support growth mindset, and the nature of feedback?
4. What is the relationship between the nature of feedback provided to students enrolled in a Keystone course and the performance of those students on the corresponding Keystone exam?
5. What do Keystone course teachers report as possible reasons that more of their students do not earn the minimum proficiency score on the Keystone exam?
6. What do teachers of Keystone courses identify as the most significant challenges to successfully preparing more of their students to pass the Keystone exams at the end of the course?

2.5 RATIONALE FOR THE STUDY

This study specifically explores teacher mindset and its relationship to the nature of the feedback teachers provide to students enrolled in the Keystone courses (algebra, biology, and literature). It also explores a relationship between these variables and student performance on the corresponding end-of-course exam. While this study specifically explores teacher mindsets and teaching practices in Pennsylvania's Keystone courses, the study aims to offer insight to any

educator who must prepare students for an end-of-course examination. The study also inquires about the self-reported reasons that teachers offer as challenges or barriers to helping more of their students to earn proficient scores on the Keystone exams. Even with the anticipated changes in policy for Pennsylvania's graduation requirements in relation to Keystone exam proficiency, the study offers insight to educational practice as it explores teacher feedback strategies used with students and how such feedback might be related to a teacher's mindset about intelligence and learning.

3.0 METHODOLOGY

This study explores the nature of feedback strategies that teachers of Pennsylvania's Keystone courses (Algebra I, biology, and literature) use to prepare their students to meet the minimum proficiency standard on the corresponding Keystone exam, taken at the end of the course. The study will also explore the relationship between teacher mindset and the feedback that is provided to students throughout the course. It will also explore the relationship between the nature of feedback provided during the course and the performance of the enrolled student population on the Keystone exam. Teacher perceptions about the reasons why more students do not earn the minimum proficiency score on the exams will be explored alongside the self-reported challenges teachers face while preparing students for the end-of-course exam. Survey research was used to conduct the study.

3.1 STATEMENT OF THE PROBLEM

The recently revised Chapter IV guidelines of the PA School code require that all high school students demonstrate a minimum proficiency level in Algebra I, biology, and literature, starting with the Class of 2017 (22 Pa. Code § 4.24). The minimum proficiency level was to be achieved by means of each subject's corresponding Keystone exam. Governor Wolfe, however, delayed Keystone exam proficiency graduation requirements, until the Class of 2019 (Niederberger &

Crompton, 2016). During the timeframe of the delay, PDE released a report that recommended changes to the Keystone exam graduation requirement that included opportunities for students to show evidence that they were ready to engage in postsecondary plans for a career (PDE, 2016). The recommended changes also propose a shift to using a composite Keystone exam score to determine overall proficiency in the three content areas rather than requiring that students earn the minimum proficiency score in each of the three content areas (PDE, 2016). Aside from the delay of the graduation requirement date and recommended changes, much of the Pennsylvania law remains the same. Schools must still administer the exams for state and federal accountability requirements during the two-year moratorium on the graduation requirement. Once the moratorium expires with the start of the 2018-2019 academic year, regular education students who do not earn a proficient Keystone exam score, or a composite Keystone exam score, will be required to provide evidence of career readiness through various recommended options by the Department of Education (PDE, 2016).

Prior to the announcement of the delay in requiring Keystone exam proficiency, tens of thousands of students across the state of Pennsylvania were at risk of not meeting the graduation requirement. Mounting political pressure about the matter led policy makers to propose bills that delayed the requirement of Keystone exam proficiency for graduation until the 2018-2019 school year (Niederberger & Crompton, 2016). The two-year delay does not alleviate any pressure for educators, however. The state's new teacher evaluation model, named Educator Effectiveness, links student achievement and growth on these exams to teacher and principal evaluations (Act 82 of 2012). To avoid a significant drop in the state's graduation rate, whether it begins with the Class of 2017 or 2019, teachers of the three Keystone courses must ensure that their students are learning and retaining the content well enough to achieve proficiency. They must also help

students to become self-regulated learners in a manner that empowers them to observe and respond to their own learning continuum as they strive to meet or exceed the Keystone exam proficiency goal by the time they complete the course. The new requirement sets a standard for proficiency for all students who are required to participate in Keystone exams. (Students with severe cognitive disabilities are not required to take the Keystone exams. Instead, they take an alternate exam.) This implies that state policy makers believe that the minimum proficiency requirement is a realistic expectation for college-bound Pennsylvania graduates, if not all Pennsylvania graduates.

This study shall examine the nature of feedback that teachers in the three Keystone courses provide to their students throughout the course in preparation for earning proficiency on the Keystone exam for that course. It also will explore the relationship between a teacher's beliefs about intelligence and learning influence the nature feedback that is provided to students. The study also explores the relationship between the nature of feedback provided during a Keystone course and overall student performance on the Keystone exams. Teacher expression of reasons why more students do not earn the minimum proficiency scores on the exams as well as the self-reported challenges they face while preparing students is also discussed.

3.2 RESEARCH METHODS AND DESIGN

I sought to address the research questions using survey research. A convenient sample of teachers in Pennsylvania completed a questionnaire. Teachers were eligible to participate in the study if they taught a Keystone course (Algebra 1, biology, or 10th grade English) during the 2015-2016 school year. Because there was currently no publicly accessible database of teachers

who teach Keystone courses, I solicited the assistance of superintendents and principals in secondary schools, to disseminate the survey for Keystone course teachers.

3.2.1 Population

Teachers within school districts who belong to one of two professional organizations sponsored by the University of Pittsburgh were invited to participate in the study. The first professional organization was the Forum for Western PA School Superintendents. The Forum for Western PA School Superintendents had a membership of 50 school superintendents (Western PA Forum for School Superintendents, 2016). Locally known as The Forum, the organization has provided a leadership network of support to the area's school superintendents for nearly 20 years. The Forum was founded by Dr. Richard C. Wallace and is currently led by Dr. Jerry Longo. Membership into The Forum is limited to active superintendents or chief executive officers of public school organizations across western Pennsylvania. Members represent not only school districts, but also charter school districts, parochial school districts, and intermediate units.

The Forum sponsors retreats where its members receive professional development in a variety of themes that relate to its mission of promoting collaboration among leaders and advocacy for children. It also aims to serve as a mentoring program for new superintendents in the area. Funding for The Forum comes from grants from the Grable and Buhl Foundations as well as from member dues (Western PA Forum for School Superintendents, 2016).

The second professional organization that comprised the population for the study was the Tri-State Area School Study Council. The Tri-State Area School Study Council is also a network with roots at the University of Pittsburgh. Tri-State's membership consists of over 100 school districts throughout Western Pennsylvania (Tri-State Area School Study Council, 2016). Similar

to The Forum, The Tri-State Area School Study Council's membership consists of public school districts, charter schools, vocational technical schools, and intermediate units. Dr. Diane Kirk of the University of Pittsburgh directs the Council.

The Tri-State Area School Study Council provides a number of professional development and networking opportunities for its members. To support its offerings, The Council charges an annual membership fee that is scaled according to the district's student enrollment (Tri-State Area School Study Council, 2016). Some of the workshops sponsored by The Council include the Principal Leadership Institute, School Law and Special Education Conference, and Enhancing School Governance and Management (Tri-State Area School Study Council, 2016). The Council also provides a job listing service for educators and school leaders. The mission of The Council is stated on its website as being an organization that strives to increase capacity within schools by providing professional development, technical services, and problem solving activities in effort to help members prepare its students to make positive contributions to the our society (Tri-State Area School Study Council, 2016).

Both professional organizations benefit the western Pennsylvania community and involvement in this study by its members may provide the opportunity to capture important data and teacher insights about important issues relating to the nature of feedback provided to students, a teacher's mindset and its relationship to the nature of feedback provided to students, and the nature of feedback and its relationship to performance on the Pennsylvania Keystone exams.

Superintendents and principals supported the research study in two steps. First, principals or other school leaders completed a brief survey to collect total counts of teachers who taught a Keystone course during the 2015-2016 school year in each of the three subject areas: algebra,

biology, and literature. These data were used to calculate a response rate for the survey that teachers of the Keystone courses took. The second step was for the principal or school leader to provide a copy of the recruitment letter directly to each teacher who taught a Keystone course during the 2015-2016 school year, encouraging them to participate in the research study by completing a brief questionnaire using the link within the recruitment letter.

3.2.2 Survey design

Links to the online surveys were distributed to all superintendents and/or principals within schools representing members of The Forum for Western Pennsylvania Superintendents and the Tri-State Area School Study Council via a recruitment letter that was emailed through distribution lists maintained by The Forum and The Tri-State School Study Council . The survey questionnaires were designed with Qualtrics Survey Software provided by the University of Pittsburgh. The school leader survey was used to determine the total numbers of teachers who taught a Keystone course during the 2015-2016 school year within a particular school and district. Respondents were to state the name of their district and school along with the number of teachers who taught a Keystone course in each of the three subject areas (algebra, biology, and literature) during the 2015-2016 school year. These data were used to calculate response rates for the survey of Keystone teachers. The researcher used the total recipients for the membership organizations to derive a response rate for the school leader survey.

The Keystone course teacher survey consisted of ten questions that focused on a particular theme related to the research questions. An eleventh question asked the respondent if he or she is willing to participate in a telephone interview to discuss his or her experience teaching a Keystone course. At the end of both the school leader and Keystone course teacher

surveys, the respondent had the opportunity to click a link to send a pre-fabricated email requesting a copy of the results at the conclusion of the study. By opening a separate Internet browser window to submit the email request, there will be no linkage between the survey participant's responses and the email address the respondent may request to which the results of the study be sent.

The interview phase of the survey consisted of seven open-ended response questions that aimed to garner more descriptive information pertaining to the feedback strategies utilized in the Keystone course and the respondent's perceptions about the challenges that may have prevented more of his or her students from earning a proficient score on the Keystone exam. The themes of all questions were aligned with the research questions.

Table 1. Alignment of research questions and Keystone course teacher survey questions

Research Question	Survey Items	Interview Items	Analysis Notes	Connections to research literature
Demographic data collection: type of course, course enrollment, percentage of Keystone proficiency on exam	Q1, Q2, Q3, Q4, Q5, Q6	IQ1, IQ2	frequency distribution, cross tabulation, points of disaggregation	
Q1. Nature of feedback	Q8	IQ2a, IQ2b	frequency distribution, cross tabulations, Chi Square analyses, thematic analysis of interview data	Black & William (1998), Boud (2000), Clark (2012), Nicol & Macfarlane-Dick (2006), Resnick & Schantz (2015), Sadler (1989), Wilson et al (2011)
Q1a. Types	Q7 & Q9	IQ3		
Q1b. Frequency	Q9			
Q1c. Student utilization	Q10.2 & Q10.5	IQ2c		
Q2. Mindset-based characteristics	Q10.1, Q10.2, Q10.4, 10.6, 10.7, 10.10		frequency distribution, cross tabulations, Chi Square analyses	Dweck (2006), Gould, Beylin, Tanapat, Reeves & Shors (1999), Willis (2011)
Q2a. Beliefs about intellectual capacity	Q10.3, 10.8, 10.9, 10.11			
Q2b. Practices that support a growth mindset	Q9, Q10.1, 10.2, 10.4, 10.5, 10.6			
Q3. Relationships among teacher beliefs, classroom practices, and nature of feedback	Q8, Q9, Q10	IQ5	Cross tabulations with Chi Square analyses, thematic analysis of interview data	Dweck (2006)
Q4. Relationship between nature of feedback and performance on Keystone exam	Q6a & Q9	IQ4	Cross tabulations with Chi Square analysis, thematic analysis of interview data	Dweck (2006)
Q5. Reasons why more students are not proficient on Keystone exam	Q10	IQ6	Thematic analysis	
Q6 Perceived challenges to having more students earn proficiency	Q10	IQ6	Thematic analysis	
The full survey questionnaire and interview protocol may be found in the appendices.				

Skip logic was used within the survey. The first purpose of using skip logic was to confirm that the respondent taught a Keystone course during the 2015-2016 school year. If the respondent did not confirm that he or she taught a Keystone course and identify the content area for that Keystone course, the survey would skip to the end. The second purpose for using skip logic was to determine whether the respondent reviewed the Keystone exam results for his or her students on the previous year's Keystone exam. If the respondent stated that he or she reviewed the results of the May Keystone exam, he or she was asked to report the percentage of students who earned a proficient or advanced score. The question was skipped if the respondent did not review the results of the May Keystone exam for his or her students.

3.3 DATA COLLECTION AND ANALYSIS

The teacher survey collected mostly categorical data. Respondents were asked questions about the Keystone course they taught. The questions collected data about feedback strategies used to prepare students to meet expectations for the course and the Keystone exam, as well as the frequency the strategies were utilized. Questions also explored teachers' dispositions toward the nature of intellectual capacity and the ability for a person to change their intellectual capacity. Additional questions explored the perceptions teachers had about reasons why more of their students do not earn the minimum proficiency score and the perceived challenges faced while trying to prepare more students to earn the minimum proficiency score on the Keystone exam for the course.

Categorical data collected through the survey were used to cluster participant responses for analysis based upon subject area and characteristics associated with a growth mindset. The

questions used to determine an association to growth and fixed mindset types were informed from the book *Mindset: The New Psychology of Success* by Carol Dweck (Dweck, 2006). Analysis of the survey explored how mindset types relate to the nature of feedback strategies used to prepare students for success in the Keystone courses. Mindset types also served as a lens to view teacher perceptions about the challenges that interfere with their ability to help their students to reach the minimum proficiency requirement on the Keystone exam.

The data collected from the questionnaire and follow-up interviews were analyzed in a variety of ways. Descriptive statistics, including frequency distributions, were calculated for each item. Cross tabulation and Chi Square analyses were performed to explore the type and frequency of each feedback strategy, as well as any emergent patterns of feedback strategies, in relation to the mindset characteristics. The mindset characteristics were also cross-tabulated with the responses about challenges that interfered with the ability to prepare all students to reach the minimum proficiency level on the Keystone exam. Feedback strategies used, along with their frequencies of usage, were categorized in relation to the percentages of each teacher's students who scored proficient or advanced on the Keystone exam.

In addition to comparing how mindset may or may not influence feedback strategies and teachers' perceptions of challenges to helping all students achieve proficiency, survey responses were also analyzed through the lens of each Keystone content area: Algebra I, biology, and literature to determine any similarities or differences that might occur in disaggregate form in contrast to the aggregate data.

3.4 PARTICIPANT RECRUITMENT

The researcher asked the Forum for Western PA School Superintendents and the Tri-State Area School Study Council professional organizations to support the research study. In support of the study, the leaders reached out to their membership school districts and encouraged the members, to respond to the school leader survey and distribute the recruitment letter, containing a link to the survey of Keystone course teachers for the 2015-2016 academic year. They also encouraged members to, in turn, encourage the Keystone course teachers of school year 2015-2016 to participate in the survey.

Leaders were asked to report the number of teachers who taught at least one section of a Keystone course during the 2015-2016 school year for their school or district. Keystone subject areas include Algebra I, biology, or literature in the designated grade level for the Keystone course. While the literature Keystone exam is typically administered at the end of grade 10, each district has the liberty to designate any course as the Keystone literature course, provided that it is aligned with the appropriate standards.

Teachers of the three Keystone courses were provided with a copy of the recruitment letter for the research study. Participation involves the completion of a brief survey that was estimated to take about 5-10 minutes. The Qualtrics software estimates the completion time to be 5 minutes, but an additional 5 minutes was added to the estimate for the completion open-ended questions. Participants were asked if they were willing to participate in a follow-up telephone interview to further discuss their experience teaching a Keystone course. All participants were informed that their responses would be kept anonymous and any linkages between any identifiable information and survey responses would be destroyed at the conclusion

of the study. I also informed respondents that their participation was voluntary and that they had the right to withdraw from the study at any time.

After distribution of the support letter and recruitment script, I requested follow-up reminder emails to be sent by the supporting organizations. Second and third follow up email messages were sent when responses were not received. After three attempts to determine if participants choose to participate or decline participation, I recorded a non-response for the district, school, and/or teacher.

All participants had the opportunity to request a copy of the aggregate results and data analysis upon conclusion of the study. Results were also provided to The Forum for Western PA School Superintendents and the Tri-State Area School Study Council. The opportunity to see results for the western Pennsylvania area may have provided an incentive to support and participate in the study.

3.5 LIMITATIONS

There were limitations to this study. By recruiting member districts of The Forum for Western PA School Superintendents and of the Tri-State Area School Study Council, the study's findings would only be representative of the western Pennsylvania region. Additionally, if for whatever reason a district were not a member of either professional organization, it would not have had the opportunity to be included.

The study also used a secondary source for teacher recruitment. Because the primary investigator relied upon the dissemination of the recruitment letter by principals and superintendents to gain participation by Keystone course teachers during the 2015-2016 school

year, there was potential for a delayed response and a decreased response rate. Engaging The Forum for Western PA School Superintendents and the Tri-State Area School Study Council to encourage support of the study provided benefit and credibility to the study in terms of achieving a respectable response rate. In exchange for the organizations' support, I offered to present the findings of the study to the memberships at meetings, conferences, or in newsletter correspondence.

While a direct source of information to identify Keystone course teachers would have been optimal for a clear process of teacher recruitment, no such database was available to the public at the state level. Some districts may post teacher names, assignments, and email addresses on their websites, but that was neither a more efficient way to collect the necessary contact information nor a guarantee of availability and accuracy in terms of who taught a Keystone course during the 2015-2015 school year.

The study involved the self-reporting of teachers. While the primary investigator makes every effort to design a clear and comprehensible survey, participants may misinterpret the intent of questions. They may also overstate or understate responses about the frequency of feedback strategies they use with students based upon the degree they may or may not be able to recollect their practices during the past academic year.

The online format of the survey questionnaire could also be a limitation based on the potential that some teachers may not be comfortable using technology to record their responses to questions. While it may seem unlikely that there may be teachers who do not have a basic comfort level and skill set for using technology, it is not beyond the realm of possibility.

3.6 INTRODUCTION TO RESEARCH RESULTS

The purpose of the study was trifold. First, the study explored the nature of feedback teachers provide to students in the Pennsylvania Keystone courses: algebra, biology, and literature. The study also sought to explore any relationships among the types of feedback teachers utilize and potential relationships to mindset and student achievement on Keystone Exams. Third, the study explored the perceived challenges that teachers face as they strive to help students earn the minimum proficiency score on the end-of-course Keystone exam. The study involved the use of two surveys. Because there is no publicly available database of Pennsylvania Keystone course teachers, school and district leaders within two local professional organizations were asked to complete an initial survey about the numbers of Keystone course teachers in their schools during the 2015-2016 school year. The researcher also asked the leaders to relay the teacher survey link to their 2015-2016 Keystone course teachers. The survey for Keystone course teachers was the primary instrument for data collection and analyses of the research questions. The survey for Keystone course teachers also solicited interest from participants to participate in follow-up interview with the researcher to gain a deeper insight about individual teacher insights related to the research questions.

The population for both surveys included member districts of the 2016-2017 Tri-State Area School Study Council and the Western Pennsylvania Forum of School Superintendents. Both organizations supported the research study by sending the introductory recruitment letter and two follow-up reminder messages on behalf of the researcher, asking member districts to consider participating. By garnering the support of these two professional organizations, the researcher hoped that member districts would be interested in the results of the

study, which were representative of their groups, and would serve as a motivational factor to participate.

3.7 SCHOOL LEADER SURVEY RESULTS

The first survey asked school leaders to report the number of Keystone teachers, teachers who taught a Keystone course, in their schools. The survey also asked school leaders to disaggregate the numbers of Keystone teachers according to the three Keystone subject areas: algebra, biology, and literature. Response rates were determined from the data collection process, which helped the researcher gain an understanding about how many teachers taught Keystone courses during the 2015-2016 school year.

The population included public school districts and charter schools with active memberships in the Tri-State Area School Study Council and/or the Western Pennsylvania School Superintendent's Forum. Intermediate Units, Vocational and Technical Schools, and private/parochial schools may also be members of the Tri-State Area School Study Council and/or the Western Pennsylvania School Superintendent's Forum. The researcher excluded these schools from response rate calculations because they do not participate in the Keystone end-of-course exams. According to a member list on the Tri-State Area School Study Council's website, 94 public school districts and charter schools had the opportunity to participate (Tri-State Area School Study Council, 2017). Many members of the Western Pennsylvania School Superintendent's Forum are also members of the Tri-State Area School Study Council. Sixteen members were unique to the Western Pennsylvania School Superintendent's Forum, and they were invited to participate in the research survey, bringing the total number of school districts

and charter schools invited to 110. A secretary for the two organizations distributed the survey link via email to superintendents of member districts along with a letter signed by the two organizations leaders expressing support for the research study. Two follow-up messages were also sent, reminding superintendents to complete the leader survey and to distribute the Keystone course teacher survey to the appropriate personnel. The researcher appreciated the support of these professional organizations and its secretary. It is likely that response rates would have been lower without this support.

Fifteen unique school districts and charter schools responded to the Survey for School Leaders, yielding a 13.6% response rate. Two respondents reported the name of their school or district but did not report numbers of teachers. One of the two was a K-5 charter school that did not teach any Keystone courses. The other was a public school district that did not report its numbers of Keystone teachers. Therefore, only 13 school districts and charter schools provided viable responses to the Survey for School Leaders, yielding an 11.8% completed response rate. This response rate is low and the results of the research study are not representative of or generalizable to the two professional organizations.

Responding schools reported having 115 Keystone course teachers during the 2015-2016 school year. Among the 115 Keystone course teachers, 47 taught algebra, 36 taught biology, and 32 taught the Keystone literature course. Among the 47 Keystone algebra teachers reported, 11 taught the course in a middle school as opposed to a high school or a combined junior/senior high school.

Table 2. Percentage of Keystone course teachers by subject area reported by leaders (n=115)

Subject area	%	n
Keystone algebra teachers	40.9	47
at middle school	9.6	11
at junior/senior high school	31.3	36
Keystone biology teachers	31.3	36
Keystone literature teachers	27.8	32

3.8 KEYSTONE TEACHER SURVEY RESULTS

Within the participating districts, school leaders reported they had 115 teachers who taught a Keystone course during the 2015-2016 school year. The participating school leaders distributed the recruitment letter and link to the Keystone Course Teacher Survey to the teachers they reported as teaching a Keystone course during the 2015-2016 school year, inviting them to participate in the study. Forty-two teachers responded to the teacher survey, yielding a teacher response rate of 36.5%.

Two of the teacher respondents indicated that they had not taught a Keystone course during the 2015-2016 school year. One possible reason for the response could be that the school leader gave the survey to all current Keystone teachers, and these two teachers are new to teaching the Keystone course for the 2016-2017 school year. This reduces the total number of 2015-2016 Keystone teachers who responded to the survey to 40, yielding a Keystone teacher response rate of 34.8%.

3.8.1 Description of respondent grade levels taught by subject area

Among the 40 Keystone course respondents for the 2015-2016 school year, 20 taught algebra, eight taught biology, and 12 taught literature. The Keystone algebra teachers reported teaching students in grades 7-11. Most Keystone biology teachers reported teaching students only in grade 9, but two Keystone biology teachers reported teaching students in grades 9 and 10. All literature teachers, except two, reported teaching students in grade 10. Of the two teachers who reported teaching literature students outside of grade 10, one reported teaching students in grades 9 and 10, and the other reported teaching students in grades 7 and 8. The following table represents the frequency distributions of these data.

Table 3. Percentage of teachers reporting grade levels taught in Keystone courses for each subject area

Subject	Grade 7		Grade 8		Grade 9		Grade 10		Grade 11		Total	
	%	n	%	n	%	n	%	n	%	n	%	n
Algebra	13.5	5	10.8	4	40.5	15	24.3	9	10.8	4	100.0	37
Biology	0.0	0	0.0	0	80.0	8	20.0	2	0.0	0	100.0	10
Literature	7.1	1	7.1	1	7.1	1	78.6	11	0.0	0	100.0	14

**Some teachers reported teaching more than one grade level.*

3.8.2 Usage of exam and course related resources

The PDE publishes a number of resources to help teachers and students understand the expectations for Keystone courses and their corresponding end-of-course exams. Teachers may also prepare their own syllabus to communicate the course expectations to students. Thirty-seven teachers responded to the question asking about six specific course and exam resources they provide to students. The course resources listed were as follows: PA Core Standards, PA Core Assessment Anchors and Eligible Content, PA Keystone Exam Item and Scoring Sampler,

PA Keystone Exam Blueprint, and PA Keystone Exam Scoring Guidelines for Constructed Responses. Recognizing that teachers also may create a custom syllabus for their Keystone course, Teacher-made Syllabus was included as a sixth option for participants to choose.

All teachers stated that they used at least one of the listed resources to help prepare students for course and exam expectations. Five teachers only used one of the listed resources. Three teachers used two of the listed resources. Twelve teachers used three of the resources. Eight teachers used four resources, and another eight teachers reported using five of the six resources. One teacher reported using all six resources. There were no noticeable differences observed in the number of resources used by teachers of the different Keystone subject areas.

Among the resources used by teacher respondents, the Scoring Guidelines for Constructed Responses was the utilized most, as 31/37 (84%) of the respondents stated that they used it. The teacher-made syllabus, was reported as utilized by 30/37 (81%) of respondents, and 29/37 (78%) of respondents used the Item & Scoring Sampler. The PA Core Standards for the course and its corresponding Anchors & Eligible Content were reported as utilized by 14/37 (38%) and 18/37 (49%) of respondents respectively. Finally, only 5/37 (14%) of respondents indicated that they used the Keystone exam test blueprint, a document that shows how each section of the exam and question types are organized and weighted.

The following chapters address the research questions for the study. Within each chapter is a description of the results related to the research question along with conclusions and recommendations.

3.8.3 Interviews

To gain deeper insight about the nature of feedback teachers provide to students in their Keystone courses, I solicited interviews from survey respondents. The final question within the survey for Keystone course teachers asked teachers to provide email contact information that the researcher could use to set up an agreeable time to interview the teacher. I did not contact teachers who agreed to participate in an interview at the time they completed the survey. Instead, I decided to wait until the online survey portion of the study concluded. Two follow-up messages were sent to school leaders over three months' time, with winter break falling within this timeframe. It was my intention to obtain as many survey responses as possible prior to beginning the interview process. I was also interested in reviewing all of the survey data prior to beginning the interviews in effort to allow the survey data to inform the interviews. I wanted to have the opportunity to be able to draw upon the survey data to ask follow-up questions during the interview about any patterns observed among the results.

Therefore, I contacted the 11 teachers who agreed to participate in an interview and provided an email address, but not until three months had passes since the first teacher responded to the survey. No teachers responded to the first message sent by the researcher. A follow-up request was sent several weeks later. Two teachers responded to the first follow-up request. One teacher responded and participated in the interview. Another teacher responded with a question about how long the interview would take. I stated that the interview was likely to take about 20 minutes, and the teacher did not respond to set up an interview date and time. I sent a second follow-up email message to the remaining potential interviewees, and no additional teachers responded.

A large gap in time between when the teacher responded to the survey and when the researcher contacted him or her to set up an interview may have contributed toward the low interview response rate. Most teachers who agreed to participate in an interview were among the earliest responders to the initial survey disseminated in November. However, the survey did not close until mid-January. I then reviewed the survey data to reflect upon potential follow-up interview questions within the semi-structured format that would offer a deeper insight to the survey data collected. The first contact to teachers about interview arrangements did not occur until February. It is possible that teachers either forgot about the study or changed their mind about participating in an interview.

Having just one interview presented me with challenge about how to deal with the data collected. While the interview was helpful and provided me with interesting insight about one teacher's practice, it did not make sense to analyze the data in isolation. Therefore, I decided to fold the interview responses into the mix of open-ended survey responses. Themes discussed during the interview provided greater depth to data that was provided within open-ended responses to the survey.

4.0 DESCRIPTION OF RESULTS

Chapter 4 provides a discussion of the survey results with responses from the sole interview folded within the discussion of open-ended responses. The results are organized by research question in a manner that provides descriptive information about the most prevalent responses. Chapter 5 will discuss the findings, recommendations, and implications of these data through a lens of professional practice.

4.1 NATURE OF TEACHER FEEDBACK PROVIDED TO STUDENTS IN KEYSTONE COURSES

Research question one sought to examine the nature of feedback that teachers of the Pennsylvania Keystone courses provide to students while enrolled in the course. Research question one asked, **“What is the nature of feedback that teachers of the Pennsylvania Keystone courses (Algebra I, biology, literature) are providing to students while enrolled in the course? What types of feedback do teachers provide? How frequently do they provide it? How do teachers perceive their students utilizing the feedback they have been provided to prepare for the end-of-course Keystone Exam?”**

This discussion of results will specifically address what types of feedback the teachers provide, how frequently they provide it, and how they perceive their students utilizing the

feedback they have been provided to prepare for the end-of-course Keystone exam. This section first reports the types of feedback teachers believe to have the greatest impact on student learning as a lens to compare the frequency to which teachers practice the feedback strategies in the classroom. To provide clarity to the discussion of results, survey response options are italicized.

4.1.1 Feedback forms perceived by teachers that most affect student learning

Teachers selected the three forms of feedback that they believed had the most impact on student learning. Research literature on effective forms of feedback for the learning process directly informed the items for this list. The survey design did not enforce teachers to select three choices nor did it limit teachers to selecting only three choices. A few teachers chose fewer than three choices. Some teachers chose more than three options. This explains why the totals for each subject do not equal the number of respondents times three. The total number of teachers who responded to the survey item was 37. The 37 teachers made 143 selections. Twenty algebra teachers made 62 selections. Eight biology teachers made 35 selections, and 11 literature teachers made 46 selections. If teachers had chosen three choices, and only three choices, the total number of responses from 37 teachers would have totaled 111. Therefore, teachers chose 32 additional selections. It is important to note that the research literature identified all listed forms of feedback as effective forms of feedback to affect student learning. Therefore, it is understandable that teachers felt compelled to choose more than three. Table 4 shows the total number of selections by teachers with disaggregation by subject area.

Table 4. Forms of feedback teachers think most affect student learning

	algebra (n=18)		biology (n=8)		literature (n=11)		total (n=37)	
	% algebra responses	n	% biology responses	n	% literature responses	n	% total responses	n
Written work that explains student thinking or learning	61.1	11	62.5	5	63.6	7	62.2	23
Student-to-teacher dialogue	44.4	8	62.5	5	54.5	6	51.4	19
Reteaching and reassessing	44.4	8	37.5	3	54.5	6	45.9	17
Review of homework	61.1	11	37.5	3	18.2	2	43.2	16
Use of rubrics and performance exemplars to discuss quality work	22.2	4	37.5	3	81.8	9	43.2	16
Student-to-student dialogue	44.4	8	62.5	5	18.2	2	40.5	15
Review of quizzes and tests	27.8	5	50	4	45.5	5	37.8	14
Computer-based or online tutorial software	16.7	3	25	2	18.2	2	18.9	7
Student self-assessments	11.1	2	0	0	36.4	4	16.2	6
Online assessments (Aimweb, CDTs, MAPs, etc.)	5.6	1	25	2	9.1	1	10.8	4
Other	0.0	0	37.5	3	9.1	1	10.8	4
Pre-testing	5.6	1	0	0	9.1	1	5.4	2
Total selections by subject	344.4	62	437.5	35	418.2	46	386.5	143

*Total selections exceed 100% because teachers were asked to make three selections. Some made more.

Teachers were consistent across subject areas when selecting *written work that explains student thinking or learning* as a top form of feedback perceived to most impact student learning. It received the most selections overall with 23/37 (62.2%). It was one of the most selected forms of feedback among algebra and biology teachers. It was the second most selected form of feedback among literature teachers. This is not surprising since the shift to PA Core Standards and its related state examinations have placed more of an emphasis on having students explain their answers and particularly in mathematics, to explain the process for arriving at their answers. Algebra teachers also selected *review of homework* to the same degree as *written work that*

explains student thinking or learning with 11/18 (61.1%). Perhaps this perception suggests that use and review of homework as strategies to affect student learning go hand in hand with *written work that explains student thinking and learning* because homework is a form of written work completed by the student. Moreover, if the homework involves complex problem solving and requires the student to show steps of a process for solving a problem in detail, algebra teachers may perceive *written work that explains student thinking or learning* as equivalent to *review of homework*.

Biology teachers rated *student-to-teacher dialogue* and *student-to-student dialogue* with the same degree of frequency as *written work that explains student thinking or learning*. These three strategies ranked highest among biology teachers with 5/8 (62.5%) choosing them.

The most selected form of feedback by literature teachers, however, was not *written work that explains student thinking or learning*. Seven of 11 literature teachers (63.6%) selected it as one of the top forms of feedback that most affect student learning. Nine of 11 literature teachers (81.8%) selected *use of rubrics and performance exemplars to discuss quality work*. This is not surprising because one might expect rubrics and performance exemplars to accompany composition assignments with a greater degree of frequency. However, it is somewhat surprising that algebra and biology teachers emphasized *written work that explains student thinking or learning* in their selections, but only 4/18 (22.2%) algebra teachers and 3/8 (37.5%) biology teachers identified *use of rubrics and performance exemplars to discuss quality work* as a most impactful form of feedback. Perhaps algebra and biology teachers lack an understanding about using rubrics and performance exemplars as tools to effectively and methodically evaluate students' written work. Another interesting difference between literature teachers and their algebra and biology-teaching peers was that literature teachers selected *student-to student*

dialogue with considerably less frequency than *student-to-teacher dialogue*. Algebra and biology teachers selected the two forms of feedback with the same degree of frequency. Eight out of 18 algebra teachers (44.4%) selected *student-to student dialogue* and the same number of algebra teachers selected *student-to-teacher dialogue*. Five out of eight biology teachers (62.5%) selected *student-to student dialogue* and the same number of biology teachers selected *student-to-teacher dialogue*. Only two of 11 (18.2%) literature teachers, however, selected *student-to-student dialogue* in comparison to six out of 11 (54.5%) who selected *student-to-teacher dialogue* as a top form of feedback to most affect student learning.

The forms of feedback that teachers selected least frequently as having the most affect on student learning were consistent across the three subject areas. Only two teachers, one algebra teacher and one literature teacher, selected *pre-testing* which received only 1.4% of the total responses. *Online assessments* (i.e., Aims web, MAPs, or CDTs) was also consistently selected by the fewest number of teachers: only one algebra teacher, one literature teacher, and two biology teachers selected the feedback form, receiving just 2.8% of total responses. Additional variation among the three subject areas was evident among the forms of feedback selected by teachers that fell neither into the most selected or least selected categories as show below in Table 4. Table 4 shows the degree to which teachers in the different subject areas chose the different feedback strategies in relation to the total sample's ranking. Teacher respondents had the option to include self-defined forms of feedback that they perceived to have the most impact on student learning. Teachers reported four additional forms of feedback, which included the following responses:

- “wide variety of resources for students to use,”
- “completion of work,”

- “The teacher has to have a real grasp on what the content is and what is excluded and stick to the curriculum,”
- “Tests and other assessments designed in the style of the Keystone, using question stems and assessment anchors.”

While some of these open responses do not seem to fall within the category of a form of feedback, it is evident that the teachers who provided the responses felt strongly about the fact that it had more of an impact on student learning than the feedback responses that were available for selection.

4.1.2 Teacher regularity in using practices that most impact student learning

Teachers reported how frequently they used each form of feedback with students in their Keystone courses. Thirty-six teachers completed this response on the survey. That is one fewer than the number who completed the question about which forms of feedback teachers believed had the most impact on student learning. Thirty-four of 36 (94.4%) of teachers reported that they used *student-to-teacher dialogue* regularly or almost daily in the classroom. The second most frequently used forms of feedback were *review of homework* (29/36, 80.6%) and *review of quizzes and tests* (29/36, 80.6%) which were reported by the same number of teachers who use those forms regularly or almost daily. The third most frequently used form of feedback was *written work that explains student thinking or learning*, 28/36, 77.8%.

Zero teachers reported that they used *pre-testing* regularly or almost daily in the classroom, and only one teacher, or 2.8%, reported using online assessments regularly or almost daily. It makes sense that *online assessments* would not be used more than occasionally because these are typically diagnostic or benchmark type assessments that provide teachers with data to

inform instructional decisions, but it is interesting to note that 16/36 (44.4%) did not use them at all. These data may reflect a lack of technology available to teachers to use such tools, or teachers may not see additional value in the information provided by such tools. Pre-testing was another form of feedback that teachers used on an occasional basis rather than a regular or almost daily basis. Thirty of 36 teachers, or 83.3%, reported using *pre-testing* on an occasional basis and 6/36 or 16.7% did not use *pre-testing* at all. This is interesting to note in light of the fact that 29/36 teachers, or 80.6%, of teachers reported that they use the *review of quizzes and tests* as a form of feedback to students regularly or almost daily. This suggests that many teachers are likely to skip the use of pre-testing prior to teaching concepts that are evaluated by means of a quiz or test. It may be that teachers feel pressed for time to fit in curricular content during the academic year that pre-testing is perceived as not worthy of the time to administer and correct. However, because pre-testing also ranked lowest in number of teachers who believed it had the most impact on student learning, the data suggest that teachers simply do not perceive as much value in pre-testing and therefore do not use it regularly.

When comparing teacher perceptions about which practices make the greatest impact on student learning to those practices teachers use most regularly in their classroom, there were some consistencies and some variation. One notable consistency was that 10 of 11 literature teachers (90.9%) reported *using rubrics and performance exemplars to discuss quality work* regularly or almost daily. Literature teachers most often identified this form of feedback as one of the forms of feedback that has the most impact on student learning. Teachers within all three Keystone courses reported using *written work that explains student thinking or learning* on a regular basis, with 28/36 (77.8%) stating they use the form of feedback regularly or almost daily. Teachers within all three Keystone courses reported using *student-to-teacher dialogue* most

frequently, as 34/36 (94.4%) stated using the form of feedback regularly or almost daily. These data were consistent with the fact that 19/37 (51.4%) of teachers reported the perception that *student-to-teacher dialogue* was among the forms of feedback that had the most impact on student learning.

Other forms of feedback used by most teachers on a regular basis include *review of homework* and *review of tests and quizzes*, each with 80.6% of teachers reporting using the form of feedback regularly or almost daily. Algebra teachers rated *review of homework* highest as a form of feedback that has the most impact on student learning. Sixteen of 17 algebra teachers, or 94.1%, reported using the form of feedback regularly or almost daily. Biology and literature teachers did not select *review of homework* as frequently as algebra teachers did. Five of eight (62.5%) biology teachers and nine of 11 (81.8%) literature teachers reported using *review of homework* regularly or almost daily. *Review of tests and quizzes* was reported as used regularly or almost daily by 29/36 (80.6%) of all teachers; however, only 14/37 (37.8%) of teachers selected it as a top choice when asked if it had the most impact on student learning.

Forms of feedback that teachers selected the least in response to having the most impact on student learning included *pre-testing* and *online assessments*. No teachers reported using *pre-testing* on a regular or almost daily basis, which is consistent with their perception, as a group, that it does not have the most impact on student learning. Due to the nature of the online assessment form of feedback, it is more sensible to look at the percentage of teachers who do not use them or who use them occasionally because the nature of this feedback form. *Online assessments* were not used by 44.4% of teachers, but 52.8% reported using them occasionally. Table 5 shows the breakdown of each form of feedback and its regularity of use by teachers. Tables 5a, 5b, and 5c show the same information disaggregated by subject area.

Table 5. Regularity of feedback usage among teachers in rank order by most regularly used

	% did not use	n	% used occasionally	n	% used regularly or almost daily	n	Total n
Student-to-teacher dialogue	2.8	1	2.8	1	94.4	34	36
Review of homework	2.8	1	16.7	6	80.6	29	36
Review of quizzes and tests	0.0	0	19.4	7	80.6	29	36
Written work that explains student thinking or learning	2.8	1	19.4	7	77.8	28	36
Student-to-student dialogue	2.9	1	22.9	8	74.3	26	35
Reteaching and reassessing	0.0	0	44.4	16	55.6	20	36
Use of rubrics and performance exemplars to discuss quality work	2.8	1	47.2	17	50.0	18	36
Student self-assessments	20.0	7	60.0	21	20.0	7	35
Computer-based or online tutorial software	19.4	7	61.1	22	19.4	7	36
Online assessments	44.4	16	52.8	19	2.8	1	36
Pre-testing	16.7	6	83.3	30	0.0	0	36

*Percentages may not equal 100% due to rounding.

Table 5.a. Regularity of feedback usage among algebra teachers in rank order by most regularly used

	% did not use	n	% used occasionally	n	% used regularly or almost daily	n	Total n
Review of quizzes and tests	0	0	5.9	1	94.1	16	17
Student-to-teacher dialogue	0	0	5.9	1	94.1	16	17
Review of homework	0	0	11.8	2	88.2	15	17
Written work that explains student thinking or learning	0	0	17.7	3	82.4	14	17
Student-to-student dialogue	0	0	25	4	75	12	16
Reteaching and reassessing	0	0	41.2	7	58.8	10	17
Use of rubrics and performance exemplars to discuss quality work	5.9	1	64.7	11	29.4	5	17
Computer-based or online tutorial software	17.7	3	52.9	9	29.4	5	17
Student self-assessments	17.7	3	64.7	11	17.6	3	17
Online assessments	58.8	10	35.3	6	5.9	1	17
Pre-testing	17.7	3	82.4	14	0	0	17

*Percentages may not equal 100% due to rounding.

Table 5.b. Regularity of feedback usage among biology teachers in rank order by most regularly used

	% did not use	n	% used occasionally	n	% used regularly or almost daily	n	Total n
Student-to-teacher dialogue	12.5	1	0.0	0	87.5	7	8
Review of quizzes and tests	0.0	0	25.0	2	75.0	6	8
Student-to-student dialogue	12.5	1	12.5	1	75.0	6	8
Review of homework	12.5	1	25.0	2	62.5	5	8
Written work that explains student thinking or learning	12.5	1	25.0	2	62.5	5	8
Reteaching and reassessing	0.0	0	50.0	4	50.0	4	8
Use of rubrics and performance exemplars to discuss quality work	0.0	0	62.5	5	37.5	3	8
Computer-based or online tutorial software	25.0	2	50.0	4	25.0	2	8
Student self-assessments	50.0	4	37.5	3	12.5	1	8
Pre-testing	25.0	2	75.0	6	0.0	0	8
Online assessments	25.0	2	75.0	6	0.0	0	8

*Percentages may not equal 100% due to rounding.

Table 5.c. Regularity of feedback usage among literature teachers in rank order by most regularly used

	% did not use	n	% used occasionally	n	% used regularly or almost daily	n	Total n
Student-to-teacher dialogue	0.0	0	0.0	0	100.0	11	11
Use of rubrics and performance exemplars to discuss quality work	0.0	0	9.1	1	90.9	10	11
Review of homework	0.0	0	18.2	2	81.8	9	11
Written work that explains student thinking or learning	0.0	0	18.2	2	81.8	9	11
Student-to-student dialogue	0.0	0	27.3	3	72.7	8	11
Review of quizzes and tests	0.0	0	36.4	4	63.6	7	11
Reteaching and reassessing	0.0	0	45.5	5	54.5	6	11
Student self-assessments	0.0	0	70.0	7	30.0	3	10
Computer-based or online tutorial software	18.2	2	81.8	9	0.0	0	11
Pre-testing	9.1	1	90.9	10	0.0	0	11
Online assessments	36.4	4	63.6	7	0.0	0	11

*Percentages may not equal 100% due to rounding.

4.1.3 Teacher perceptions about student use of feedback provided

In addition to reporting the types of feedback forms that teachers believe have the most impact on student learning and the frequency to which they reported using each form of feedback, teachers also reported a level of agreement pertaining to whether or not they believed their students used the feedback provided to them to improve their performance. Teachers responded to a Likert Scale with the following choices: strongly agree, agree, disagree, or strongly disagree. Teachers also had the option to state that they were uncertain about the matter.

The majority of teachers expressed that they believed their students used the feedback provided to improve upon their performance in the course. Thirty-six teachers among the three subject areas responded to the question. Seven (19.4%) teachers strongly agreed and 23/36 (63.9%) teachers agreed that their students used the feedback they received to improve their performance in the course. Four (11.1%) teachers disagreed and one teacher (2/8%) strongly disagreed that their students used the feedback they received to improve their performance in the course. Only one teacher (2/8%) reported that he or she was uncertain about whether or not his or her students used feedback provided to improve performance in the course. Disaggregation of these data by subject area did not present any notable differences in teacher perceptions about their students' use of feedback to improve performance in the course.

Table 6. Teacher agreement with statement that their students used feedback to improve performance

	All Teachers (n = 36)		Algebra (n = 17)		Biology (n = 8)		Literature (n = 11)	
	%	n	%	n	%	n	%	n
Strongly Agree	19.4	7	23.5	4	12.5	1	18.2	2
Agree	63.9	23	52.9	9	75.0	6	72.7	8
Disagree	11.1	4	11.8	2	12.5	1	9.1	1

Table 6 continued

Strongly Disagree	2.8	1	5.9	1	0.0	0	0.0	0
Uncertain	2.8	1	5.9	1	0.0	0	0.0	0

One insight offered by a literature teacher who participated in an interview suggested that students in honors level courses may be more likely to take advantage of feedback provided during a course to improve their performance in that course. During the interview, the teacher explained that students in her honors courses were more likely to stop by her classroom before or after class to ask for additional feedback that was likely to improve their performance in the class. She explained that the honors students typically showed a greater interest in high achievement and were willing to work harder to acquire the desired level of achievement. The teacher wondered if the honors level students embraced the growth mindset approach to learning more than her non-honors level literature students.

4.2 SELF-REPORTED MINDSET CHARACTERISTICS OF KEYSTONE COURSE TEACHERS

Growth mindset is a journey along a continuum. Upon revisiting earlier research on growth mindset in relation to public interpretation of her work, Dweck (2013) shared dissatisfaction with interpretations that people were of either a growth mindset or a fixed mindset. She emphasized that we should think about the body of research on mindset as a journey along a continuum where people exhibit a blend of growth and fixed mindset characteristics. Consequently, people may fall closer to one end of the continuum, depending upon the prevalence of growth mindset characteristics versus fixed mindset characteristics, rather than possessing either a growth or

fixed mindset. In respect of Dweck's revisited explanation about mindset theory, the researcher chose to explore the mindsets of Pennsylvania Keystone course teachers along a weak to strong continuum of growth mindset based on teachers' self-reported levels of agreement with statements that aligned directly or inversely to growth mindset characteristics. Growth mindset characteristics explored in this chapter consist of teachers' self-reported beliefs about intellectual capacity and beliefs about a person's ability to change. The ability to change may relate to changing intellectual capacity and degree of success.

Research question two explored the self-reported mindsets of Pennsylvania Keystone course teachers. Question two asks, **“What are the self-reported mindset-based characteristics, related to the research of Carol Dweck, of teachers and their teaching in the PA Keystone courses? What are their self-reported beliefs about intellectual capacity? What self-reported characteristics of their teaching practice support a growth mindset?”**

Teachers reported a level of agreement or disagreement with statements that were congruent with characteristics along the growth mindset continuum. While the survey offered choices for strong agreement and strong disagreement, the researcher chose to recode responses based only on agreement or disagreement due to the low response rate. Therefore, the results can only offer insight regarding a level of agreement and not the degree to which teachers agreed or disagreed with a statement. Teachers also had the option to report that they were uncertain about whether they agreed or disagreed with the statement. Teachers also had the option to withhold a response to any of the statements.

Effort and intellectual capacity are two dominant themes discussed within the literature about mindsets (Dweck, 2006). The theme of effort relates to a person's ability to change in relation to the amount and quality of work dedicated to making the change (Dweck, 2013). To

determine where Keystone course teachers might fall along the growth mindset continuum in relation to the themes of effort and intellectual capacity, the researcher composed 10 statements associated with mindset characteristics described within the literature. Thirty-six teachers responded with a level of agreement or disagreement. Occasionally, a teacher responded that he or she was uncertain about agreement or disagreement with a particular statement. On rare occasion, a teacher chose not to respond to a statement or neglected to respond to a statement. Among the 10 statements, six related to theme of effort and four related to the theme of intellectual capacity. To determine where a teacher might fall along the growth mindset continuum, the researcher attributed a growth mindset point when a teacher selected a level of agreement with the following seven statements:

- My students could increase their intellectual capacity with effort.
- My students worked hard enough to meet learning expectations.
- My students monitored their progress in relation to learning expectations.
- I observed my students grow in relation to learning expectations throughout the course.
- I adjusted my teaching based on formative assessment of my students.
- Students who did not succeed did not work hard enough.
- My students had the intellectual capacity to meet the learning expectations.

The researcher also attributed a growth mindset point when a teacher selected a level of disagreement with the following three statements:

- My students' intellectual capacity was not likely to change much regardless of effort.
- The Keystone exam was too difficult for my students.
- Students who did not succeed did not have the intellectual capacity to do so.

The researcher assigned one of three mindset categories along the continuum of growth mindset. Those categories were strong, moderate, and weak. A strong growth mindset categorization represents teachers with eight to 10 growth mindset points. A moderate growth mindset categorization represents teachers with six or seven growth mindset points, and a weak growth mindset categorization represents teachers with five or fewer growth mindset points.

The mean growth points earned among 36 teachers was 7.1 with a median of 7.0. Disaggregation of the data by subject area showed little variation among algebra and literature teachers; however, the mean and median growth points of the eight biology teachers was lower. Table 7 shows the details for the aggregate and disaggregate groups.

Table 7. Mean and median growth points by subject

	Mean Growth Points	Median Growth Points
All subjects (n=36)	7.1	7.0
Algebra (n=17)	7.1	7.0
Biology (n=8)	6.3	6.0
Literature (n=11)	7.7	7.0

Most responding teachers, 16/36 (44.4%) fell into the category of a moderate level of growth mindset based on self-reported levels of agreement or disagreement to statements related to effort and intellectual capacity. Almost as many teachers, 14/36 (38.9%), fell into the category of a strong growth mindset, and the fewest number of teachers, 6/36 (16.7%), fell into the category of a weak growth mindset. Table 8 shows the details for the aggregate and disaggregate groups.

Table 8. Numbers of teachers in strong, moderate, and weak growth mindset categories

	strong		moderate		weak	
	%	n	%	n	%	n
All subjects (n=36)	38.9	14	44.4	16	16.7	6
Algebra (n=17)	35.3	6	52.9	9	11.8	2
Biology (n=8)	37.5	3	12.5	1	50.0	4
Literature (n=11)	45.5	5	54.5	6	0.0	0

It is not surprising that the majority of teachers fell into the strong and moderate growth mindset categories. The literature of mindset theory has become a mainstream topic for reading and professional development among educators. Therefore, it is possible that a number of respondents were knowledgeable about mindset theory and responded in ways that were in alignment with strong mindset characteristics because they perceived it as the desirable way to respond. It is also possible that the nature of a person who enters the teaching field is more likely to align with stronger growth mindset characteristics, as they have a professional desire to help students learn and the learning process naturally is one associated with growth.

The number of teachers who fell into the moderate growth mindset category matches Dweck's conclusion that most of us are a mixture of growth and fixed mindsets (Dweck, 2013). Characteristics associated with a fixed mindset are most likely to surface when a person faces challenges or adversity (Dweck, 2013). In light of the struggles associated with teaching students to earn proficient scores on the Pennsylvania Keystone Exams, with the added stressor of being evaluated in part by student exam proficiency, it makes sense that a teacher would make some responses associated with a fixed mindset. For example, 16/36 (44.4%) teachers agreed that the Keystone exam was too difficult for their students. One-third (12/36, 33.3%) of teachers responded that they believed that their students who did not pass the exam, did not have the

intellectual capacity to do so. One-third (12/36, 33.3%) of teachers also responded that they agreed that a student's intellectual capacity was not likely to change much regardless of effort. Teachers who fell into the moderate growth mindset category mostly responded in favor of growth mindset characteristics with just three or four deviations. They may have also chosen to respond that they were uncertain about their stance on a statement or perhaps failed to provide a response to a statement. Both of these occurrences would have decreased the number of points they received in terms of where they fell on the growth mindset continuum.

Teachers who fell into the weak growth mindset category chose agreement with growth mindset characteristics to 50% or fewer statements. Teachers in this category were also more likely to have chosen a greater number of uncertain responses. It is noteworthy that zero of 11 literature teachers were among the weak mindset category. Biology teachers had the highest rate of teachers who fell into the weak growth mindset category, 4/8 (50.0%).

The following sections will address research questions that explore any potential relationships between the mindsets of teachers, the frequency which they utilize the forms of feedback that were studied, and the percentage of students who earned proficient or advanced scores on the Keystone exams.

4.3 RELATIONSHIP BETWEEN TEACHER MINDSET AND FEEDBACK PROVIDED TO STUDENTS

One purpose of the study was to explore the degree that teacher mindset influenced forms of feedback they used with students and the frequency to which they used different forms of feedback. Research questions three asked, “**What are the relationships among a teacher's self-**

reported beliefs about intellectual capacity, classroom practices that support growth mindset, and the nature of feedback?”

Cross tabulation of a teacher’s strong, moderate, or weak mindset category and the numbers of teachers who reported using each listed form of feedback regularly or almost daily, did not provide evidence of significant differences for most feedback types. This chapter discusses these cross tabulation tables followed by a discussion about possible implications and limitations of these analyses.

4.3.1 Comparison of feedback usage frequency by teacher growth mindset category

The frequency which teachers in each growth mindset category utilized a particular type of feedback did not differ markedly in most cases. For example, the feedback type *written work that explains student thinking* was reported to be used regularly or almost daily by 12/14 (85.7%) of teachers in the strong growth mindset category, by 12/16 (75%) of teachers in the moderate growth mindset category, and by 4/6 (66.7%) of teachers in the weak growth mindset category.

Looking only at the percentages may be misleading when comparing the strong growth mindset and weak growth mindset categories, as the difference in the percentages appear to be large. However, this is not the case due to the lower number of teachers (6/36, 16.7%) represented in the weak growth mindset category. Therefore, it makes more sense to look at the raw numbers of teachers in relation to the total number of teachers in each growth mindset category rather than to look at percentages alone.

Tables 9a, 9b, and 9c present the cross tabulation data for teachers in each growth mindset category in relation to the reported frequency that they used each type of feedback. Table 8a presents the data on teachers who reported regular or almost daily usage of each

feedback type. Table 8b presents the data on teachers who reported occasional usage of each feedback type. Table 8c presents the data on teachers who reported no usage of each feedback type. One teacher who was categorized as having a strong growth mindset failed to make a selection regarding his or her frequency of use for the feedback type *student self-assessments*, and consequently is not represented in the tables for that item.

Table 9.a. Number of teachers reporting regular use of feedback type by growth mindset category

	Strong Growth Mindset (n=14)		Moderate Growth Mindset (n=16)		Weak Growth Mindset (n=6)	
	%	n	%	n	%	n
1. Review of homework	78.6	11	87.5	14	66.7	4
2. Review of quizzes and tests	92.9	13	75.0	12	66.7	4
3. Use of rubrics and performance exemplars to discuss quality work	71.4	10	37.5	6	33.3	2
4. Reteaching and reassessing	64.3	9	43.8	7	66.7	4
5. Student-to-student dialog	78.6	11	62.5	10	83.3	5
6. Student-to-teacher dialog	92.9	13	93.8	15	100.0	6
7. Written work that explains student thinking or learning	85.7	12	75.0	12	66.7	4
8. Computer-based or online tutorial software	14.3	2	25.0	4	16.7	1
9. Pre-testing	0.0	0	0.0	0	0.0	0
10. Student self-assessments	21.4	3	18.8	3	16.7	1
11. Online assessments (AimsWeb, CDTs, MAPs, etc.)	0.0	0	6.3	1	0.0	0
Note: One teacher in the strong growth mindset category did not choose a frequency response for item 10 "Student Self-Assessments."						

Table9.b. Number of teachers reporting occasional usage of feedback type by growth mindset category

	Strong Growth Mindset (n=14)		Moderate Growth Mindset (n=16)		Weak Growth Mindset (n=6)	
	%	n	%	n	%	n
1. Review of homework	21.4	3	12.5	2	16.7	1
2. Review of quizzes and tests	7.1	1	25.0	4	33.3	2
3. Use of rubrics and performance exemplars to discuss quality work	28.6	4	56.3	9	66.7	4
4. Reteaching and reassessing	35.7	5	56.3	9	33.3	2
5. Student-to-student dialog	21.4	3	31.3	5	16.7	1
6. Student-to-teacher dialog	7.1	1	0.0	0	0.0	0
7. Written work that explains student thinking or learning	14.3	2	18.8	3	33.3	2
8. Computer-based or online tutorial software	64.3	9	62.5	10	50.0	3
9. Pre-testing	92.9	13	68.8	11	100.0	6
10. Student self-assessments	57.1	8	62.5	10	50.0	3
11. Online assessments (AimsWeb, CDTs, MAPs, etc.)	57.1	8	43.8	7	66.7	4
Note: One teacher in the strong growth mindset category did not choose a frequency response for item 10 "Student Self-Assessments."						

Table 9.c. Number of teachers reporting no usage of feedback type by growth mindset category

	Strong Growth Mindset (n=14)		Moderate Growth Mindset (n=16)		Weak Growth Mindset (n=6)	
	%	n	%	n	%	n
1. Review of homework	0.0	0	0.0	0	20.0	1
2. Review of quizzes and tests	0.0	0	0.0	0	0.0	0
3. Use of rubrics and performance exemplars to discuss quality work	0.0	0	6.3	1	0.0	0
4. Reteaching and reassessing	0.0	0	0.0	0	0.0	0
5. Student-to-student dialog	0.0	0	6.3	1	0.0	0
6. Student-to-teacher dialog	0.0	0	6.3	1	0.0	0
7. Written work that explains student thinking or learning	0.0	0	6.3	1	0.0	0
8. Computer-based or online tutorial software	21.4	3	12.5	2	40.0	2
9. Pre-testing	7.1	1	31.3	5	0.0	0
10. Student self-assessments	14.3	2	18.8	3	40.0	2
11. Online assessments (AimsWeb, CDTs, MAPs, etc.)	42.9	6	50.0	8	40.0	2
Note: One teacher in the strong growth mindset category did not choose a frequency response for item 10 "Student Self-Assessments."						

4.3.2 Significance of feedback usage frequency by teacher growth mindset category

The researcher observed a potentially notable difference among the growth mindset categories of teachers for one of the feedback types listed in Table 8a. The regular/almost-daily usage of *rubrics and performance exemplars to discuss quality work* was reported more often among

teachers categorized as a strong growth mindset. While 33.3% (2/6) of teachers with a weak growth mindset and 37.5% (6/16) teachers with a moderate growth mindset reported using *rubrics and performance exemplars to discuss quality work* regularly or almost daily, 71.4% (10/14) teachers with a strong growth mindset reported using this form of feedback regularly or almost daily.

Curious about whether this observed difference was statistically significant, I performed a Chi Square test on the specific data set. The observed values for strong, moderate, and weak growth mindsets were 10, 6, and 2 respectively. The expected value was 6, and the P-value was 0.069. Therefore, the differences among the growth mindset categories in using *rubrics and performance exemplars to discuss quality work* is not statistically significant. Additionally, because the observed value of two is less than the required number 5, the Chi Square test may not be a reliable source of significance. To resolve the issue of an observed number less than five, the researcher merged the observed values of the moderate and weak growth mindset. The P-value returned for that Chi Square test was 0.64. There is no statistically significant difference between the observed and expected values.

Additional Chi Square tests on the data for other feedback types and feedback frequencies in relation to growth mindset categories of teachers did not yield any statistical significance. **Therefore, based on this sample of data, we may conclude that there is no relationship between teacher mindset and the nature of feedback provided to their students.**

4.3.3 Limitations and recommendations for future research

It is possible that the small sample size limited the potential for this study to find a relationship between teacher mindset and the nature of feedback provided to their students. It is also possible that teacher mindset plays no significant role in the decisions that teachers make regarding types and frequency of feedback provided to students. It may be that teachers are likely to utilize various feedback strategies during the teaching and learning process because they believe they are most likely to make an impact on student learning, regardless of their beliefs about intellectual capacity or effort. A number of other factors such as recent professional development initiatives, expectations of supervisors, and availability of technology and curricular materials may also influence the decisions teachers make regarding what feedback types are used with students and how often. The exploration of additional variables that may play an influential role in teacher selection of feedback types and frequencies used to guide student learning is recommended for future research.

In addition to the small sample size, another limitation of this study was the reliance on teacher self-reporting of all data. It is possible that teachers reported regularity for feedback choices that they believed to be most desirable rather than actual reflections of their practice. An interesting future study might include observations of teachers in practice, noting the forms of feedback they use with students to guide the learning process. Characteristics relating to growth mindset could also be observed by the comments teachers make as well as by the structure and facilitation of a lesson.

The researcher also recommends future research on the use of growth mindset characteristics as a means for personal reflection. While having a strong growth mindset did not relate to the types of feedback teachers provide to students in this study's sample, it might

instead relate to degrees of perseverance students have when confronted with challenging new learning goals. It may also relate to the likeliness of a student choosing challenging learning experiences in the first place. For example, there may be a relationship between growth mindset characteristics and students enrolled in honors level courses versus non-honors level courses, as the teacher interviewee noticed.

4.4 RELATIONSHIP BETWEEN THE NATURE OF FEEDBACK AND STUDENT KEYSTONE EXAM PERFORMANCE

It may be possible that the nature of feedback teachers provide to students during a course will influence student performance on an end-of-course exam. The fourth research questions of this study explores the relationship between student performance on Pennsylvania Keystone exams and the nature of feedback provided to students during the Keystone course. Research question four specifically asks, **“What is the relationship between the nature of feedback provided to students enrolled in a Keystone course and the performance of those students on the corresponding Keystone exam?”** Before looking at the potential relationship between the nature of feedback and student Keystone exam performance, the researcher will discuss student data within the sample of Keystone teachers’ courses.

4.4.1 Description of student data within respondents’ Keystone courses

The responding teachers reported teaching various numbers of students in their Keystone courses. They reported the number of students enrolled in their Keystone courses in May of

2016. The range of students reported was 11 to 132. Two algebra teachers did not report the number of students taught. In total, all Keystone course teachers reported having taught 2,341 students in their Keystone courses in May of 2016. The Pennsylvania Department of Education requires that school administer its Keystone exams during its designated assessment window. During the 2015-2016 school year, the Keystone testing window was May 16-27, 2016. Among the 2,341 students reported by teachers as enrolled in their Keystone courses in May, 2,267 students took the corresponding Keystone exam for the course. Seventy-four students did not take the Keystone exam for the course, roughly 3% of the reported student population.

While the Pennsylvania Department of Education (PDE) requires that all students take the Keystone exam at the end of the corresponding Keystone course, there is one exception. Students whose parents follow strict procedures outlined by PDE are excused from taking the exam if they follow protocol with the school to review the exam and write a letter to the district superintendent explaining that they have a religious conflict with their child taking the exam. Because 3% of the students enrolled in the Keystone course did not take the exam, some parents exercised their rights to opt their child out of the exam. The 3% of the students reported by teachers in the study may not have all been opted-out of the exam by parents, however. There are a number of explanations for the discrepancy between the number of students enrolled in a Keystone course and the number of students who take the end-of-course exam. The following possibilities may include student withdrawal from the school just before or during the testing window. There are also times when a student has a medical reason to be absent or unable to take the exam (i.e. concussion) for the duration of the testing window and the week following the testing window used for make-up exam purposes. English Language Learners may also be excused from taking the Keystone Literature exam if they are enrolled in the Keystone Literature

course during their first year enrolled in a U. S. school. It is also possible that some students enrolled in Keystone course for the second time because they did not earn a passing grade in the course the first time. PDE does not permit students to retake the Keystone exam if they earned a proficient or advanced score during a previous attempt. The research survey did not ask teachers to specify why students did not take the Keystone exam at the end of their course; therefore, any combination of these reasons could explain the 3% discrepancy.

Among the 40 teacher respondents who completed the research survey, 39 reported that they reviewed the Keystone exam results of their students who took the exam in May of 2016. One teacher left the question blank and did not complete any additional survey questions.

Among the 39 teacher respondents who reported reviewing the test results for their students, three did not respond to the questions about the forms of feedback they use with their students. Among the 36 teachers who completed questions about the forms of feedback used with students, seven reported that they did not know the proficiency percentage of their students who took the Keystone exam that corresponded with their course. Therefore, the sample size to explore this research question is 29 teachers.

4.4.2 Description of student performance data on Keystone exams

Among the sample of 29 teachers who provided data for both feedback used in the course and the percentage of students who earned proficient or advanced scored on the Keystone exam for their course, 13 taught Algebra I, eight taught biology, and eight taught literature. The phrase ‘proficiency percentage’ describes the number of students who earned a proficient or advanced score on the Keystone exam. The ranges of reported proficiency percentages for each subject area are 12.5% - 100% for algebra teachers, 35%-100% for biology teachers, and 1%-95% for

literature teachers. The mean and median proficiency percentages are 53.9% and 45% for algebra teachers, 71% and 70% for biology teachers, and 65.1% and 78.5% for literature teachers.

4.4.3 Relationship between feedback provided to students and Keystone exam proficiency

The researcher used cross tabulation and Chi Square analyses to explore a potential relationship between the types of feedback teachers regularly use to guide student learning in their Keystone courses and student proficiency percentages on the corresponding Keystone exams. Because 23 different responses for the proficiency percentage were provided by 29 teachers, the researcher divided the sample in half based on the reported proficiency percentages. The chosen cut score was a proficiency percentage of 65%. Fifteen teachers reported proficiency percentages above 65%. For readability purposes, the researcher named them Proficiency Group 1. Fourteen teachers reported proficiency percentages below 65%. The name for this second group is Proficiency Group 2. The difference among descriptive statistics between the two proficiency groups is significant. The mean and median of Proficiency Group 1 are 89.0% and 94.7% respectively. The mean and median of Proficiency Group 2 are 32.5% and 35%. Because of these differences between the two proficiency groups, the researcher is comfortable that the cut score of 65% was an appropriate cut score to create two groups that are different enough from one another to explore a potential relationship to the regular or almost daily feedback types used by teachers to guide student learning.

Data were similar between Proficiency Groups 1 and 2 for most feedback types used regularly or almost daily by teachers. Table 10 shows the cross tabulation of the data.

Table 10. Comparison of teachers' use of feedback types by proficiency group

	Proficiency Group 1, above 65% (n=15)		Proficiency Group 2, below 65% (n=14)	
	%	n	%	n
1. Review of homework	86.7	13	71.4	10
2. Review of quizzes and tests	66.7	10	71.4	10
3. Use of rubrics and performance exemplars to discuss quality work	53.3	8	35.7	5
4. Reteaching and reassessing	66.7	10	50.0	7
5. Student-to-student dialog	66.7	10	78.6	11
6. Student-to-teacher dialog	86.7	13	100.0	14
7. Written work that explains student thinking or learning	60.0	9	92.9	13
8. Computer-based or online tutorial software	13.3	2	35.7	5
9. Pre-testing	0.0	0	0.0	0
10. Student self-assessments	20.0	3	21.4	3
11. Online assessments (AimsWeb, CDTs, MAPs, etc.)	0.0	0	7.1	1

4.4.4 Significance of feedback usage frequency by proficiency group

The researcher selected four feedback types for Chi Square testing because they met the minimum required observed value of five and one proficiency group had at least three more teachers reporting regular use compared to the other. The four groups selected were as follows: *review of homework, use of rubrics and performance exemplars to discuss quality work, reteaching and reassessing, and written work that explains student thinking or learning.* The Chi Square test for each of the feedback types indicated that **there was no significant relationship present between regular use of feedback types and proficiency levels on the Keystone exam.**

4.4.5 Limitations and recommendations for future research

The small sample size limited the potential for this study to find a relationship between nature of feedback provided to their students and subsequent performance of students on the Keystone exam. It is also possible that the nature of feedback plays no significant role increasing or decreasing student performance on the Keystone exam. It may be that teachers are likely to utilize various feedback strategies during the teaching and learning process because they believe they are most likely to make an impact on student learning, regardless of whether or not empirical evidence shows that it actually makes a difference. A number of other factors such as recent professional development initiatives, expectations of supervisors, and availability of technology and curricular materials may also influence the decisions teachers make regarding what feedback types are used with students and how often. It is possible that teachers reported regularity for feedback choices that they believed to be most desirable rather than actual reflections of their practice. An interesting future study might include observations of teachers in practice, noting the forms of feedback they use with students to guide the learning process. It is also possible that the feedback teachers regularly provided to students had a greater influence on course grades than Keystone exam performance. Because the researcher did not collect data related to course performance, it is unknown whether the feedback teachers provided was in any way related to course performance. The researcher recommends that future research explore relationships to both course performance and end-of-course exam performance as well as the rigor-level of the course being studied (i.e., honors, college prep, etc.)

The reliance on teacher self-reporting of all data was another limitation of the study. It is possible that teachers reported regularity for feedback choices that they believed to be most desirable rather than actual reflections of their practice. Future research may explore

relationships between feedback types used and student performance in the course and on end-of-course exams using a combination of observations and self-reporting to collect data about feedback types used and their frequencies of use by teachers. With a larger sample size, it is recommended that disaggregation among content areas also be further explored.

The researcher finally acknowledges that many variables influence student performance. Exploring just a small piece of the teaching and learning experience, such as feedback provided to students, is a limitation in itself. Research questions five and six explore teachers' perceptions about other factors that influence student performance on Keystone exams and the most significant challenges they face in trying to prepare their students to pass the Keystone exams.

4.5 CHALLENGES ASSOCIATED WITH PREPARING STUDENTS TO PASS KEYSTONE EXAMS

With Pennsylvania's undesirable pass rates on Keystone exams, I felt that it was only fair to ask teachers about their reasoning about the pass rates. The final two research questions for the study were as follows: **What do Keystone course teachers report as possible reasons that more of their students do not earn the minimum proficiency score on the Keystone exam? What do teachers of Keystone courses identify as the most significant challenges to successfully preparing more of their students to pass the Keystone exams at the end of the course?** The researcher compiled data on emergent themes among 35 teachers' open-ended responses about the topic. The three leading themes reported were student motivation, time, and lack of pre-requisite skills for the Keystone course.

Fourteen responses indicated that teachers struggle with a lack of motivation among their students. Some respondents pointed to recent changes in state laws that delayed proficiency on the exams as a graduation requirement and the elimination of the requirement to place exam performance levels on transcripts. Teachers reported that these changes contributed to a change in students' perceptions about the test. They stated that they struggle with getting students to take the exams seriously, to take responsibility for their own learning, and to put forth their best effort throughout the course and on the exam. One teacher commented that students just do not seem to care about their learning or performance on exams. Teachers also expressed that they struggled to provide a persuasive rationale for students to do their best in the course and on the exams. They claimed that students just did not take the subject matter seriously and did not see a connection between the content and relevance to their future. One teacher even agreed that the biology test was not relevant, "This test is not relevant for skills or knowledge that average people will benefit from in society, and reads like a group of people sat in a room and tried to prove how clever they were."

In effort to improve student motivation, one teacher mentioned that his or her school provided an incentive for students to do well on the Keystone exam for literature. School officials permitted students who earned a proficient or advanced score on the literature exam to elect a semester English course during their junior and senior years.

Time was the second most prevalent theme among teacher responses. Ten teachers commented about a lack of enough time for one reason or another. Teachers mostly expressed that there was not enough time to cover the eligible content for the exams. Algebra teachers were especially vocal about this. They commented that the Keystone exam for algebra tested content that was considered Algebra II material, and they simply did not have enough time to cover all of

the tested areas. Algebra teachers who taught students in eighth grade had an additional concern about having enough time to cover content because they not only had to prepare students for the Keystone exam, but also cover additional content that was tested on the eighth grade Pennsylvania State System of Assessments (PSSA) math exam. There is an overlap in the state's testing cycles for PSSAs and Keystones when a student takes Algebra I before ninth grade. One teacher commented that time was an issue in terms of providing adequate feedback in a timely manner to all students.

The third leading theme among teachers, eight responses in total, was that students did not have the necessary prerequisite skills to be successful in the course or on the exam. One teacher stated, "The current sophomore and freshman classes have a very difficult time processing higher level application type problems because that don't have good number sense skills." Another teacher commented, "Some of my students struggle with knowing how to read." Teachers stated that the expectations of the Keystone courses and their corresponding exams did not take into account the needs of struggling learners who work below grade level. There is a sense that the Keystone courses and exams were a one-size-fits-all approach and did not consider the array of students with unique needs.

Other teacher responses included comments relating to challenges associated with the following: balancing course concepts with tested skills, getting students to cite textual evidence, not having clear data on student performance for the literature exam, inconsistencies in the way that the test assesses the same anchor, a lack of student attendance, family and other personal issues that exist in student lives, and even that students do not have the intellectual ability and stamina to succeed on the Keystone exams.

4.6 CONSIDERATIONS FOR PENNSYLVANIA POLICY

At the conclusion of this study, the Pennsylvania Department of Education was in process of determining whether to continue use of the Keystone exams as a graduation requirement. They were considering additional pathways to meet graduation requirements, especially for students with special needs and students whose future ambitions do not involve college. Discussion among lawmakers included waiving Keystone exam proficiency in one or more of the subject areas for the attainment of industry credentials that are valued within a particular career path. Legislators also presented the option of using a combined average of the three Keystone exam scaled scores to determine an overall proficiency score across subject areas as a graduation requirement. There was also discussion about the transition between PSSA requirements and Keystone exam requirements. Policy makers may wish to consider granting PSSA exam waivers when enrolled in a Keystone course for the same subject area prior to completing eighth grade. This would address the argument that there is too much content for teachers to cover and students to master when PSSA and Keystone standards (two separate sets of standards that do not completely overlap) are tested at the end of the 7th or 8th grade Keystone course.

Conflicting messages about graduation requirements, the delay of such requirements, and rhetoric in the media among stakeholders regarding the relevance of the Keystone exams potentially contributed to a decrease in motivation for students to give their best effort on the exams and for schools to fund remediation programs for students to perform better on a retest examination. Regardless of the outcome decided by lawmakers, the implications of this study pertain to any end-of-course exam situation. While the results represent a small sample size and are not generalizable to any population, there are a few key implications for educational practice. The results suggest that teachers have a tendency to practice what they perceive to be most

effective. There was considerable congruence among the feedback types that teachers identified to have the most impact on student learning and the feedback types they used regularly. Therefore, when school leaders desire a particular practice to be utilized more often by teachers, it is advisable that they address the impact that practice has on learning outcomes and have discussions with teachers about their perceptions of the potential impact on student learning and any challenges to successful implementation that should be addressed.

The study's findings did not suggest that there is any relationship between the type of feedback teachers regularly use and student achievement. These results suggest that there are additional factors that contribute to a lack of student achievement that regular feedback alone cannot address. Additionally, data collected during an interview suggest that feedback may most be utilized by students who place a high value on academics and achievement. Such students typically seek academic challenges by taking honors level courses. Perhaps the students who have a history of success in the academic areas that have prepared them to persevere when confronted with constructive feedback and take action to achieve learning goals. Teachers and school leaders may wish to consider ways to help additional students, not just honors level students, acquire these skills by setting specific learning goals that they need to use constructive feedback to achieve. They may want to engage students in reflective discussions about how they may use feedback provided by teachers to attain a better outcome. Through these discussions, teachers may learn more about what their students like about the feedback they receive, and how they are likely to take action with the feedback they receive.

The study's findings also did not support that there is a relationship between the feedback types that teachers used regularly with students and their mindset characteristics about intellectual capacity and effort. This may also suggest that teachers are likely to practice what

they feel will have the most impact on student learning even if they do not believe their students are capable of learning what they are teaching or if they believe that students do not have the motivation to exert the effort to succeed in the subject area. There seem to be established routines that teachers follow in relation to providing feedback to students because they believe the routines have the most impact on learning. Where teachers may fall short is with the implementation of routines to ensure that students utilize the feedback in a manner that leads to improved academic performance.

The literature suggests that computer-based formative assessments are a way to provide students with timely feedback that students could use to improve achievement (Wilson et al, 2011). However, teachers among the sample reported using this form of feedback the least or that they did not use it at all. School leaders may inquire about what computer-based formative assessments are available, appropriate, and feasible for teachers and students to use. The addition of such a resource may offer additional information about students' individual strengths and needs, tracking progress aligned to course and exam expectations throughout the year. The teacher and student may use the data as a focal point for discussion about learning goals. Determining effective ways to improve student achievement certainly involves addressing numerous variables. Some are within educator's realm of control; others are not. I believe, however, that providing and utilizing feedback can be a very effective way to improve student achievement if it is an iterative process where both the teacher and the student communicate regularly about learning expectations, the effort put forth to achieve the expectations, and the results of the learning that occurred. Feedback is important to the process of learning.

5.0 INSIGHTS THROUGH A LENS OF PROFESSIONAL PRACTICE

In the case of end of course exams, there is reason to believe that much can be done to provide students with better chances of earning minimum proficiency scores. While the sample size of this research study was small and did not yield a statistically significant relationship among the variables, the study offers some important insights. This chapter will discuss insights and implications for the field of education through a lens of professional practice. The discussion will revisit the research literature on feedback and mindsets to discuss these implications.

5.1 COMMUNICATION OF CCOURSE AND EXAM EXPECTATIONS

Research suggests that educators and their students would benefit from practicing effective feedback strategies. In order to benefit from feedback in a significant way, it is essential that students first understand the expectations for performance (Sadler, 1989). The results of this study indicate that all teachers used at least one document or resources to communicate course and exam expectations to students. The most utilized documents were the Scoring Guidelines for Constructed Responses, 31/37 (84%), and teacher-made syllabus, 30/37 (81%). The Scoring Guidelines for Constructed Responses is a helpful rubric to communicate the expectations for answering the constructed response questions on the Keystone exams. It explains how exam evaluators score these questions. While this is important information, it alone does not

communicate all of the course and exam expectations to students. It only communicates the expectations for responding to constructed response questions. It is possible that a teacher-made syllabus provides a more comprehensive set of expectations; however, without a review and analysis of the syllabi, the degree to which they are effective tools to communicate course and exam expectations is uncertain. One possibility for future research is to examine teacher-made syllabi in courses where an end-of-course exam is present to determine the degree to which they effectively communicate expectations.

Two documents that provide a comprehensive explanation of course and exam content expectations are the PA Core Standards for each Keystone course and their corresponding set of Anchors & Eligible Content. These documents provide a comprehensive listing of what content is to be learned throughout a Keystone course to prepare students for the Keystone exam. The PA Core Standards provide the overarching big ideas that students are expected to understand and the Anchors & Eligible Content provide more detail about the specific skills that students must be able to demonstrate to meet the expectations of each standard. Ideally, educators would use both documents in tandem to share course and exam expectations with students. It is problematic that 38% (14/37) of Keystone course teachers utilized the PA Core Standards and 49% (18/37) reported using the corresponding Anchors & Eligible Content. Without clear and effective communication of the full course and exam expectations to students, successful use of feedback and self-regulation of meeting full course and exam expectations may be left to chance.

In contrast, 78% (29/37) of teachers used the Item & Scoring Sampler to communicate expectations to students. Because the Item & Scoring Sampler is just a sampler of released test items and explanations of correct and incorrect responses to the items, it is important to understand that this document in no way communicates the full set of expectations for learning

in the course. It is test preparation tool because it communicates the format and style of test questions. The document also provides comments related to exam question scoring and what evaluators look for in student responses. The results suggest the possibility that Keystone course teachers may only be communicating a partial set of expectations for learning in the course and therefore may only be partially preparing students for exam proficiency. Reflecting back on the disappointing proficiency percentages on Keystone exams from Chapter 2, the suggestion seems fitting.

Last, only 14% of teachers used the Keystone exam test blueprint to communicate expectations to students. Because the blueprint only offers insight about the emphases of test content and question types, it is most effectively used as a strategy guide for test preparation rather than a tool to understand the expectations for learning course content. Therefore, it is essential for teachers to communicate the full understanding of course content expectations before teachers and students can effectively use test preparation tools as supplemental resources.

The findings of the study suggest that teachers might improve the communication of course and exam expectations with students by sharing the PA Core Standards and their corresponding Anchors & Eligible Content explicitly and referring to them regularly as they move through the course curriculum. This would provide a foundation for the learning expectations and provide a focus for students' self-assessment and self-regulation. Utilizing these resources in such a manner aligns with the principles of good feedback practice described in Chapter 1.

5.2 USAGE OF FEEDBACK TYPES TO FACILITATE LEARNING

Feedback is a cycle of student and teacher actions that aims to advance the learning process. Chapter 1 discussed the seven principles of good feedback practice defined by Nicol & Macfarlane-Dick (2006) that facilitate self-regulation of the learning process. To recap, principle one addresses the need for teacher feedback that promotes dialogue about what the learning goals are and offers opportunities for students to assess their own progress toward the learning goals (Black & Wiliam, 1998; Sadler, 1989). The second principle calls for feedback to support reflection and self-assessment throughout the learning process. Principle three emphasizes the importance for a teacher to provide external feedback to students so they may troubleshoot and self-correct their own performance. Principle four calls for dialogue between the teacher and student, as well as among fellow students about the feedback provided. Principle five acknowledges the fact that student beliefs about intelligence and learning play a role in how they respond to teacher feedback and how they may assist or impede the student's commitment to self-regulated learning (Dweck, 1999; 2006). Principle six reiterates the importance of providing students with opportunities to reduce the discrepancy between their current level performance and the desired level of performance, and principle seven relates to the cyclical nature of good feedback whereas teachers also can self-regulate their own teaching, using feedback from formative assessments to inform decisions about future teaching (Nicol & Macfarlane-Dick, 2006).

Reflecting upon principles one and three, the results of the study raise concern about why only 20% (7/35) of teachers reported regular use of student self-assessment as a feedback strategy to help students succeed in Keystone courses and on the exams. If students have access to the PA Core Standards and the Anchors & Eligible Content, they may use those resources to

organize documentation of their mastery of content, monitor their progress in light of comprehensive expectations, and self-regulate plans and pacing for future learning. Future research may explore ways that effective teachers use feedback in such a manner. It may also inquire about why other teachers do not use the strategy to guide students and help them take ownership of their learning throughout the course on a regular basis. Based upon some of the open-ended responses from teachers in the survey, I acknowledge that there are a number of additional variables they may impede the feasibility of using self-assessment to improve the effectiveness of using the feedback cycle to increase student achievement. Some variables identified during the study include lack of time, lack of student motivation to take learning seriously, and issues related to student attendance. However, I believe that the use of a self-assessment routine that is connected to the learning goals and expectations of the course could actually motivate students to take the learning more seriously, because such a routine would offer them the opportunity to take ownership of their learning. Additionally, such a routine would offer opportunities for students to reflect upon their actions, attitude, and behaviors that led to the degree of their learning. The establishment of such a routine would require additional time and planning at the beginning of a course, but once established as a course expectation, the routine would become more efficient, an automatic process owned by the student and supervised by the teacher. A self-assessment routine could provide students with an understanding about the degree of their preparedness for an end-of-course exam at any point throughout the course. Students could then compare their self-assessments to course assessments designed by the teacher and to online benchmark or diagnostic assessments that offer objective measures of student preparedness. Any gaps or discrepancies identified among all assessments could serve as a focal point for rich dialogue about learning and future instructional plans. Active participation

in the feedback cycle described by Nicol & Macfarlane-Dick (2006) offers an opportunity to cultivate and nurture strong growth mindsets among teachers and students alike.

5.3 IMPLICATIONS FOR GROWTH MINDSET

Mindsets shape learner engagement. People have different beliefs about intelligence, and these beliefs have an impact on engagement patterns and academic achievement (Blackwell, Trzesniewski, & Dweck, 2007; Cury, Elliot, Fonseca, & Moller, 2006; Dweck & Leggett, 1988). Based on the self-reported teacher responses to statements characterizing attributes related to growth or fixed mindset types, 14 out of 36 (39%) teachers were categorized as having a strong growth mindset, 16 (44%) teachers as having a moderate growth mindset, and 6 teachers (17%) as having a weak growth mindset. Among the 14 teachers categorized as having a strong growth mindset, only 21.4% (3/14) reported regular use of student self-assessments. Three out of 16 teachers (18.8%) categorized as having moderate growth mindset reported regular use of student self-assessments, and one teacher out of six (16.7%) categorized as having a weak growth mindset reported using student self-assessments on a regular basis. While these are small numbers, it is interesting to notice the decline in the percentage of teachers who reported regular use of student self-assessments in comparison to the decline in strength of a growth mindset. Future research is encouraged to explore a potential relationship between these two factors in greater depth. I speculate that regular use of a systemic self-assessment routine to map content mastery, as aligned to standards and eligible content, over the duration of a course would increase student motivation to take ownership of their learning, foster stronger growth mindsets among students and their teachers, and ultimately lead to increased student achievement on end-

of-course exams. I am not suggesting that student self-assessments be used as a form of feedback in isolation, however. It is important to incorporate them systematically within the full cycle of effective feedback practice. Upon reflecting upon the results of the study in comparison to the principals of effective feedback, I wonder if perhaps the lack of this one essential component might be enough to hinder the effectiveness of the feedback cycle as a whole to improve student performance. Students with stronger growth mindsets might be better at utilizing feedback. Teachers with stronger growth mindsets might be better at facilitating full systemic cycles of effective feedback. Reflecting upon teacher comments about how students in honors courses seem to take more initiative to sustain or improve their achievement levels, I wonder if perhaps they have instinctively developed their own methods of self-assessment, independent of teacher guidance. Perhaps the students who have a history of success in the academic areas are the ones that have been prepared to persevere when confronted with constructive feedback and take action to achieve learning goals. I also wonder what other important factors may be at stake for the students who believe that the degree of learning is not within their control: students who have fixed mindsets and believe that they will not be able to improve their performance regardless of the effort they expend. Perhaps these students need more teacher guidance and practice at utilizing feedback to assess their own progress and commit to an action plan for improvement. Growth mindset is not a hat that we can decide to pull out of the closet and wear every now and then, but it is the product of a culminating collection of habits developed from experience over time. It is a powerful indicator for how we will react to challenging situations (Dweck, 2015). We are more likely to persevere through challenges if it is strong. We are more likely to give up if it is weak or fixed. The strength of student and teacher growth mindsets may be shaping the

outcomes of teaching and learning more than we realize. How might we change our habits of teaching and learning?

5.4 IMPLICATIONS FOR DIALOGUE ABOUT LEARNING IN LIGHT OF PENNSYLVANIA POLICY

Conversations about learning expectations and utilizing a systemic feedback cycle to achieve them might offer untapped opportunities to increase student performance. Thirty-four of the 36 teachers (94.4%) in the study reported that they used student-to-teacher dialogue on a regular basis to provide feedback to students about their learning. Only 51.4% (19/37) reported that they believed this form of feedback was among the types of feedback they believed had the most impact on student learning, however. This disparity might suggest that teachers can afford to improve quality of dialogue they have with students about strategies to achieve learning expectations. If dialogue is intermittent or disconnected from comprehensive learning goals, and does not function within a systemic cycle of feedback, it may not be as effective in improving student performance.

If educators wish to protect themselves from becoming trapped within a default philosophy of education, driven by the prevalence of high-stakes testing and educational legislation, then it would be beneficial to engage in dialogue with students about the purpose of learning, learning goals, and the learning process. Use of a comprehensive, systemic feedback cycle might serve as a powerful engine for that learning process, and pairing it with a strong growth mindset may generate a synergistic effect. If we can improve our practice in relation to these ideas, educators could one day find that they need not concern themselves with the

mandates of lawmakers because their students will have already achieved higher performance standards.

5.5 REFLECTION ON THE DISSERTATION PROCESS

My journey through the dissertation process taught me that inquiry is not simply asking questions and searching for answers. Instead, I learned that inquiry is a process. It is an iterative process that involves questioning, researching, reflecting, soliciting feedback from others, and revising initial thought processes. Conducting research was no easy matter. It was humbling to learn that I did not find relationships between feedback, mindset, and student achievement among my sample data. Although the sample size was small and not representative of any population, my hunch is that perhaps even a larger sample would not have produced different results. Perhaps the most important lesson I learned was that educational research is complicated, complex, and necessary. Because of my experience with this process, I will be much more cautious about jumping on the latest bandwagons that claim to improve student learning. Instead, I will ask questions and have conversations with colleagues about the nature of the claims that tend to bombard us. Sometimes I have felt that the culture of educators is one that believes we need to be doing something new in order to make progress. Perhaps it is not something new that we need to do at all. Perhaps we just need to learn how to get better at what we are already doing, and we can do that by engaging in dialogue about our practice and utilizing the feedback that others have to offer.

Through graduate work I learned that the study group process is one that provides students with a place to share one's work and gain valuable insight about ways to improve one's

work. I also learned that it is often times hard to hear that what you thought was the best approach to go about a task was not feasible or manageable. My initial thoughts for conducting research for this study were grandiose. I thought a statewide random sample was the way to go. During my overview meeting, my committee conveyed that I was planning a pathway that was problematic on many fronts. As a result, I redesigned the study based upon the feedback I received from my committee. Although I still had a low response rate, I am sure that it was not as low as it would have been had I stuck to my initial plan.

The smartest thing I did through this process was listen to the feedback of others. It was not easy. I can also say that I learned most by listening and responding to the feedback of others. Whether it was to hear a different perspective on my thinking or to understand that others did not understand what I was trying to convey, receiving and acting upon constructive feedback was critical to making progress within the dissertation process and ultimately the completion of my learning goal. I had to persevere with a strong growth mindset.

I now understand that research is not just about asking questions and finding answers. It is about the iterative process of thinking and rethinking based upon dialogue and feedback that we receive from others. If I were to go through the dissertation process again, I would certainly do some things differently. I also realize that the details I would change are just details. The process would remain the same, and it is the process that taught me the most about inquiry in the field of education.

APPENDIX A

SURVEY QUESTIONNAIRES

A.1 SURVEY FOR SCHOOL LEADERS



University of Pittsburgh

What is the name of your school district?

What is the name of your school building?

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How many teachers taught the **Keystone biology** course in your building during the 2015-2016 school year?

How many teachers taught the **Keystone literature** course in your building during the 2015-2016 school year?

Thank you for your participation. If you would like to receive a copy of the results for this research study, please [click to send your request to Kim Prevost at kap94@pitt.edu](mailto:kap94@pitt.edu).

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A.2 SURVEY FOR TEACHERS OF KEYSTONE COURSES

0% 100%

 University of Pittsburgh

You are about to participate in a study about the relationships among teaching practices that relate to use of feedback strategies, teacher beliefs, and student achievement in the three Pennsylvania Keystone courses: algebra, biology, and literature. **Your participation is voluntary and you may decline to participate at any time.**

1. Did you teach a Keystone course during the 2015-2016 academic year? (A Keystone course is a course that requires students to take a Keystone Exam at the end of the year?)

Yes

No



University of Pittsburgh

2. What subject was the Keystone course that you taught last year?

Algebra I

Biology

Literature (English Language Arts)

None of the above



University of Pittsburgh

4. How many students were enrolled in your Keystone course in May of 2016?

5. How many of your students took the Keystone exam in May of 2016?

6. Have you reviewed the Keystone exam results for the students in your Keystone course last year?

Yes

No

3. What grade level(s) were the students in the Keystone course previously selected?
Select all that apply.

7th

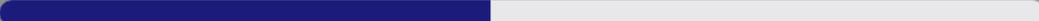
8th

9th

10th

11th

Other, please specify

0%  100%



University of Pittsburgh

6a. What **percentage** of your students, who took the Keystone Exam in May of 2016, earned a **proficient or advanced score**? If you do not know, you may type "don't know" or "don't have access."

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7. Which, if any, of the following Keystone course learning expectation documents have been provided or communicated to your students? Select all that apply.

PA Core Standards for the course

PA Core Assessment Anchors and Eligible Content for the course

PA Keystone Exam Item & Scoring Sampler for the course

PA Keystone Exam Blueprint for the course

PA Keystone Exam Scoring Guidelines for Constructed Responses

Teacher-made syllabus for the course



8. Think about your practice as a teacher. What forms of feedback do you think most impact student learning? Select the top three.

Review of homework

Review of quizzes and tests

Use of rubrics and performance exemplars to discuss quality work

Reteaching and reassessing

Student-to-student dialog

Student-to-teacher dialog

Written work that explains student thinking or learning

Computer-based or online tutorial software

Pre-testing

Student self-assessments

Online assessments (Aimsweb, CDTs, MAPs, etc.)

Other, please specify

Other, please specify



9. Think about the course for which you are answering this survey. Which of the following feedback strategies have you used to help students understand their learning strengths and challenges? How frequently have you used used them?

	did not use	occasionally	regularly	almost daily
1. Review of homework	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Review of quizzes and tests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Use of rubrics and performance exemplars to discuss quality work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Reteaching and reassessing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Student-to-student dialog	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	did not use	occasionally	regularly	almost daily
6. Student-to-teacher dialog	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Written work that explains student thinking or learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Computer-based or online tutorial software	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Pre-testing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Student self-assessments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	did not use	occasionally	regularly	almost daily
11. Online assessments (AimsWeb, CDTs, MAPs, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Other, please list below <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Other, please list below <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



University of Pittsburgh

10. Think about your Keystone course and its student learning expectations. Please indicate your level of agreement with the following statements. A response of **1 equals strongly disagree** and a response of **4 equals strongly agree**.

	1 (strongly disagree)	2 (disagree)	3 (agree)	4 (strongly agree)	5 (uncertain)
1. My students worked hard enough to meet learning expectations.	<input type="radio"/>				
2. My students monitored their progress in relation to learning expectations.	<input type="radio"/>				
3. My students had the intellectual capacity to meet the learning expectations.	<input type="radio"/>				
4. I observed my students grow in relation to learning expectations throughout the course.	<input type="radio"/>				
	1 (strongly disagree)	2 (disagree)	3 (agree)	4 (strongly agree)	5 (uncertain)
5. My students used feedback to improve their performance.	<input type="radio"/>				
6. I adjusted my teaching based on formative assessment of my students.	<input type="radio"/>				
7. The Keystone exam was too difficult for my students.	<input type="radio"/>				

8. My students' intellectual capacity was not likely to change much regardless of effort.

1 (strongly disagree) 2 (disagree) 3 (agree) 4 (strongly agree) 5 (uncertain)

9. My students could increase their intellectual capacity with effort.

10. Students who didn't succeed did not work hard enough.

11. Students who didn't succeed did not have the intellectual capacity to do so.

0%  100%



University of Pittsburgh

10. What are the top challenges that you face in preparing your students for proficiency on the Keystone exam.

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University of Pittsburgh

11. Are you willing to participate in a brief telephone interview to further discuss your experience teaching a Keystone course? **If yes, please provide your email address in the text box below. You will be contacted by email to schedule an interview date and time as well as to exchange phone numbers with the interviewer. (The connection between your email address and your survey responses will be kept strictly confidential and will be destroyed at the conclusion of the study.)**

Yes

No

0%



100%



University of Pittsburgh

Thank you for your participation. If you would like to receive a copy of the results for this research study, please [click to send your request to Kim Prevost at kap94@pitt.edu.](#)

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APPENDIX B

INTERVIEW PROTOCOL AND QUESTIONS OF KEYSTONE COURSE TEACHERS IN PENNSYLVANIA

B.1 INTERVIEW SCRIPT

Hello,

My name is Kim Prevost, and I am a doctoral student at the University of Pittsburgh and a practicing administrator in Allegheny County. If you have questions about the study, you may contact Kim Prevost directly at kap94@pitt.edu or 412-XXX-XXXX.

Let me first thank you for taking the time to speak with me today.

This interview will be audio recorded and consists of seven open-ended questions about your beliefs, perceptions, and teaching practices related to helping students achieve the challenging tasks associated with taking a Keystone course. The interview will take approximately 25 minutes.

I am currently conducting a research study about the relationships among teaching practices that relate to feedback, teacher mindset, and student achievement in the three Pennsylvania Keystone courses: algebra, biology, and literature. The population I am studying includes member districts of The Forum for Western Pennsylvania School Superintendents and

the Tri-State Area School Study Council. Your district is a member of at least one of these professional organizations.

Participation is voluntary, and you may withdraw from the research study at any time. There are no direct benefits to you for participation, and you will not be paid for your participation. All responses are confidential. There is a risk of confidentiality breach with survey research. To protect against a confidentiality breach, responses will be disassociated from any identifiable information that may be provided within the survey. Additionally, the results will be reported anonymously so that the identities of schools and districts are also protected. I will be using Interview ID number [XXX] to track the information gathered during this interview. Additionally, the results will be reported anonymously so that any identities of schools and districts are also protected.

I would like to record our interview to help me accurately capture your responses to the questions. Is that alright with you?

If the interviewee responds affirmatively, I will say, “Thank you. Please know that this audio recording will be deleted after I transcribe the contents of the interview. I will begin recording now.

If the interview responds negatively, I will say, “That’s quite alright. I will do my best to take notes, and at times, I may ask you to repeat a response or clarify my understanding of what you say. Is that ok?”

This interview is being conducted for the [name of study] by Kim Prevost on [date] at [time]. The interview id number is [XXX].

At the conclusion of the interview, I will say the following.

Thank you for taking the time to talk with me today. If you have any questions about the study after we hang up today, please feel free to contact me at any time at kap94@pitt.edu or 412-XXX-XXXX.

B.2 INTERVIEW QUESTIONS

1. Have you heard the term growth mindset before, or are you familiar with the theory about how people can increase their intellectual capacity or get better at something by utilizing constructive feedback and making the effort to improve?

2. Would you describe yourself as a teacher who believes in this theory? Why or why not?

If the interviewee responds affirmatively, I may ask one or more of the following questions.

2a. Can you describe some examples of how you may have practiced a growth mindset as a teacher?

2b. What are some ways that you have worked with your students to help them achieve challenging academic tasks in your Keystone course?

2c. Do you feel that your students took advantage of the feedback you provided to them to improve their learning in your Keystone course? Why or why not? Can you give me some examples?

3. What kinds of learning activities did you do with students to help them succeed in your course?

4. If students were successful in your course, to what extent were they successful on the Keystone exam?

5. Were you satisfied overall with your students' performance on last year's Keystone exam? Why or why not?

6. What are some reasons why you believe your non-proficient students did not pass the Keystone exam last year?

7. Is there anything else you would like to share about your teaching practice in relation to student success in the course and/or on the Keystone exam?

APPENDIX C

LETTER REQUESTING SUPPORT OF DISTRICT AND SCHOOL LEADERS TO COMPLETE RESEARCH STUDY SURVEY QUESTIONNAIRES

Dear Colleagues,

The Forum for Western Pennsylvania School Superintendents and the Tri-State Area School Study Council request your support for a dissertation research study by University of Pittsburgh doctoral student and fellow district administrator, Kim Prevost.

The research study is about the relationships among teaching practices that relate to feedback, teacher beliefs about effort and intellectual capacity, and student achievement in the three Pennsylvania Keystone courses: algebra, biology, and literature. The population for the study includes member districts of The Forum for Western Pennsylvania School Superintendents and the Tri-State Area School Study Council.

We encourage you to support the study by doing the following:

- 1) Complete a brief survey for leaders that only involves indicating the number of teachers who taught a Keystone algebra, biology, or literature course during the 2015-2016 school year. The recruitment letter with a survey link is attached.
- 2) Distribute the attached recruitment letter to your teachers who taught a Keystone algebra, biology, or literature course during the 2015-2016 school year. The recruitment letter with a survey link is attached.

Responses will be kept strictly confidential. Teachers will also be asked if they wish to participate in a follow-up interview. **All participation is voluntary.**

Upon completion of the study, Kim will share aggregate results with our organizations. Individual participants may also request a copy of the results by sending an email to kap94@pitt.edu. We look forward to learning about the practices and perceptions of your district's Keystone course teachers. Your support is greatly appreciated.

Sincerely,

Dr. Diane Kirk

Clinical Associate Professor, Administrative and Policy Studies

Dr. Jerry Longo

Clinical Associate Professor, Administrative and Policy Studies

APPENDIX D

RECRUITMENT LETTER FOR SURVEY QUESTIONNAIRES

Dear Colleague,

Your participation in a research study is requested.

The purpose of this research study is to explore relationships among teaching practices that relate to feedback, teacher beliefs about effort and intellectual capacity, and student achievement in the three Pennsylvania Keystone courses: algebra, biology, and literature. The population for the study includes school leaders and teachers within the member districts of The Forum for Western Pennsylvania School Superintendents and the Tri-State Area School Study Council.

The **survey for school leaders** consists of 5 short answer entries indicating the name of the district, school, and numbers of teachers who taught the Keystone algebra, biology, and literature exam at the school last year. Approximate completion time is 2 minutes.

The **survey for Keystone teachers** consists of short answer, multiple choice, checkbox selection, and items that request selection of a response on a 4-point scale. There is also one open-ended toward the end of the survey. Approximate completion time is less than 10 minutes.

Participation is voluntary, and you may withdraw from the research study at any time. There are no direct benefits to you for participation, and you will not be paid for your participation. All responses are confidential. There is a risk of confidentiality breach with survey research. To protect against a confidentiality breach, responses will be disassociated from any identifiable information that may be provided within the survey. Additionally, the results will be reported anonymously so that the identities of schools and districts are also protected. Additionally, teachers will have the opportunity to supply an email address if they wish to participate in a follow-up interview about their practice. Any contact information collected at that point will be kept confidential, will be disassociated from the survey responses, and will be destroyed at the conclusion of the study.

This study is being conducted by Kim Prevost, a doctoral student at the University of Pittsburgh and a practicing administrator in Allegheny County. If you have questions about the study, you may contact Kim Prevost directly at kap94@pitt.edu or 412-XXX-XXXX.

If you are willing to participate, please complete the appropriate survey by using the links below. Clicking the survey link indicates consent to participate in the study.

School Leader Survey

Participants will be asked for the name of your district, school, and number of teachers who taught each Keystone course at your school during the 2015-2016 school year.

<I will insert hyperlink here once it is activated in Qualtrics.>

Keystone Course Teacher Survey

Participants will be asked questions about the Keystone course they taught during the 2015-2016 school year. Questions include the total number of students who took the Keystone Exam, the percentage of students who were proficient or advanced, classroom strategies and resources utilized, and perceptions about matters related to Keystone courses and their corresponding exams.

<I will insert hyperlink here once it is activated in Qualtrics.>

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