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The Effect of the Mastery Learning Approach on Student Motivation in Middle Level Science

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THE EFFECT OF THE MASTERY LEARNING APPROACH ON STUDENT MOTIVATION IN MIDDLE LEVEL SCIENCE

By

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CHAPTER ONE

Introduction

The goal of educators is to have all of their students learn. This goal is present in our pre-service learning. Throughout pre-service experiences, we are presented with different models of education and their history. One of those models focuses on the importance of developing motivation in the learning experiences of our students. The classroom in this mastery learning model includes personal feedback, chances to build off academic success, and opportunities for different rates of student mastery. How best can teachers work to build a model that applies all these principles, a model that develops student motivation for learning?

My experience as a paraprofessional, then as a pre-service teacher, and finally as an educator led me to believe that there are some important factors that lead to a student's motivational growth. Student motivation does not exist in a vacuum; it is built through feedback and self- efficacy in the educator's classroom (Ames, 1992; Changeiywo, Wambugu, & Wachanga, 2011). So, if a classroom is based on a model that values mastery of standards and the learning experience, a mastery learning approach, might students' motivation for learning increase?

In a mastery learning approach classroom, students are given a chance to work on the standards until they master them; students are not forced onward to

keep up with the class (Diegelmann-Parente, 2011). At the same time, students can accelerate their learning through enrichments if they quickly master standards. When students are working on reinforcing ideas, they meet with a teacher to review their work rather than turning it in and waiting for feedback. This is important, particularly in classrooms like those teaching middle level science where students' background knowledge can vary a vast amount. The disparity in previous learning and mastery time requires an adjustment to the one-speed classroom. The change and growth in student motivation that I saw in my students through qualitative observation pushed me to find more qualitative and quantitative data to support this mastery classroom approach. This desire to gather data led me to the following capstone question: *How does a mastery learning environment affect the motivation of students in middle level science?*

My Experience

In the fall of 2010, I began working as a special education paraprofessional in a local middle school while also beginning my educational licensure program at a local university. Working through these two experiences simultaneously deeply shaped how I viewed education and allowed me to arrive at what has become the guiding question for my capstone research.

It had been a long time since I had been in a middle school classroom. When I arrived, I immediately noticed the attitude of teachers toward the students I supported. The mindset toward students with exceptionalities was universal between the special education teachers and their mainstream counterparts. It was

made clear that the students with exceptionalities only needed to put pen to paper and turn in all the assessments, and they would pass. My primary role as a paraprofessional was to make sure my students accomplished their class work and got a passing grade. At the time, I did not think there was anything wrong with the mentality that completing work for completion sake rather than completing it for understanding seemed a perfectly acceptable attitude to have. I pushed my students to complete their assignments. I helped simplify questions and guided their thinking to a point where they basically were required to do no higher order thinking of their own. My students received decent grades, so I was patted on the back for my good work. I cringe now thinking about the learning that didn't occur for my students, for the critical thinking and problem solving skills I robbed from them.

It was during this time that I began work on my education licensure in middle school science. Beginning with the first class I took as a pre-service teacher, I found myself questioning and developing a better understanding of the purpose education served. In the spring of 2011, I took a class called "Theory to Practice." This class took me from the theoretical work of education into actual classroom practice. It was in this class for the first time that I was exposed to the ideal possibilities of education. It left me deeply conflicted by the things I was seeing in my day-to-day experience and forced me to reconsider if I was promoting the learning of my students. The cornerstone assignments for this class were based on a book study. My group read Alfie Kohn's *Punished by Rewards* (1999), and it completely shifted the paradigm through which I viewed my daily interactions.

Kohn (1999) posited that rewarding good behavior was hardly better than punishing bad behavior. I agreed and now had solidified my opinion that educators should strive to build intrinsic motivation in their students. Intrinsic motivation would allow student to be motivated beyond the constructs of a classroom. When grades, stars, and systems went away, the students would still have motivation to learn.

Beyond just what I was seeing in the classroom, I began to see the relationship between motivation and my younger self. My development in a system of extrinsic motivation left me struggling when the praise fell away in college. This development as a learner is explained in the next section.

My Reflection

As a child, I was constantly built up for how intelligent I was when I shared a book I had read or a complicated math problem I had solved. I slowly lost the desire to learn new information. I was simply working for confirmation that I was intelligent rather than genuinely exploring and learning new topics.

In high school, I recall using what my friends and I called the grade to effort ratio. I would work just hard enough to receive the A or B, but I never extended myself; I never worked to truly learn something new. As a paraprofessional, the students I worked with at the middle school level simply gave up on the motivation of the reward sooner than I had. They exhibited the disinterest I had in college already in their middle school years. These middle school students weren't motivated from within. The students had reached a point where the extrinsic

motivators were not enough to counteract the amount of effort involved in learning. If I wanted my students to become lifelong learners, then the approach of pushing for work completion and grades was doing more harm than good. I struggled to reconcile my understanding of learner motivation with my role as a paraprofessional. My job, according to my supervisor, was to entice students to complete their work, even if they did not understand the work. My reflections reached a point where I needed change.

During this same time, I saw a TED talk called *How Schools Kill Creativity* by Ken Robinson (2006). He spoke about the shift that needed to occur in classrooms so that students could explore their natural curiosities and learn at the pace that was appropriate for them. He spoke about the need to transition away from the "assembly line" school system that moved students by age rather than preparedness for the next level. It was troublesome to hear about the way schools were set up like factories that pushed kids along whether the students understood the material or not. Systemic problems, however, seemed too great to stimulate any positive change in the education system. How was I going to change the whole system? What could I really do in my small sphere of influence? These questions ate at me.

In the fall of 2012, I was ending my time as a paraprofessional and moving into the classroom as a student teacher. I had spent the past two years combining my training with my time in the classroom as a supporter, but now I was able to have some control as a student teacher. I was fortunate enough to have worked as a paraprofessional in the classroom of a science teacher at my school who wanted me

to join her as a student teacher. I was delighted and things fell into place. We worked together exceptionally well and challenged each other in how we could build lessons with authentic learning opportunities and inquiry so that our students could have great learning experiences. Near the end of the student teaching experience, a science teacher informed the school that he was leaving the school. After applying and interviewing, I was offered the vacated position. Everything was set up so that I could help reset some of the expectations of students that had frustrated me during my time as a paraprofessional. In my classroom, the expectations were no longer going to be about work completion, but rather the students understanding the subject material.

Important Experiences

That spring was one of the hardest times of my life. I took over a collection of eighth graders who had seen me as a paraprofessional for two years in and out of their classrooms. They were unmotivated and unruly. I struggled hard to maintain control of my classroom. I spent that spring feeling as though I was always just keeping my head above water in terms of planning and instituting the kind of classroom culture I desired. Consequently, I bought into the school's culture of saying that if students did not want to learn, the staff could not do anything for them. I sent students who misbehaved out of the classroom because it was just too overwhelming and exhausting. I moved toward lecture-based lessons to maintain control of my classroom. I knew that my kids weren't learning, but who was I to do

anything about it? After that spring, I knew that I would have to change my classroom approach, or I was not going to be able to live with myself as a teacher.

The next fall, 2014, saw a fresh start and one of the most impactful attitude changes of my life. A perfect storm of events led me to the current model of education that I wanted to study. The first event was the professional development and staff time devoted to the idea of a growth mindset. It was presented by our staff development group members who had studied a book by Carol Dweck (2006). I began challenging myself to approach education with a growth mindset. I began to stop asking myself what was holding my students back, but rather I asked what I could do to change students' experiences. It was a complete reversal for me. Thankfully, there were a few other staff members who shared my desire to follow through with this goal. Over the next year, we challenged each other to grow and changed our practice into the form it has become today.

I had one of the most impactful moments in my education experience with one of those co-workers. In fall, 2013, the Annual Conference on Middle Level Education occurred in Minneapolis. Our district scheduled a staff development day so that the staff could attend. I went to a session titled "So, You Still Want Student Ownership?" (Cunningham, ,Fondale, & Lavric, 2013). The three presenters gave an exceptional presentation on how they transformed their classrooms into models of individually paced mastery learning. These presenters had students assess themselves on topics and used those assessments to guide their students' learning. Students were working until they showed mastery and then deepening their

learning through enrichment or moving toward the next unit of study. No longer were accelerated students held back. At the same time, the presenters identified the students who were not learning and spent more time supporting those students. It was a perfect model of differentiation with high rigor for each student.

Before students could move on to the next benchmark, students had to demonstrate that they understood the standards being addressed. Students actually had to show they could accomplish their learning targets, not just write them in their notebook and forget them. I walked out of the presentation and turned to my co-worker; both of our faces were lit with a passion that I thought I had lost after the previous spring. I had to adopt this style of individualized instruction in my classroom. It was as if the presenters had seen all the essays I had written in university describing what my ideal classroom would look like, and the presenters were showing me a path to reach it.

Classroom Changes

I began building my classroom around the master learning model. A shift occurred as my focus went from grades to the learning of my students. At every step of the way, there were bumps and arguments against what I was trying to implement. I had pushback from my administration but also buy-in from coworkers who were seeing the same lack of student motivation in their classrooms. Through all of the classroom changes, other staff members and I were gathering qualitative evidence of increased student learning and motivation to learn. The success in student learning I saw in a mastery oriented setting led me to want to continue my

exploration of it. Students seemed, at least anecdotally, driven and motivated to learn. I wanted to show that this change in classroom model could produce a quantitative increase in student motivation to learn. So, in this capstone, I pose the question: *How does a mastery learning approach affect the motivation of students in a middle level science classroom?*

Review

In conclusion, through my primary experiences working toward becoming an educator, I struggled reconciling the perspective of a special education paraprofessional and the perspectives of an idealistic education student. Upon beginning my first job, I began to fall into the trap of a fixed mindset toward student motivation that many teachers around me exhibited. Fortunately, I had some coworkers and a particularly powerful learning experience that shifted my mindset to a growth approach focused on how I could implement a classroom strategy that could increase student motivation. The desire for a more quantitative inquiry into a mastery methodology led me to my research question—*How does a mastery learning approach affect the motivation of students in a middle level science classroom?*

Preview

Chapter two focuses on reviewing the literature relevant to the capstone question. After, chapter three presents the design and methodology of the capstone study. Results of the study are presented in chapter four. Finally, chapter five provides the findings of the study and its implications.

CHAPTER TWO

Literature Review

Introduction

The ultimate goal of teachers is to increase students' desire to learn. There are many factors that go into how much a student learns. Learning is not a one-way street where a teacher puts knowledge into students' heads; it requires the students to buy in to the learning as well. This motivation for learning is important for student success. It is also a crucial component when teachers are designing their courses. Developing a classroom approach that positively affects student motivation is a piece of hidden practice that every teacher works towards creating. With this idea in mind, it is important to remember that motivation should be at the forefront of a teacher's classroom model design. It is also the focus of the research question of this paper: *How does a mastery learning approach affect the motivation of students in middle level science?*

Overview

The literature review looks into the work that has been done around the mastery learning approach and the concept of motivation in education. This chapter starts with a section devoted to motivation. The section begins with a definition of motivation in education. A review of the different types of motivation follows. Then,

the section breaks down the important factors in building motivation. A method of analyzing motivation in the classroom concludes the section.

The next section entitled “Mastery Learning Approach” addresses the research on the mastery learning approach and provides a common definition for the concept. The section opens with the goals of the mastery learning approach.

The third section explores the relationship between motivation and mastery learning. This section defines self-efficacy and feedback, with attention to their classroom implications. After defining self-efficacy and feedback, the relationship between the mastery learning approach and motivation is investigated.

The conclusion of the chapter addresses the middle level science aspect of the research question: *How does the mastery learning style affect the motivation of students in a middle level science classroom?*

Motivation

Motivation is an important idea to education (Ames, 1992; Deci, 1991/2008). In an educational setting, teachers are constantly seeking to motivate their students to learn and grow. What is motivation in education? Student motivation in education is defined as the need and willingness for students to apply themselves to learn and show mastery in that learning (Feng, 2005). This is a guiding goal for teachers when working with students. So, how can teachers build this type of motivation in their students? The answer starts with defining motivation.

There are two types of motivation put forth by research, intrinsic and extrinsic motivation (Deci, 1971; Kohn, 1993). Intrinsic motivation comes from

within; it is the motivation where one performs a task in the absence of a reward beyond the task itself (Kohn, 1993). Extrinsic motivation comes from an external reward for the completion of a task (Deci, 1971). A reward can be something like money or grades or even praise (Kohn, 1993). Research suggests that there is a link between the use of extrinsic motivators and a decrease in intrinsic motivation for a task (Kohn, 1993). However, it is important to point out that that praise for the work done, although extrinsic in nature, does not seem to decrease the intrinsic motivation one feels (Deci, 1971).

Some researchers have further defined motivation (Kohn, 1993). Praise of effort, an extrinsic factor, can have a positive effect on intrinsic motivation (Deci, 2008). This concept led to a change to the categories of motivation. Continued work in the field has brought forth a new theory to motivation, the self-determination theory (Deci, 2008). Deci (2008) presents two adjusted categories of motivation. Autonomous motivation includes the traditionally described intrinsic motivation and the types of external motivation that can be internalized as part of the activity. An example is praise for hard work, where the person associates the feelings related praise to the work itself (Deci, 2008). The praise associated for the effort becomes internalized and is indistinct from an intrinsic motivation.

The contrast of autonomous motivation is controlled motivation (Deci, 2008). Controlled motivation occurs when people experience pressure to think, feel, or act a certain way and is derived from internal and externally imposed regulations (Deci, 2008). Deci (2008) describes some factors of internal regulation as “approval

motive, avoidance of shame, contingent self-esteem, and ego-involvements" (p. 281).

It is important to distinguish between these types of motivation for teachers trying to build motivation in students. If teachers are building intrinsic and autonomous motivation, then a student leaves the classroom with the desire to learn for learning's sake. This can be a powerful mindset for a student to possess. A mindset that is built from autonomous motivation promotes an adaptive and mastery oriented mindset (Dweck 1988). Mastery-oriented children take on challenging new learning opportunities and persist through the hardships associated with them. This leaves us with a question—Can a teacher increase the motivation of students?

The ARCS (attention, relevance, confidence, satisfaction) model of instruction (Keller, 1987) addresses what a teacher can do to increase a student's motivation in learning. This model provides insight into the first steps that teachers can take to promote motivation for learning in their students. Attention is the initial arousal of student's curiosity in a topic; it is a balancing between overwhelming someone and getting past boredom for a subject matter. Possible methods of implementation include inquiry, humor, or incongruity (Keller, 1987).

In teaching training programs, this attention piece is sometimes called the hook for a lesson and when used correctly can promote attention to the subject matter. In practice, sustaining the attention of students becomes the real task of the motivator (Keller, 1987).

Relevance can lend itself toward this task (Keller, 1987). Often, relevance is thought of as simply relating the material back to the students' experiences. Feng (2005) and Keller (1987) posit that relevance can also come from the method of instruction, not just from the material itself. Feng (2005) found that relevance could come from students establishing goals for the learning, even when students felt a subject such as organic chemistry was unrelated to their daily lives. To sustain motivation through a task, students need to feel a sense of confidence. This relates back to the mindset approach; autonomous motivation is built through confidence in self (Deci, 2008). If a teacher can present material in a manner that instills confidence in effort and growth, then a student can carry motivation even when the task is novel.

The final piece of classroom motivation is the inclusion of some satisfaction from learning. As autonomous motivation is built, the satisfaction of learning is the hope (Keller, 1987). Under the umbrella of satisfaction, one also finds the satisfaction of success or growth from a task. The ARCS method (Keller, 1987) provides some practical questions for teachers to reflect upon as they begin to implement strategies aimed at increasing motivation for students: What are the primary methods of feedback? Does feedback reinforce positive feelings toward the effort of learning? and Does the method of assessment induce high anxiety? (Feng, 2005). With these questions in mind, educators can begin to address the motivation of their students through curriculum design.

As established previously, motivation is an important factor as teachers consider the learning of their students. Using their understanding of motivation, teachers can begin to rethink classrooms to incorporate elements of ARCS (Keller, 1987). When evaluating a classroom, it is important to think about whether classroom strategies reach the known factors of motivation. Does a classroom provide feedback? Do students have positive feelings from learning reinforced? Are students able to have success in the classroom model? Logically, the next question a teacher might ask is—What is an effective classroom approach to increase student motivation?

Mastery Learning Approach

The mastery learning approach is a style of classroom that allows for the most learning for the most students to occur. This section establishes the source of the tenets of the mastery learning approach and explains the goals and outcomes expected from a mastery learning approach. Finally, a model of mastery learning is presented.

Before delving into the mastery learning approach, it is prudent to consider its source. In a traditional classroom, students receive instruction aimed at getting the most students to learn the material in an allotted time period. This method leaves many students behind. One of the foundational beliefs to the idea of mastery learning is that all students can learn (Carroll, 1963). When one looks at assessments of learning, the measurements seem to contradict this statement. Why

are all students not showing learning if they can? What is the factor holding them back?

In 1963, John Carroll proposed an answer to this question. A variable that had not been accounted for was time; every student can learn, but at a different pace (Carroll, 1963). In the current form, public schools are not particularly conducive to thirty students learning material at different speeds. Students move through the grades with similar aged peers, not necessarily with peers who have mastered the same material. Time for learning is an important factor to consider in pacing in a classroom, but not the only factor.

Another consideration that went into the development of the mastery learning approach is what styles of learning are most effective for increasing student mastery. Bloom (1984) explored this topic and found that the most effective method of learning was in a one-to-one tutoring setting. This is not a feasible option in a standard classroom of thirty students. However, is there a method that has a level of student success similar to one-to-one tutoring? The mastery learning style resulted in the average student performing above 84% of the traditional classroom (Bloom, 1984). These results warrant further investigation into the mastery learning approach and what it looks like in a classroom.

Given that the foundation of the mastery learning approach is that all students can learn (Carroll, 1963), what does this require of a teacher? This foundation requires the teacher to work flexibly with students to determine what learning is needed by which students. To facilitate this process, there are some

common practices exhibited across mastery learning classrooms. First, complex full units are broken into smaller subunits that are short enough to measure understanding rapidly (Block 1971; Diegelmann-Parente, 2011). The subunits have discrete and measurable outcomes. The material for the students to learn is presented in a logical sequence that increases in conceptual complexity. Students remain with one skill or concept until they master it and then move on to the next subunit. Each subunit has a formative assessment attached to it to measure student mastery. If students show mastery, they move on to enrichment activities (Diegelmann-Parente, 2011). If mastery is not yet achieved, the teacher can target students who need reinforcement of concepts (Block, 1971). This lends itself to smaller group settings, reaching toward the outcomes measured in one-to-one tutoring. A visual representation of the classroom process, created by the researcher, is shown in Figure 1.

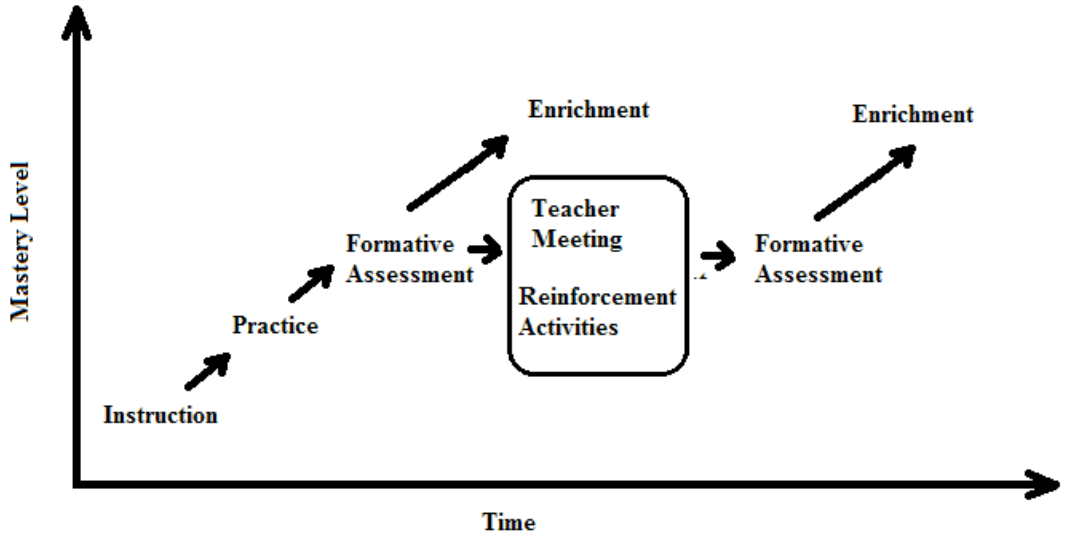


Figure 1. This is a visual representation of the progression of students over time in the mastery learning approach. The arrows follow the path of the learners' mastery as a function of time. Important learning events are highlighted through the process.

Another important aspect to the mastery learning approach is that learning is the most important outcome in the classroom (Block, 1971). All students can learn. This idea manifests itself in a reduction in the importance of grades. A focus on graded outcomes has been shown to reduce students' ability to develop mastery mindset (Dweck, 1988). Again, a mastery mindset is a key aspect of student motivation. Students also show less learned helplessness when classroom work is not attached to graded outcomes but instead attached to learning outcomes (Ames, 1992). Additionally, a grade is also not always the best indicator of a student's understanding of material (Diegelmann-Parente, 2011). One may consider a classroom where students work hard and turn in work but score poorly on an assessment of their learning. These students end up with high grades in the daily work without supporting evidence that they learned the material. A grade that does

not reflect a student's understanding is doing that student a disservice. Even if grades are weighted towards a test, a summative assessment puts an end date on student learning. Conversely, students may put little effort into the work, but they may have learned the material and scored a high grade on an assessment. These students still may have a low classroom score. How well does the grade reflect the learning of these students?

On the other hand, a mastery classroom focuses simply on the learning as the outcome. If a student reaches the mastery level, then there is no concern for a grade. The outcomes are measured by mastery of material, not a grade (Deigelman-Parente, 2011). Once students show mastery, then they can move on to enrichment activities.

Enrichment is a final key to the mastery learning approach. Mastery of material does not mean the use of it is done. Initial mastery enables a person to begin really exploring a subject (Gentile, 2003). As seen in Figure 1 on page 18, the goal of education is for every student to reach a level of mastery that enables him or her to participate in enrichment level activities. In the same way as a musician does not practice a skill to set his or her instrument aside when the skill is accomplished, a student does not master material only to set it aside to be reproduced for state testing. The basic skills are mastered so that they can be applied to novel problems or ideas. Enrichment provides an opportunity to expand knowledge and internalize understanding (Gentile, 2003). The mastery learning approach encourages students

to move to understanding and then extend beyond understanding to apply and use the mastery students have developed.

This clear picture of what the mastery learning approach looks like in practice allows for new connections to be drawn. In the next section, the relationship between the mastery learning approach and student motivation is explored.

The Mastery Learning Approach and Student Motivation

The past two sections of this literature review looked at two important areas that could be applied to science education. The first section reviewed the importance of motivation to student learning. The mastery learning style of classroom was then examined. The stated research goal of this paper is to explore the relationship between the mastery learning approach and the motivation of students. The next section identifies why these two aspects of education are related. There is a particular focus in this section on two factors that help illuminate why there is a relationship. One is a factor in motivation, self-efficacy, and the other is the component of the mastery learning approach, feedback. The definitions of self-efficacy and feedback are provided, followed by an explanation of their role in the mastery learning approach and motivation.

Definitions of Self-efficacy and Feedback

It is useful to establish normed definitions of the factors that are explored more in-depth. Key factors include self-efficacy and feedback.

Self-efficacy. There are multiple components to motivation, but one that continues to stand out as influential to student success is self-efficacy. Self-efficacy is the perception one has in one's ability to perform a particular task successfully (Bandura, 1982). As Dembo and Seli (2004) eloquently stated, self-efficacy is answering the question: "Am I capable of succeeding at this task?" (p. 2). The answer to this question directly affects how much effort someone puts into a task. Those individuals who have low ideas of their skill will in turn put low effort into a challenging task, whereas those individuals who have a high self-efficacy will put more effort into a challenging task (Bandura, 1982). Not only does a positive self-efficacy allow an individual to persist in the face of obstacles, but it can also increase the individual's desire to attempt challenging and novel tasks (Feng & Tuan, 2005).

There are four main influences that can affect self-efficacy. They are defined as mastery experiences, vicarious experiences, social persuasion, and psychological or emotional state (Bandura, 1982; Tsojon, 2014). With these four factors creating the self-efficacy level, it is prudent to recognize that self-efficacy is not stagnant and can change as these factors change for an individual (Bandura, 1982). It is the mastery experiences that promote self-efficacy. The mastery learning approach has components that lend themselves to positively influencing the self-efficacy of a student. Again, before exploring the confluence of the approach and self-efficacy, one last term must be defined.

Feedback. Feedback is the response a teacher gives students on their work. In a classroom, feedback can play an important role in a student's learning

experience (Nichols, 2012). Feedback provides the opportunity for the teacher to give the student individualized instruction or correction. In a mastery learning classroom, feedback is a fundamental part of the process. After formative assessments, the student meets with the teacher to receive feedback (Diegalmann-Parente, 2011). Students who receive positive and supportive feedback go on to show significant gains in subsequent assessments (Clair, 1979). Feedback is most effective when it is specific and given as part of a dialogue rather than simply marks on a paper (Clair, 1979). Using this understanding of feedback, the next section explores the relationship between motivation and the mastery learning classroom.

Relationship

The relationship between the mastery learning approach and motivation comes from the way the components of mastery learning align with the research-supported practices that increase motivation in students. To develop an understanding of the relationship, this section looks at several components of the mastery learning approach and relates them to the aspect of motivational development with which they align. First the ARCS model (Keller, 1987) of building motivation and the layout of the mastery learning approach classroom are addressed.

The ARCS model of motivation (Keller, 1987) in the classroom lays out four keys to motivation for students. In the ARCS model (Keller, 1987), the A stands for attention, and is the first consideration. When compared with the mastery learning approach, as seen in Figure 1 on page 20, this attention aspect is named the initial

inquiry event and is when the student is first exposed to the topic (Keller, 1987). The second key from the ARCS model (Keller, 1987) is relevance of the topic. When laying out the approach, Keller (1987) promotes the idea that "relevance can come from the way something is taught, it does not have to come from the content itself" (p. 3). Relevance is the linking of needs to the skills already acquired. To address relevance, the mastery learning approach breaks large units into small manageable subunits that build in complexity (Diegelman-Parente, 2011). With new skills being applied to a series of ever increasing problems, students are able to have relevance in their work.

The third portion of the ARCS model (Keller, 1987) is confidence. This is the aspect of motivation where the mastery learning approach is most successful. Confidence is a positive expectation for success (Keller, 1987). Confidence is built by completing tasks at the student's level and remediating as needed for students who are not prepared for work at the expected level. This is the foundation of the cycle of learning in mastery learning. Students work toward mastery and are not sent onto a new concept until the first concept is mastered. This instills confidence in students because they have knowledge that they have mastered previous material (Changeiywo, Wambugu, & Wachanga, 2011).

The final aspect of the ARCS motivation model (Keller, 1987) is satisfaction. This means there is intrinsic or extrinsic reinforcement for effort. In the mastery learning model, the opportunity for enrichment is an extrinsic motivator while the successful accomplishment of a skill provides intrinsic motivation for effort

(Diegelman-Parente, 2011). Students grow most by achieving and feeling fulfilled, by developing intrinsic motivation (Feng, 2005). Using the ARCS model (Keller, 1987), teachers can look for attention, relevance, confidence, and satisfaction as a measure of the motivation practices in their classrooms. There are, however, more ways motivation overlaps with the mastery learning approach.

The mastery learning model focuses on all students learning for mastery. This approach is different from a grades-based approach. This means that assessment is not comparative (Bloom, 1984). Comparative assessments compare students to each other rather than measuring against a defined bar that all can achieve. Classrooms that structure themselves around non-comparative models of assessment provide positive motivational growth in students (Ames, 1992). The focus on improvement and mastery fosters an adaptive mindset in students (Dweck, 1988). In the mastery approach, the student strives for learning a concept rather than focusing on achieving a grade (Feng, 2005). If all students feel that they can achieve and do not get compared with other students when they do not achieve, a classroom where students are motivated to learn is established. Focusing on learning for mastery and using assessments as formative tools provides great opportunities for teacher feedback (Bloom, 1984).

Feedback is a prime component in the development of motivation in students (Changeiywo, Wambugu, & Wachanga, 2011). Personal and frequent feedback is the hallmark of the one-to-one tutor learning model, which shows high levels of mastery (Ames, 1992). In the mastery learning model, feedback is built into the structure, it

takes place after frequent formative assessments (Ames, 1992). Feedback that is prompt and provides opportunities for improvement builds positive motivation in students (Ames, 1992). Feedback is not like other extrinsic motivators. For example, verbal feedback has been shown to build, or at the very least not negatively affect motivation levels (Deci, 1971). This can be attributed to the eventual internalization of feedback (Deci, 2008). A process of developing autonomous motivation is described by the self-determination theory (Deci, 2008).

Feedback is also an opportunity for students to show mastery. In the mastery learning classroom, the students can show mastery during the feedback time (Block, 1971). Feedback time allows for the teacher to discover the student misunderstandings and gives the student an opportunity to negotiate meaning. These events can act to supplement formative assessments. When feedback is timely and positive, the students develop a confidence in their efforts (Feng, 2005). Confidence in one's ability to learn is self-efficacy.

Self-efficacy has been demonstrated as a key contributor to motivation. Feedback, as written about in the previous section, is a great way to build that self-efficacy in students (Feng, 2005). The mastery learning model provides the supports that have been shown to develop positive self-efficacy in students (Changeiywo, Wambugu, & Wachanga, 2011). Students gain confidence when they have success in learning; this then breeds more success because the students do not have gaps in knowledge when they move onto the next topic (Block, 1971). This concept sums up the mastery approach's relationship with self-efficacy.

Changeiywo and his colleagues (2011) also found success on one task led to higher self-efficacy on a new or a more complex task. By providing support to students who are struggling, teachers are able to prevent students from becoming discouraged by consistent failure and avoid having them turn-off to learning. Students avoid developing a learned helplessness as the structure of the mastery learning approach provides reinforcement that focuses on learning not receiving a failing grade (Ames, 1992; Block, 1971).

The previous section showed the relationship between motivation and the mastery learning style. The model lines up with the ARCS method (Keller, 1987) of student motivation. The focus on student mastery and learning rather than grades promotes students' confidence and satisfaction in learning. It appears that feedback plays a prominent role in both the mastery learning approach and the growth of motivation in students (Diegalmann-Parente, 2011). Finally, the effect of the mastery model on self-efficacy was explored. The structure of the mastery learning approach has many components that promote the development of self-efficacy.

Conclusion

The connection between classroom learning approach and the development of student motivation is clear. By reviewing the research in educational motivation, as provided in the section titled "Motivation," the importance of establishing motivation building practices in a classroom model was explained. The mastery learning approach is aligned with motivation building practices. Establishing a definition of this model allowed for further examination of its relationship with

motivation. When the relationship was explored, some key factors emerged. The importance of self-efficacy and its role in motivation were shown. The role of feedback in the mastery learning model also illuminated the connection between the mastery learning approach and student motivation. With all of this considered, the next section of this review addresses the science aspect of the research question: *How does the mastery learning approach affect the motivation of students in a middle level science classroom?*

Importance of Science

Science is an important facet of student education. There has been a push in recent years for students to work toward STEM (science, technology, engineering, and mathematics) careers. This has been seen through the congressional appropriations made to agencies like the National Science Foundation (H.R. 448). There has been growing concern that the rate of engineer graduates is decreasing and will eventually lead to a decrease in global competitiveness in the United States. From this concern, there has been a call to reassess and improve K-12 science education (National Academies of the Sciences, 2007). Because motivational growth is seen in students in higher-level classrooms, it is important that we extend that research to middle level classrooms (Changeiywo, Wambugu, & Wachanga, 2011; Diegelman-Parente, 2011; Feng, 2005). Thus, the research question, *How does the mastery learning approach affect the motivation of students in a middle level science classroom?* serves the purpose of extending the understanding of the current

literature. The next section concludes the chapter by reviewing what has been covered and previewing what will come in the next chapter.

Review and Preview

This chapter of the project reviewed the literature that was relevant to the research question: *How does the mastery learning approach affect the motivation of students in a middle level science classroom?* It explored the current research into motivation. Then the review turned toward the mastery learning approach and the research behind this model of classroom. The chapter then looked at how the two concepts were connected to one another. Finally, the conclusion of the chapter looked at the research question and why middle level science was specifically targeted in this study.

The methods used to create a mastery learning environment and the method of data collection and analysis are revealed in Chapter Three. That chapter launches the question into its research form.

CHAPTER THREE

Research Methods

Introduction

In the last chapter, the literature relating to the research question was presented. The relationship between student motivation and the mastery learning classroom model was investigated. The past research of Changeiywo, Wambugu, and Wachanga (2011) looked at the influence that classroom style has on the learning of students. Referencing the work presented in the literature review, this chapter describes the methods that were used to investigate the research question: *How does the mastery learning approach affect motivation in the middle level science classroom?*

The methods laid out in this chapter present a clear methodology for addressing this question. First, the rationale and relevance of the research are provided. The chapter then has a description of the research setting and participants. The next section addresses the curriculum of the unit and how it fits with the mastery learning approach. After the overview of curriculum, the methods of research are presented. This section addresses the motivation survey, motivation indicators observations, and assessments and reassessments. The next section covers the storage of data and addresses human research. After the research project is described, the timeline for the project is presented. Finally, the chapter concludes with the research question and why middle level science is specifically targeted.

Rationale and Relevance of the Study

The research presented in the second chapter provided a background for the research on motivation and the mastery learning approach in the classroom. The research pointed out many connections between the known factors that increase motivation in students and how well feedback and self-efficacy align with the structure of the mastery learning classroom. The literature reviewed in chapter two explored motivation and the mastery approach in studies that took place in post secondary education. This study seeks to expand the knowledge of motivation and the mastery learning approach in the middle school setting.

As presented in the literature of chapter two, increasing the growth of students pursuing the sciences is important to the country. If educators can increase student motivation for science at a middle level, more students may pursue science later in their education. Exploring a link between the mastery learning approach and motivation is a justifiable target for research.

Research Setting and Participants

This section provides insight into the setting of the research. The research took place in an urban midwestern school. The free and reduced lunch rate at the school is 70%. The student body makeup is diverse with 39% Hispanic students, 27% White students, 24% Black students, 8% Asian students, and 2% American Indian students. The English Language Learner population is 35% of the entire student body. The research took place within all of the researcher's seventh grade science classrooms (three classrooms).

Overview of Curriculum

The section covers how the mastery learning approach was blended with the curriculum in the classroom. References are made to the methods of research. The specifics of these methods are addressed in the next section. This overview describes the curriculum and the reinforcement and enrichment period.

Curriculum

The curriculum used for this study was based on the *Minnesota Academic Standards in Science* (2009). This unit addressed benchmarks related to the change in populations over time, numerically—7.4.3.2.1, 7.4.3.2.2, 7.4.3.2.3, and 7.4.4.1.1 (Appendix A). The curriculum was presented over the course of two weeks. The unit began with the students taking the motivation survey (Appendix C). After the survey, the students were introduced to the curriculum. Once the curriculum had been covered over the two week time period, the students were given an assessment. The assessment was broken down by the four benchmarks. Students were then given a benchmarks report that showed how they performed on each benchmark. Students showed mastery if they answered the benchmark's questions with 70% or greater correct responses to the questions; anything below this score was non-mastery. The period of reinforcement and enrichment followed. After the reinforcement and enrichment period, students who had not shown mastery were assessed on their un-mastered benchmarks. Students who mastered the benchmarks created and presented their enrichment projects. After the final assessment window, the students were given the same motivational survey

(Appendix C) a second time. The reinforcement and enrichment period provided the differentiation found in the mastery learning approach.

Reinforcement and Enrichment Period

During the reinforcement and enrichment time, students were responsible for two things. Reinforcement fulfilled the cornerstone of mastery learning, feedback and one-on-one instruction (Diegelman-Parente, 2011). During reinforcement, students worked on activities targeting the specific benchmarks they had not mastered. An example of a reinforcement activity is a guided reading on variation in a population. After they completed each activity, the students had a one-on-one conference with the teacher to determine if they had reached understanding and if not; the two worked together to negotiate an understanding.

If a student mastered all benchmarks, there were enrichment opportunities. These opportunities came in the form of explorations using the information they mastered, but not specifically tied to benchmarks. In this particular unit, students had an opportunity to explore whale evolution or the history of different dog breeds. For example, According to Gentile (2003), mastery of a concept is not the end goal; using that information is. Enrichment allowed students to apply their new knowledge to areas that interested them. For students who had not mastered all standards, they spent this period on reinforcement.

The curriculum presented above addressed the mastery of state benchmarks relating to evolution. The unit was designed and created by the seventh grade science teachers at the research school. The connection to the mastery learning

approach was demonstrated through the inclusion of a reinforcement and enrichment period. Students received personal feedback and worked with teachers in one-on-one settings to better understand those things they had missed previously. Another connection, the one between mastery learning and motivation is behind the research question—*How does the mastery learning approach affect motivation in the middle level science classroom?* To answer this question, multiple methods were used to measure student motivation: motivation survey, motivation indicators, and benchmark assessment. The next section of the chapter provides explanation of these two methods.

Research Methods

There were three main methods of research used to assess the question of student motivation. These methods are described in more detail in their own sections. The motivational survey method will be explained first. Next the motivational indicator method is described. Finally, for an overall picture of student mastery, assessment data were collected. Used together, these three data points provided the researcher with the information to answer the research question: *How does the mastery learning approach affect motivation in the middle level science classroom?*

Motivation Survey Method

This method of research followed a quantitative approach. To measure motivation, the students took a motivation survey twice, once before the unit and once after it was completed. The survey was adapted from the work of Changeiywo,

Wambugu, and Wachanga (2011)(Appendix B). The researchers' survey (Changeiywo, Wambugu, & Wachanga, 2011) explored student's motivation for learning physics. The survey was adapted to fit the curriculum of evolution (Appendix C). The survey was presented at the beginning of the unit. It was also taken upon completion of the reinforcement and enrichment period at the end of the unit. The students' identification (ID) numbers were used to compare changes in their motivation. The ID numbers were not recognizable to the researcher and were only used to correlate results from the pre-unit and post-unit surveys (Appendix C). The results were analyzed through basic statistical means. Each question had its mean and standard deviation presented.

Motivation Identifiers Observations

The researcher also kept a personal journal noting student behavior for particular randomly selected students. Motivational identifiers such as beginning work immediately, employing conversation using academic language, and asking questions about the topic were noted. Six randomly selected students were the focus of this record. One male and one female student, who had been given permission to participate in the study, were randomly selected from each of the classes, giving a total of six students. The motivational indicators were used to assist in understanding the data collected from the motivation survey.

Assessment and Reassessment

The final data used for the research were the assessment scores. The data used provided an overall view of student achievement. Data from all participating

students were used. The initial assessment, entitled Evolution Quiz (Appendix D), was taken before the reinforcement and enrichment period. The data were collected as percent of students showing mastery on each benchmark. Reassessments were derived from the questions directly related to each benchmark. For example, if students mastered all benchmarks except 7.4.3.2.1, then they took a reassessment that featured only the questions from the original assessment directly related to benchmark 7.4.3.2.1. The data presented in this research were percent of students who showed new mastery and the overall level of mastery among all students from both the assessment and the reassessment.

Storage of Data

Data protection was the major confidentiality concern. To protect data the student surveys were stored in a locked cabinet and only removed for analysis. As the data were converted to digital storage, they were stored on a removable drive. The drive was stored in the same cabinet when not in use.

Addressing Human Research

The research involved humans who are under the age of eighteen; therefore a non-exempt long form was submitted to the Human Subjects Committee for review (Appendix E). Included in the human subject review was permission from the principal of the researcher's school. The review board affirmed that the study was ethical, and the researcher was permitted to proceed.

Families were contacted through a letter permission letter, sent home on May 3, 2015. The letter (Appendix F; in Spanish, Appendix G) provided an outline of

the research goals in addition to the impact on the students in the classroom. The families were given the opportunity to opt out of data collection. Since the mastery learning approach is an accepted method of practice and because of the confines of the research location's scheduling, the students were not able to opt out of the mastery learning approach experience.

Only the data from students whose parents or guardians granted permission to participate in the study were used in the study. No names were connected with the data. Motivation identifiers observation data were identified on the record sheet by sex and class period. For example, the male in the first class period was referred to in data collection as M1.

Timeline

The timeline for the research follows in Table 1.

Table 1

Timeline for the Research Study

Date (all dates 2015)	Event
March 9	Approval of school received
April 9	Submission of Human Subject Committee materials for review
April 27	Approval of Human Subject Committee to proceed with research
May 1	Permission Slips sent home to families
May 11	1. Permission Slips Due 2. Administration of initial Motivation Survey

May 12-May 27	Curriculum presented to students
May 28	Administration of assessment
May 29- June 2	Reinforcement and Enrichment Period
June 3	1. Administration of reassessment for selected students 2. Administration of final Motivation Survey

This table presents the timeline of the research. The important dates are in the left column, next to the corresponding event.

Conclusion

Using a survey, this research sought to identify a possible correlation between motivation for learning and the use of a mastery learning approach in the classroom. With the survey serving as the primary method of data collection, teacher observation of motivational identifiers and student assessments were also used to help develop a more complete picture of the learning.. The study's participants were of a middle-level age and therefore were at an important time developmentally for motivation in science. The researcher attempted to identify trends between motivation for learning science from before the mastery learning approach and then after the mastery learning approach. The findings of the study are presented in the next chapter, where there will be a continued exploration of the research question: *How is motivation affected by the use of the mastery learning approach in a middle level science classroom?*

CHAPTER FOUR

Results

Introduction

The research in this capstone set out to answer the question: *How is motivation affected by the use of the mastery learning approach in a middle level science classroom?* The primary goal of this chapter is to present the results from the three main research methods. First, the motivation survey results are presented. This section describes the initial survey results, the final survey results, and the changes between those two surveys. Next, the results of the motivational indicators are presented. Last, the student assessment results from both before and after the reinforcement and enrichment periods are presented. Each of these sections begins with a brief description of the research method and then presents the results. After the three main research methods' results are discussed, the interrelationships among the results and connections with the literature review are documented. The chapter ends with a review and preview of the next chapter.

Motivation Survey

The motivation survey (Appendix C) was given to students preceding the unit of study. The initial motivation survey refers to the first application of the survey and all corresponding results. The survey was also given after the completion of the reinforcement and enrichment period. This is referred to as the final motivation

survey. This section also presents how the data collected from the initial survey changed in the final survey.

The motivation survey (Appendix C) contains thirteen questions. Each question had possible responses of strongly agree, agree, undecided, disagree or strongly disagree. The number of each type of response is presented in the graphs (Figures 2, 3, and 4) below. Both motivational surveys (initial and final) were completed by thirty-four of the students. These students had parent permission and were present in class for both the initial and final surveys.

Initial Motivation Survey

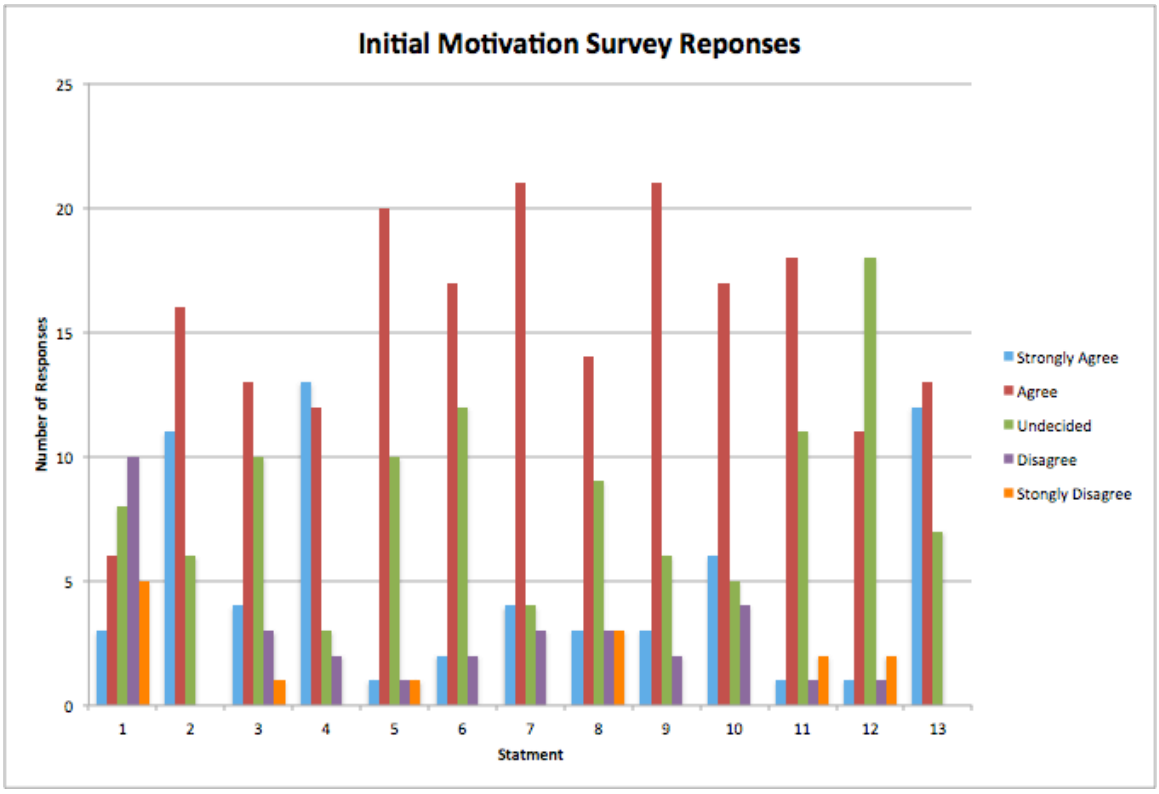


Figure 2. This is the initial motivation survey**.** The initial motivation survey has the statements listed along the bottom axis and the number of student responses along the left axis. The responses are color coded according to the legend.

The graph (Figure 2), on the previous page, shows the breakdown of student responses to the initial motivation survey. There are a few observations that require noting.

Some responses provided insights into areas where students did not respond positively to the motivation statements. Statement number one provided the most undecided, disagree, strongly disagree responses. This question asked the students to complete the statement, "I find it hard to work independently. . . ." Low confidence in independent work points to students who have low confidence in their ability to complete a task; this is related to self-efficacy. Statement twelve stated, "I am capable of explaining scientific conclusions to important people around me. . . ." This statement had the most students responding as undecided. This indicates that students are unsure about verbalizing what they have learned. Deep understanding comes with an ability to explain.

In contrast to the negative responses, there were several statements that the students responded positively to by either agree or strongly agreeing. The second statement, "I expect to be successful in learning science. . . ." and the fourth statement, "I expect to score highly on a science exam. . . ." were two statements that show student expectations had among the largest number of strongly agree or agree responses. These responses may indicate students have high expectations for themselves. Another statement with a positive response was number thirteen, "I am capable of showing what I know in science. . . ." It had the second largest amount of strongly agree responses at twelve. This response seems to contradict the response

to the statement where students said they were undecided about explaining scientific conclusions to important people. This seems to indicate a gap between students' self-perception of science knowledge and their ability to explain that knowledge to others. Overall, the initial motivation survey shows that students agreed or were undecided. Going into the unit, it seemed that students were unsure in their opinion of science learning.

Final Motivation Survey

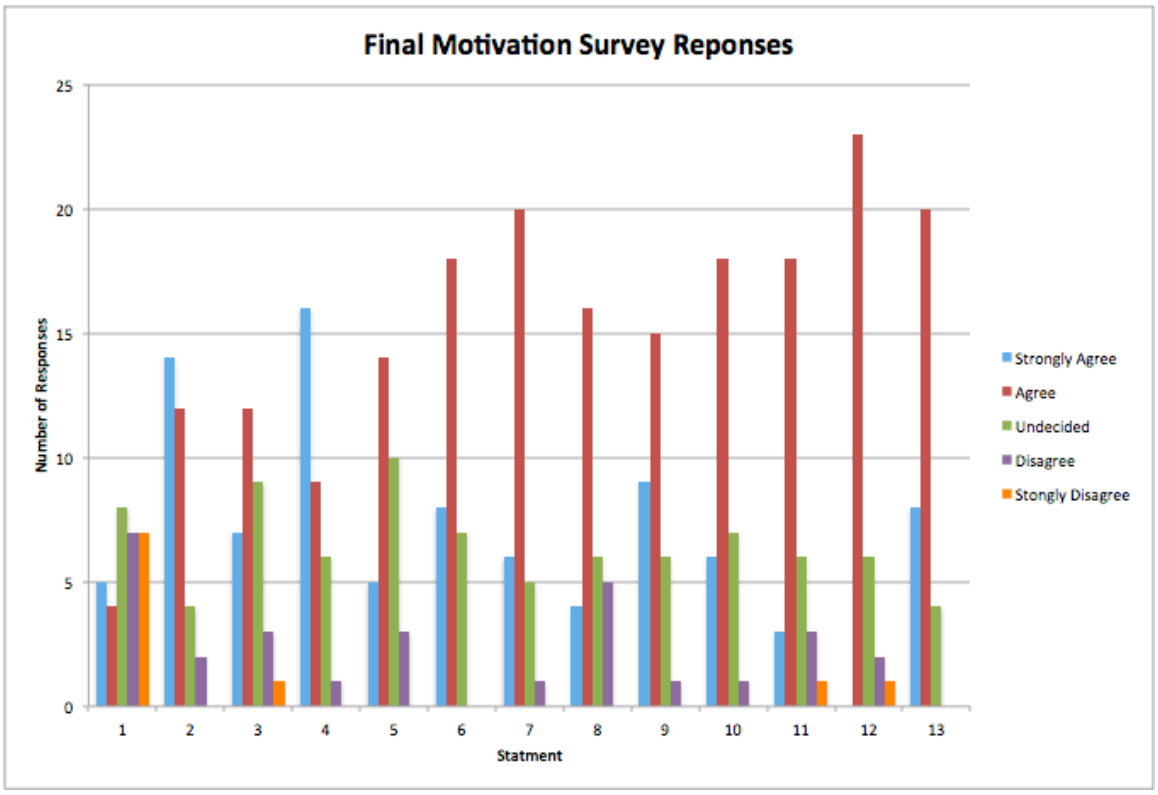


Figure 3. Final motivation survey results. This graph shows the responses to the final motivation survey. The statements are listed along the bottom axis and the number of each response is listed along the left axis. The responses are color-coded according to the legend.

The graph (Figure 3) shows the responses to the final motivation survey that were given after the reinforcement and enrichment period. The first observation is

the low number, ten, of strongly disagree responses throughout all the responses. Over all thirteen statements, there were only ten total strongly disagrees. This indicates how students were becoming more motivated in their science learning. This means almost no students felt strongly unmotivated in science. A further look into the data shows that the students were in fact more motivated. Seven of the strongly disagree responses came in response to the statement "I find it hard to work independently. . . ." The other two strongly disagrees came from questions eleven and twelve. Both statements are related to explaining scientific conclusions to others, peers or important people. Even after the unit, students continue to struggle with the confidence associated with the higher order task of explaining.

Conversely, two statements received no disagree or strongly disagree responses. Statement six, "Science lessons give me opportunities for responsibility. . ." and statement thirteen, "I am capable of showing what I know. . . ." received only positive or undecided responses. Opportunities for responsibility are related to satisfaction and showing what one knows is related to confidence (Changeiywo, Wambugu, & Wachanga, 2011). These are directly related to the ARCS understanding of motivation (Keller, 1987). According to Keller (1987), student responsibility in learning is a way teachers can address the satisfaction piece of motivation. Feeling comfortable showing what one knows comes with confidence, another important part of self-efficacy and motivation (Changeiywo, Wambugu, & Wachanga, 2011). Statement three, "I enjoy learning science. . . ." had nineteen agree or strongly agree responses. That is fifty-five percent positively responding with

most of the rest of the responses falling into the undecided category. That means only eight percent of students responded as disagreeing with enjoying learning science. Enjoyment fits within several components of ARCS motivation; relevance, confidence, and satisfaction (Changeiywo, Wambugu, & Wachanga, 2011).

Change in Motivation Survey

Below is the graph (Figure 4) displaying how responses changed from the initial motivation survey to the final motivation survey. This information is invaluable because it shows the shift that seemed to occur in the student's mind and motivation.

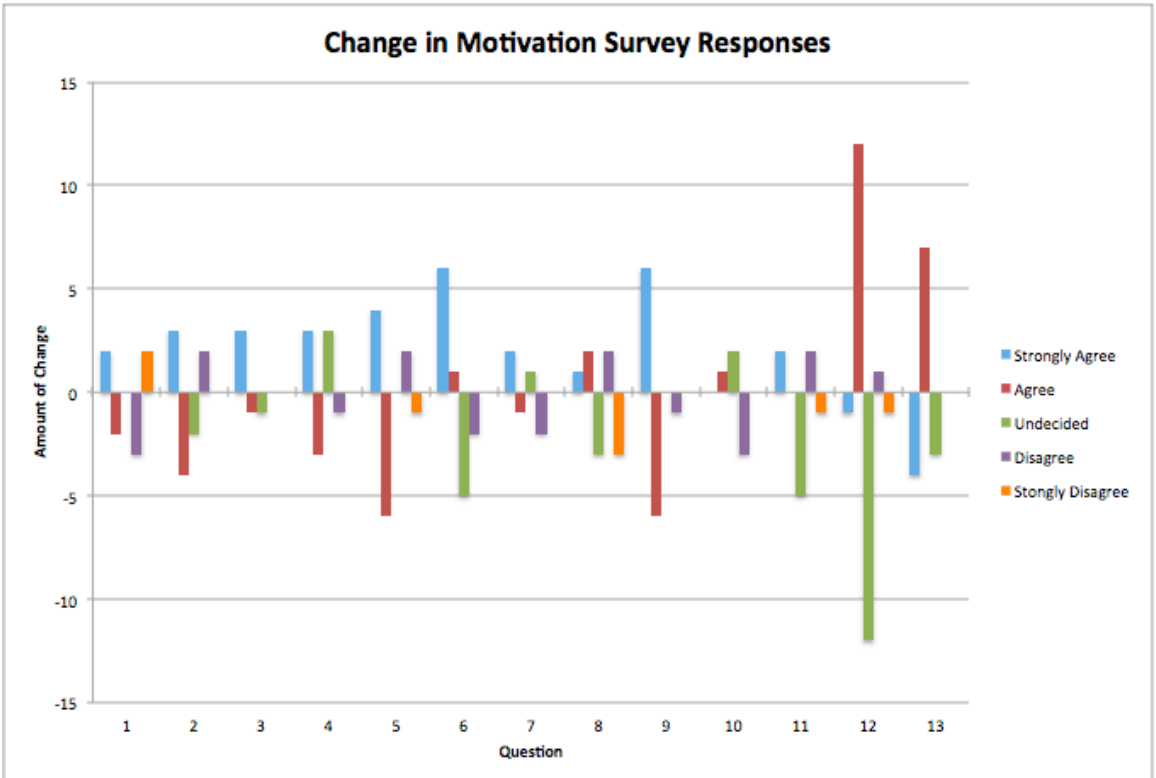


Figure 4. Change in Motivation Survey Results. This graph shows the change in motivation survey responses from initial to final. The statements are presented along the bottom axis and the amount of change in responses is along the left axis. The responses are color-coded according to the legend.

The change in motivation data shows that some statements had an increase in both agree and disagree statements. For example, to statement two, "I expect to be successful in learning science. . . ." both the strongly agree response and disagree response saw an increase. Statement number eight, "I can draw conclusions from scientific data. . . ." also saw both agree and disagree responses increase. This can be attributed to a reduction in undecided responses. Students felt stronger, one-way or the other, after the unit. It is also likely that there was an upward shift; for example the agree responses could have shifted to strongly agree and strongly disagrees changed to disagrees. Since the overall number of disagree responses and strongly disagree responses decreased, it seems to be the explanation.

In addition to the reduction in undecided responses in the post survey, there were several statements where positive responses showed an increase, and negative responses showed a decrease. Statement six, "Science lessons give me opportunities for responsibility. . . ." is an example of this, where students moved from responses of disagree and undecided to responses of strongly agree and agree. The change here indicates that students seem to be feeling more satisfaction in science learning. As seen in research, satisfaction is tied to motivation (Keller, 1987). There was tremendous change in statements twelve, "I am capable of explaining scientific conclusions to important people around me . . ." and thirteen, "I am capable of showing what I know in science . . ." as both saw an increase in agree with a large drop in undecided responses. This may indicate that students are gaining confidence in science learning. Confidence is related to self-efficacy and

growth in motivation for science learning moving forward (Changeiywo, Wambugu, & Wachanga, 2011).

Motivational Indicators

Motivational indicators involved a simple method of observation used by the researcher. Six students were randomly selected for closer observation, one male and one female from each of the three science classes. The students were observed for presenting behaviors typical of a motivated learner. The four behaviors that were identified were beginning to work immediately, asking on topic questions, peer conversation on topic, and engagement in class activity. Each behavior was scored on a scale of two for yes, one for partially, and zero for no during the class period. The data collected are presented in Appendix H. On the next page is a table (Table 2) that contains a summation of that data. The table shows the six students' motivational behavior during curriculum compared to during the reinforcement and enrichment period.

Table 2 shows the scores for the six observed students for each motivational indicator. The indicators are coded as follows; BWI is begins work immediately, AQOT is ask questions on topic, PCOT is peer conversation on topic, and ECA is engaged in class.

Table 2.

Motivational Indicator Data.

Time Frame	Indicator	Male 1	Female 1	Male 2	Female 2	Male 3	Female 3
Average During Curriculum	BWI	1.00	2.00	1.90	2.00	1.33	2.00
	AQOT	1.20	2.00	1.63	2.00	0.67	2.00
	PCOT	0.25	0.80	1.57	1.63	1.00	1.38
	ECA	1.13	1.56	1.78	2.00	1.50	1.88
	Average	0.89	1.59	1.72	1.91	1.13	1.81
Average During Reinforce-ment and Enrichment	BWI	1.50	2.00	2.00	2.00	1.00	2.00
	AQOT	2.00	2.00	2.00	2.00		2.00
	PCOT	1.00	1.00	1.50	2.00		1.50
	ECA	1.50	2.00	2.00	2.00	1.00	2.00
	Average	1.50	1.75	1.88	2.00	1.00	1.88

Male 1 had a higher incidence of the motivation identifiers during the reinforcement and enrichment period; particularly noticeable was peer conversation and beginning work immediately. Male 2 exhibited higher scores during the reinforcement and enrichment period as well; of note is the score for on topic questions, 1.63 to 2.00. Male 3 did not show growth and did not have data collected for two of motivation identifiers during the short reinforcement and enrichment period. Male 3 participated in an extracurricular activity that saw an increased number of absences at the end of the school day, which was the time he was in the research classroom.

For the female participants, growth was present, but not as noticeable as that of the randomly selected boys. All three girls exhibited the motivational behaviors during the curriculum stage of the unit. Female 1 showed her growth in her

engagement in class activities during the reinforcement and enrichment periods. Female 2 presented more on topic conversation during the reinforcement and enrichment period, compared with her average from the standard curriculum time. Female 3 found her focus during the reinforcement and enrichment period; both her conversations and engagement in the activities had higher averages during that period. Female students showed growth in motivational indicators during the reinforcement and enrichment period. Showing higher motivation during the period of curriculum instruction more closely aligned with mastery learning continues the illumination of the relationship between mastery learning and motivation.

Assessment Results

The assessment (Appendix C) was created through the collaboration of the seventh grade science teachers at the research site. The questions were based off of the *Minnesota State Standards in Science* (2009), particularly standards 7.4.3.2.3, 7.4.4.1.1, 7.4.3.2.1, 7.4.3.2.2, and 7.4.3.2.4 (Appendix A). The assessment questions were written to address standards 7.4.3.2.1, 7.4.3.2.2, and 7.4.3.2.4 (Appendix A) together because these standards all pertain to the evidence for evolution. See Appendix D for the questions.

In the table below, the number of students demonstrating mastery, or scoring above 70% on a standard is presented. The students presented below all had parent permission to participate in the study. The data collected from assessment involved thirty-eight students. These thirty-eight students are all the students with parent permission to participate in the study. The reason this is

different from the thirty-four students whose data are used in motivational survey is because four students missed either the initial or final motivation survey and are excluded from that data. All students with permission participated in the curriculum, the reinforcement and enrichment period, and the appropriate assessments.

Table 3

Assessment Results

Standard(s)	Students Demonstrating Mastery on Initial Assessment		Students Demonstrating Mastery after Reassessment	
7.4.4.1.1	32/38	84 %	37/38	97 %
7.4.3.2.3	31/38	82 %	34/38	91 %
7.4.3.2.1 7.4.3.2.2 7.4.3.2.4	27/38	71%	30/38	79%

Table 3 shows the number and percent of students who showed mastery on assessment. The standards are on the left and the number and percent of students showing mastery are indicated next to this.

The assessment data present a clear picture of improvement after the reinforcement and enrichment period. For standard 7.4.4.1.1, after the initial assessment, 32 of the 38 students demonstrated mastery of the material. After the reinforcement and enrichment period, an additional five students were then able to demonstrate mastery. Similarly for standard 7.4.3.2.3, there was an increase in the number of students from 31 to 34 who demonstrated mastery. The last three grouped standards also saw a similar increase in students demonstrating mastery

from the assessment to the reassessment. These standards saw an increase of three students who demonstrated mastery. All of this continues to seem to show the effectiveness of the mastery learning approach in increasing motivation. The self-efficacy built from confidence of success on these standards appears to allow students to pursue new and more complex concepts (Changeiywo, Wambugu, & Wachanga, 2011).

Interrelationships

Overall, there was a clear relationship between motivation and the mastery learning approach. Students demonstrated, through all three measures of motivation, an increase in motivation during the mastery learning approach. The motivation surveys indicated that students were agreeing more with the statements indicating they were confident and getting satisfaction in science learning. The motivational indicators showed that students were more motivated during times of reinforcement and enrichment, periods built around the mastery learning approach. These periods with feedback and extra time to build understanding had students demonstrating more motivation. Assessment was the final form of data presented. The students showed mastery at rates over seventy-five percent in all standards.

Connections to Literature Review

The goal of the literature review was to establish a connection between motivation and the mastery learning approach. This chapter further illuminated this connection. The increase in positive responses to statements that related to satisfaction and confidence shows that these ARCS (Keller, 1987) motivation

elements were present and effective in increasing student motivation (Changeiywo, Wambugu, & Wachanga, 2011; Keller, 1987). Carroll's (1963) vision of a classroom where students could work at their own pace is realized during the reinforcement and enrichment period. The increase in frequency of motivational indicators appears to show that the mastery learning environment increases motivation, supporting previous research in this field (Changeiywo, Wambugu, & Wachanga, 2011; Diegalman-Parente, 2011). Finally, the increase in mastery is in line with the goals of mastery learning compared to one-to-one tutoring (Bloom, 1984). When reflecting on literature, the results of the study fall in line with the previous research that points to a positive connection between the mastery learning approach and student motivation.

Review and Preview

To answer the question, *How is motivation affected by the use of the mastery learning approach in a middle level science classroom?,* a study was designed that relied on the collection of three types of data. The first was a motivation survey that was given to the students prior to and following a unit designed around the Minnesota science standards. The survey showed that change in student responses was a shift toward more agreement or strong agreement. The second method of research was an observation of randomly selected students. The randomly selected students showed growth across all the motivation indicators. Assessment was the final form of data presented. The students showed mastery at rates over 75% in all standards.

All of these considerations are examined in the next chapter. The chapter begins with an introduction, summarizing the overall project. The literature reviewed in chapter two is revisited as a way to connect with the findings. After the review, the data collected are summarized, and common themes are presented. With the project presented, limitations of the project as well as a recommendation for future research are provided. Finally, the capstone concludes by drawing all the elements of the project together.

CHAPTER FIVE

Conclusion

Introduction

The investigation presented in this project seeks to answer the question, *How is motivation affected by the use of the mastery learning approach in a middle level science classroom?* The project began with an introspection of the author's own thoughts and feelings entering the field of education. From these thoughts the research question emerged. Introspection was followed by investigation as the research moved into a review of literature related to the topic. Reviewing previous literature led to a purpose and the research questions. Research methodology was planned and executed. The resulting data were presented in the fourth chapter of the project. The previous chapters lead to this chapter.

With hopes of finding a connection between the classroom learning style and motivation, the results are analyzed. This chapter explores the connection between past research and the addition this project makes to them. It begins by revisiting the literature that was reviewed in chapter two within the context of the research's findings. The data collected are then summarized. After, the limitations and ideas for further study are presented. The project concludes with an overall reflection, means to communicate findings, and the implications of the findings presented.

Literature Revisited

Motivation. Students exhibit motivation through a need and willingness to apply themselves to learning and mastery of subject material (Feng, 2005). Unlocking what builds motivation in students is the key to creating a classroom model that promotes learning and future learning. Through the ARCS (attention, relevance, confidence, and satisfaction) model presented by Keller (1987), teachers have some insight into motivation. The final two parts of this model, confidence and satisfaction, fit with the development of intrinsic motivation. Intrinsic motivation as presented by Deci (1971) is an internal drive to perform a task with no reward beyond the task itself. If students have this type of motivation then learning will be at the center of their educational experience. The mastery learning model that was presented in chapter two will be reviewed here.

Mastery Learning Approach. Fundamentally, the mastery learning model is one based on the belief that all students can learn and the only thing that is different between them is the amount of time it might take (Carroll, 1963). The mastery learning approach seeks to eliminate this issue by providing student opportunities to master material before moving on to the next set of material. This model builds two important learning factors for students, self-efficacy and feedback.

Self-Efficacy. "Am I capable of succeeding at this task?"(Dembo, 2004). Asking and answering this question internally is self-efficacy. Self-efficacy is what promotes motivation in students. If students are confident they can succeed in a task, then

they will attempt it. Confidence comes from mastery experience, among other things (Tsojon, 2014).

Feedback. An important way for students to build understanding is through feedback. Feedback is the response a teacher gives to students after they have attempted a task (Clair, 1979). In the mastery learning approach, feedback comes after the formative assessment as a way for the student to grow and either push forward into enrichment or reinforce to find mastery (Diegalmann-Parente, 2011).

Relationship. All of these ideas—the mastery learning approach, motivation, self-efficacy, and feedback—fit neatly into a relationship that becomes the mastery learning model in the researcher's classroom. The mastery learning approach provides students with confidence through its approach to learning. Students are continually able to re-apply themselves until they demonstrate mastery. In this research study, this was seen by the increase in students demonstrating mastery from the assessment to the reassessment. Confidence and self-efficacy are primary pieces of motivation (Changeiywo, Wambugu, & Wachanga, 2011; Keller 1987). In this research study, confidence and self-efficacy manifested themselves when students responded to the final motivational survey with positive responses to statements related to confidence. The focus on mastery also allows students to develop a mastery oriented mind or one that is driven through intrinsic motivation (Feng, 2005).

Feedback that is prompt and specific promotes student motivation in learning (Ames, 1992). The feedback as a student works on reinforcement during

the mastery learning model is exactly that. When students meet with a teacher, it is an example of feedback that promotes motivation. During the reinforcement and enrichment period, students who have not yet demonstrated mastery have time to work with a teacher. The teacher is able to receive feedback on their understanding. The success of this type of feedback was shown in the study in the increased number of students demonstrating mastery from the assessment to the reassessment.

Summary of Data

Motivation Survey. The motivation survey had students report their own feelings toward science education. From the pre- to post-survey, overall there was an increase in the number of students who responded agree or strongly agree. With the statements where students reported on their own expectations with statements like, "I expect to be successful in learning science. . . . ," there was an increase in strongly agrees. This statement gets to the heart of self-efficacy. Additionally, the statement "I know how to find answers to scientific questions. . . ." shows an increase in positive responses that seems to indicate students have become more confident in their work, an important part of the ARCS motivation model (Keller, 1987). The increase, albeit not in every statement, of positive responses shows that motivation for science learning did appear to grow.

Motivation Indicators. The motivation indicator data that was collected showed most students increased their frequency or use of these behaviors. It was easy to see that when students were in control of their learning. During the

reinforcement and enrichment period, the students seemed to have more motivation to learn. The increase in student focus at the beginning of class was the most notable aspect of the model. The freedom of the reinforcement and enrichment period also gave students more opportunity to have non-academic conversations, which is evident by a few students not increasing their on-topic peer conversations. This is an area that teachers must be aware of and combat as they move to use this model in their classrooms. Looking at this evidence and the motivation survey collected from the larger population, it seems that motivation for students increased from before to after the mastery learning approach in the study.

Assessments. The data collected from assessments and reassessments while not explicitly demonstrating an increase in motivation, do show students are demonstrating mastery in the mastery learning approach used. The students who applied themselves and then showed mastery on the reassessment are evidence that the model seems to work. When students are able to spend more time working on material, they are capable of learning it. This is the idea behind mastery learning as presented by Carroll (1963). If students are improving during reinforcement, it indicates indirectly that they are motivated to learn and are finding success.

Implications

Demonstrated by the high mastery numbers, the mastery learning approach is an effective method to increase student achievement. When this is linked with the increase in motivation as indicated by the motivational survey and the behavior

indicators, it seems adopting the mastery learning approach is an effective way to improve science education at the middle level.

Limitations and Future Recommendations

Based on the constraints of this survey, there were several limitations, which also led to some future considerations. There are three main limitations and their corresponding recommendations: sample size, previous exposure, and time frame. This section will explore those relationships.

The first limitation to this research was the size of the sample. The research was limited to the responding families of the researcher's classes. In this particular case, the research could only occur in three of the five classes because the other two consisted of eighth graders. Additionally, the permission letter was based on the students' willingness to bring it to their parents and back. This will never be a great way to get a large number of responding families.

In response to these concerns, there are a couple recommendations. Moving forward, it would be helpful to train other teachers in the methods of the mastery learning approach and expand the research base. This would allow for more students to participate in the study even if the return rate of permission slips remained the same. This would also give a larger number of students to pull from for motivation indicators. Similar to increasing the sample size, the second limitation relates to the sample group.

In the instance of this research, a complete version of the mastery learning approach was applied to the student population. Before the research occurred, the

students had been exposed to several different elements of mastery learning although not a complete version as was used in the unit of the study. However, this may have inflated some of the initial motivation survey responses. To curb this, the use of a student group unfamiliar with the approach would increase the validity of the research.

The final aspect of the research that needs to be addressed is the length of research. The research was performed over the course of a two-week unit. The unit also took place leading up to the final week of school where student motivation decreases as summer looms. The reinforcement and enrichment period was only two days which meant the motivation indicator data had two data points per student and behavior. The way to improve the study would be to perform it in a unit with more standards and therefore a longer reinforcement and enrichment period.

Overall the research, while limited, does provide a reasonable basis to further study the question, *How is motivation affected by the use of the mastery learning approach in a middle level science classroom?* In summary, a better study would begin with a fresh set of students unfamiliar with the mastery learning approach. The students would take the initial survey before receiving any instruction with elements of mastery learning. The study would then take place over several units, so motivation indicators could be observed during a larger number of reinforcement and enrichment days. The final motivational survey would take place mid year, rather than at the end of the year when summer has begun to enter students' minds. A study like this would more completely address the question, *How*

is motivation affected by the use of the mastery learning approach in a middle level science classroom?

Means to Communicate Research Results

Results will be communicated through publication of this research in the Hamline Bush Library and online at the Hamline Digital Commons. The results will also be shared with colleagues at the researcher's school in hopes of adoption of the mastery learning approach throughout the school. With the assistance of administration the researcher plans to offer professional development for colleagues as a means of incorporating the methods presented in the research into more classrooms. In the future the results will hopefully be presented beyond this through professional conferences.

Conclusion

The study presented in this paper provides valuable insight into the connection between motivation and the mastery learning approach. Through the methods used to measure motivation, the students showed an overall increase in their motivation to learn science. Additionally, the increase in the number of students who were able to show mastery of the subject material after the reinforcement and enrichment periods shows that a period of mastery based learning does seem to increase academic success.

With findings from this study, it is recommended that middle level science classroom teachers work to incorporate the mastery learning approach for their students. If educators wish to help all students learn, then it is imperative that

educators use the most effective methods. The research in this paper shows an increase in motivation and achievement when students are in a mastery learning model. This model should be used in middle level science classrooms. It is the responsibility of teachers to prepare, to the best of their abilities, future scientists**.** The mastery learning approach may be the tool to accomplish that goal.

APPENDIX A

Curriculum Standards

7.4.3.2.1	Explain how the fossil record documents the appearance, diversification and extinction of many life forms.
7.4.3.2.2	Use internal and external anatomical structures to compare and infer relationships between living organisms as well as those in the fossil record.
7.4.3.2.3	Recognize that variation exists in every population and describe how a variation can help or hinder an organism's ability to survive.
7.4.3.2.4	Recognize that extinction is a common event and it can occur when the environment changes and a population's ability to adapt is insufficient to allow its survival.
7.4.4.1.1	Describe examples where selective breeding has resulted in new varieties of cultivated plants and particular traits in domesticated animals.

APPENDIX B

Student Motivation Survey

Students' Motivation Questionnaire Learning
physics using mastery learning approach has:
1. Made me love physics SD D U A SA
2. Made learning physics frustrating SD D U A SA
3. Been dull and boring SD D U A SA
4. Made physics enjoyable SD D U A SA
5. Highly motivated me to work hard in physics SD D U A SA
6. Helped me to discover skills in physics SD D U A SA

After learning physics using mastery learning approach:

7. I find it hard to work independently SD D U A SA
8. I expect to rarely be able to apply physics in life situations SD D U A SA
9. I do not expect to be successful in physics tasks given by physics teachers in the classrooms SD D U A SA
10. I am now acquiring further knowledge of physics SD D U A SA
11. I can now study and solve problems in physics on my own SD D U A SA
12. I expect to perform well I other science subjects SD D U A SA
13. I am able to work independently in physics exercises in and outside physics classrooms SD D U A SA
14. I expect to score highly in physics tests SD D U A SA
15. I expect to be able to apply physics easily in other situations in life SD D U A SA
16. I find learning physics is in itself rewarding SD D U A SA
17. I am now satisfied with the way I learn physics SD D U A SA
18. I no longer feel uneasy during physics lessons SD D U A SA
19. I am dissatisfied with my participation in classroom physics activities SD D U A SA
20. I was satisfied with the way physics was taught in the classroom SD D U A SA
21. I am now satisfied with my performance in physics assignments and tests. SD D U A SA
22. I now aspire to study physics after KCSE SD D U A SA
23. I am not sure whether I have the desire to continue studying Physics. SD D U A SA
24. I now find activities in physics lessons meaningful SD D U A SA
25. I discover that physics subject matter is related to my daily experiences SD D U A SA
26. I realise that physics gives opportunities for choice, responsibility and inter-personal influence SD D U A SA
27. Physics lessons give me opportunities for cooperation and social interaction SD D U A SA
28. I would like a career that does not require physics SD D U A SA
J. M. Changeiywo and P. W. Wambugu (2008)

APPENDIX C

Researcher's Adapted Motivation Survey

Science Motivation Survey

Answer all questions on the scale:

Strongly Disagree Disagree Undecided Agree Strongly Agree

1. I find it hard to work independently….	1. SD	2. D	3. U	4. A	5. SA
2. I expect to be successful in learning science….	1. SD	2. D	3. U	4. A	5. SA
3. I enjoy learning science….	1. SD	2. D	3. U	4. A	5. SA
4. I expect to score highly on science exams ….	1. SD	2. D	3. U	4. A	5. SA
5. Science lessons give me opportunities for choice..	1. SD	2. D	3. U	4. A	5. SA
6. Science lessons give me opportunities for responsibility...	1. SD	2. D	3. U	4. A	5. SA
7. Science lessons give opportunities for collaboration…	1. SD	2. D	3. U	4. A	5. SA
8. I can draw conclusion from scientific data….	1. SD	2. D	3. U	4. A	5. SA
9. I am capable of asking questions to help focus my scientific investigation…	1. SD	2. D	3. U	4. A	5. SA
10. I know how to find answers to scientific questions….	1. SD	2. D	3. U	4. A	5. SA
11. I am capable of explaining scientific conclusions to peers…	1. SD	2. D	3. U	4. A	5. SA
12. I am capable of explaining scientific conclusions to important people around me…	1. SD	2. D	3. U	4. A	5. SA
13. I am capable of showing what I know in science….	1. SD	2. D	3. U	4. A	5. SA

Adpated from Changeiywo, J. & Wambugu, P.W (2008)

APPENDIX D

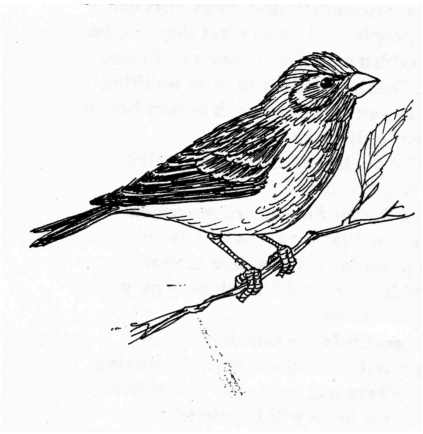
Evolution Quiz

Evolution Quiz

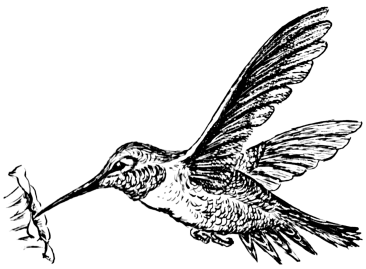
1. Dairy farmers make money by selling their cows milk. They rarely allow all of their animals to reproduce. Instead, they practice *selective breeding* and only let animals with specific features reproduce. Which of the following cows would dairy farmers most likely choose to reproduce?

a. a cow that makes a lot of milk
b. a cow with large, strong hooves
c. a cow with thick, soft fur
d. a cow that can run quickly

2 . Finches and hummingbirds are different species of birds. Finches normally eat seeds, and are unable to eat flower nectar, like hummingbirds. Why is this?



Finch



Hummingbird

a. Most finches' beaks are too short and wide to collect nectar.
b. There are no flowers in finches' environments.
c. Most finches' beaks are too long and narrow to collect nectar.
d. Flowers in finches' environments do not produce nectar.

3. A scientist is studying fossils that were found under an area that is currently a desert. Most of the fossils that he finds are from species that are not found living on earth. Which of the following is most likely true?

a. The scientist did not collect fossils in the correct area.
b. Someone moved the fossils of those organisms to the area.
c. Long ago, these organisms existed but are now extinct.

4. Four species of mice live in a particular region. All of the mice rely on the colors of their fur to help them blend in with the environment. This helps to hide the mice from predators. The table below shows how many members there are in each mouse species as well as the number of different fur-color combinations that each species has.

Species	Number of Members	Number of Fur-Color Combinations
W	7,574	3
X	998,456	1
Y	548,214	2
Z	1,437,566	3

A wildfire changed the region so that the ground was mainly one color. Without knowing what that one color would be, explain which species would likely have the best chance of survival.

a. Species Z would have the best chance of survival because it has the most members and is highly diverse in fur-color combinations.
b. Species Y would have the best chance of survival because it has a moderate number of members and is moderately diverse in fur-color combinations.
c. Species X would have the best chance of survival because it has a moderate number of members and is the least diverse in fur-color combinations.
d. Species W would have the best chance of survival because it has the fewest members and is highly diverse in fur-color combinations.

5. What evidence from the past do we have that evolution has taken place in the world? Write your answer on your bubble sheet.

6. Several years ago on the island of Kauai, flies from North America laid eggs/maggots on the backs of male chirping crickets, killing them. Fortunately for the crickets, the population was able to survive anyhow. Why?

A. The population had some mutant quiet males that were able to survive and reproduce.

B. The females were able to get the males to be quiet for once.

C. The cricket population began to reproduce asexually.

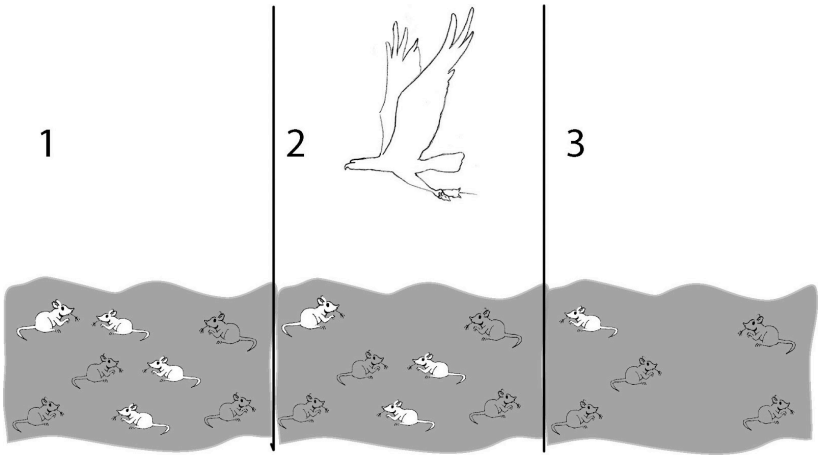
7. Extinction of species can happen because a species

A. has genetic variety (variation).

B. cannot adapt to environmental changes.

C. overproduces.

For questions 9-11, look at the pictures below.



9. What important part of natural selection is present in the mice in picture 1 above?

A. Fossils
B. Predation
C. Reproduction
D. Variation

10. In picture 2, the grey mice are winning the competition for survival. What makes the grey mice better fit for their environment? Write your answer on the bubble sheet.

11. Because the grey mice are a better fit for the environment they have survived and reproduced at a higher rate than the white mice. What would you expect picture 3 to look like if we came back to the same mouse population at a later time? Write your answer on the bubble sheet.

12. Once dogs were present in human society, we began to create different breeds. Mrs. Yunker's dog, Dug, is a goldendoodle. His mom is a poodle (less shedding trait) and his dad is a golden retriever (gentleness trait). When we humans choose dogs for the traits we want to see in their puppies, it is called

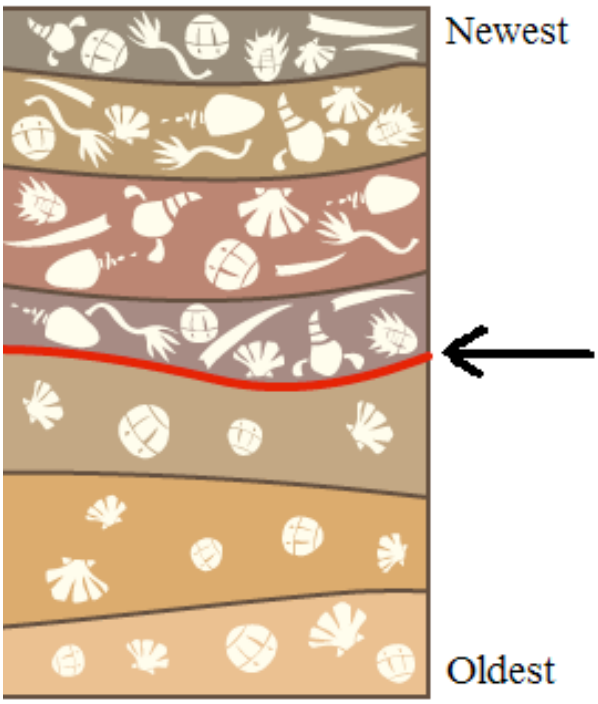
A. population decision
B. natural selection
C. artificial selection (selective breeding)

13. In artificial selection (selective breeding), humans influence the course of evolution. What determines the course of evolution in natural selection?

A. humans B. dog breeders C. survival of the fittest D. survival of the fastest

14. According to the fossil record in the diagram below, what do we know happened at the time the arrow is pointing at?

A. Extinction of Species
B. Diversification of Species



15. If scientists were looking at the fossil record from the oldest layer to the youngest layer and suddenly a type of fossil was no longer present, what is the fossil record telling us?

A. A species was diversified
B. A species suddenly appeared
C. A species went extinct

16. True or False: Humans selectively breed plants and animals in order to pass along specific traits to offspring.

17. Which **TWO** of the following are examples of selective breeding. (Choose 2)
A. Farmers have bred crops to increase their quality
B. In a certain area, birds with a short beak are the most common
C. Dogs have been bred for hunting or companionship **WAS THE QUIZ CREATED BY YOU AND YOUR COLLEAGUES? IF NOT, YOU NEED TO CITE THE SOURCE. OK?**

APPENDIX E

Human Subject Review Materials

Hamline University School of Education
Human Subjects Committee: Non-Exempt (Long) Application

Directions:

1. Before any student or faculty research project involving living human subjects can proceed, it must be reviewed by the School of Education Human Subjects Committee (HSC). Please complete this form and submit to Mary Speranza-Reeder electronically at msperanzareeder01@hamline.edu or by fax at 651.523.2489 according to published deadlines.

2. **Important:** Respond to all sections of this form, even if "Not Applicable."
3. Type or word-process all entries. Attach extra pages as needed.

4. **Important:** Attach the confirmation email received after submitting the HU IRB proposal form, in addition to all consent forms, tests, and institutional permission slips relative to this study. Informed consent forms from participating institutions, educational agencies, and parents and guardians
must be attached.

Part I: Data about Research Project

Date Submitted	3/9/15
Date of Capstone/Dissertation Proposal Meeting	1/24/15
Your Name	Phillip Hutcheson
Student Degree Program (Department if faculty researcher)	Master of Arts in Literacy Education, School of Education
Student/Faculty ID Number	9343486
Student/Faculty Hamline Email	phutcheson01@hamline.edu
Telephone Numbers	Home: 952-221-7451 Work: 612-798-6555
Capstone/Dissertation or Research Project Title	The effects of the Mastery Learning Approach on Student Motivation in Middle Level Science
Administrative Advisor/ Dissertation Chair/ or Faculty Researcher Signature	Print Name: Joletta Falknor Signature: (An email stating approval of this application will be

	accepted in lieu of a signature.)
Advisor/Dissertation Chair Hamline email	jfalknor01@hamline.edu

Part II: Determine Exempt or Non-Exempt Status
Answer the following 4 questions to determine if your research fits the exempt status. Check a box for each question.

a. If the answer is "**NO"** to questions 1 through 4, then your research is **exempt**. Do not fill out this application. Complete the short application.

b. If the answer is **"YES"** to question 1 and "**NO"** to questions 2, 3, and 4, the researcher fills out the **Non-Exempt (Long)** application form and submits the completed form to Mary Speranza-Reeder via email (msperanzareeder01@hamline.edu) or by fax (651.523.2489).

c. If the answer is **"YES"** to question 2, or 3, or 4 the application must be reviewed by the **HU IRB**. Complete the Hamline University IRB Proposal Form (All other researchers) (http://www.hamline.edu/committees/institutional-review-board). Email the decision of the HU IRB to Mary Speranza-Reeder (msperanzareeder01@hamline.edu).

d. In all cases, the School of Education's Human Subjects Committee must approve the application before research (data collection) can begin.

Question	Yes	No
1. Does your research involve minors or students, except where it only involves the observation of public behavior when investigator(s) do(es) not participate in the activities being observed?	☒	☐
2. Does your research involve prisoners, fetuses, pregnant women or in vitro fertilization?	☐	☒
3. Does your research involve mentally disabled persons?	☐	☒
4. Does your research involve subject deception of any kind?	☐	☒

Part III: Dimensions of the Research Study

The focus of this section is providing evidence that, as a researcher, you have considered the risks to
participants and will protect them from unacceptable risks.

1. Describe the site of your study.

The research will take place in an urban Midwestern school. The free and reduced lunch rate at the school is 70%. The student body make-up is diverse with 39% Hispanic students, 27% White students, 24% Black students, 8% Asian students, and 2% American Indian students. The English language learner population is 35% of the entire student body. The school is attended by a total of 906 students. The research will take place within my seventh grade science classrooms. The

parent permission slip will be given to the 59 students who are in my sections. The permission slips will be translated into Spanish. All students in my courses that have other home languages have on record with the school that they do not need translated communications. Those students who return the signed parent permission slips will participate in the study.

2. Write a brief but detailed summary of the research you intend to do (topic, questions, purposes, methods, time line). Include an extra page if needed.

The topic of the research is how student motivation is impacted by classroom instruction. The capstone question is--How does the mastery learning approach affect student motivation in the middle level science classroom?

Increasing the motivation of students is an important factor in increasing the learning of students. If students have a high level of motivation, then they are willing to work harder to learn new material even if it presents a challenge. The purpose of the study is to explore whether or not using the mastery learning style will increase the students' motivation to learn science.

The unit of study will focus on the standards related to genetics and heredity as outlined in the Minnesota state science standards. The primary method of data collection will be a motivation survey given to students at the beginning and the end of the unit assessing their motivation for learning science (see attachment). For the research design, the students will work in a mastery learning approach classroom. This will occur in the three science sections taught by the same teacher.The basis of the mastery learning approach is a student will not move onto new material before he/she has mastered the previous content. This will be accomplished by providing frequent formative assessments. The formative assessments will be given, and the level of mastery of students attain will be collected. Students showing 70% correct on the material will be considered to have shown mastery. Students who master each learning target will be given enrichment opportunities while those students who do not show mastery will work on reinforcement material with close help from the instructor. This cycle will continue through the course work until the summative assessment. The summative assessment will be analyzed. Each student will have his or her score broken down by state benchmark, and he or she will be given a rating of exceeds (100-90%), meets(89-70%), partially meets(69-50%), or does not meet (<50%). Students again will receive a period of reinforcement of enrichment during this time.Students will work to reinforce the standards they partially or did not meet through personal conferences and small group sessions. The enrichment will have a variety of options. Students will be able to explore topics related to but not targeted at the standards. There will be opportunities to explore genetic disorders, genome sequencing, and the impact of artificial selection. After this period, the students who partially or did not meet will be reassessed to show any new learning that has occurred. This assessment will be derived from an item bank of questions created by the science department at the school to directly address the state benchmark.

The research will follow a quantitative approach. To measure motivation, the students will partake in two surveys. The surveys will be adapted from the work of Changeiywo, Wambugu, and Wachanga (2011)(See attachment). This group created a survey that explored

student's motivation for learning physics. The survey will be adapted to fit the context of this work, a unit on the genetics and heredity (See attachment). The survey will be presented at the beginning of the unit, to create a baseline data set before the learning approach is used. The students will take the survey after the reinforcement and enrichment period at the end of the project. The students will be identified by student ID number to compare changes in their motivation. The ID numbers are not recognizable to the researcher and will not be used except to correlate results from the before and after surveys (see attachment).

The researcher will also keep a personal journal noting student behavior. There will be a record where I will note when students are exhibiting motivational identifiers such as beginning work immediately, employing conversation using academic language, and asking questions about the topic. Six students will be randomly selected from the pile of returned permission slips to be observed in this manner. The students who have parental consent will be put into six piles, a boy and girl pile for each class section. One survey will be selected from each pile. The students will be labelled as girl 1, 2, 3 and boy 1, 2, 3 in the research. Their motivation survey scores will not be pulled separately for comparison. The observations of these students will be used for qualitative data. They will be presented as the trends of students in a mastery learning environment.

The data taken from these students will supplement the motivational survey taken by students. By overlaying these data with the data provided from assessment and survey there will be a more complete picture of students' attitudes towards motivation for learning in the middle school science classroom. For quantitative data, the surveys and the data collected from the student observations will be used. An overall picture of motivation at the start and the end of the unit will be presented, as well as the change throughout the unit in behavior of the selected students. Additionally, the overall themes picked up through observation of the students selected will be presented in the final report.

The timeline for the project is as follows:

- February- receive permission from school district to conduct study
- March- permission to begin research granted by Human Subject Review committee
- End of March-send permission letters home to parents
- Beginning of April-Begin research once forms are returned
- Administer motivation survey
- Begin unit of study. The research will occur over the course of the 3 week unit covering the genetics and heredity standards,
- Observe randomly selected students during the unit. Keep a journal of observations.
- Give summative assessment
- Administer motivation survey

- Compile data
- Analyze data
- Write capstone

3. Describe the nature of the involvement of human subjects (participants) in the project (personal interview, mailed questionnaire, observation, etc.). Describe any potential risks to participants and how you will protect them from unacceptable risks. **Attach a copy** of any instrument(s) to be used with participants.

The students who have returned parent permission slips, written in Engilsh and Spanish, will participate in the motivation survey. All other students have indicated in school records that they do not require translated communication. The survey is attached at the end of this document. Students who do not receive parental permission will take the survey, but their survey data will not be used and will be discarded in a manner that keeps confidentiality. All students will participate in the mastery learning classroom model. There will not be any penalty for the students who do not have parent permission to participate in the research. These students will not be identified in any way to their classmates. Their work will be kept anonymous. The classroom methodology falls within the research accepted methods of classroom instruction.

The largest risk to the student is data protection. So, the students will be identified in the survey data by student ID number. This will allow for correlation of data from the beginning of the research to the findings at the end. To select students for the observational research, the students will be be placed in piles by student ID number, sex, and class hour. A boy and girl from each hour will then be pulled randomly. The identity of these students will need to be known to the researcher, but their data will be collected with only the ID number attached. The surveys will be collected and put into a secure computer file. The hard copies of the surveys will be kept in a locked cabinet. The observation data collection will occur on sheets for each hour labelled with m referring to male and f referring to female: 1m, 2m, 3m, and 1f, 2f, 3f.. The identities of the selected students will remain known only to the researcher. These data will be kept in the locked cabinet as well.

4. Describe the characteristics of the participants.

Total Number of Participants	59 (pending permission)
Gender and Number	Female: 30 Male: 19
Racial or Ethnic Group(s) Represented	Latino, Asian, African American, White, Native American
Disabled? (please circle)	Yes ☒ No □
If Yes, Type of Disability	-Specific Learning Disability, Other Health Disability
Limited English Speakers?	Yes ☒ No □

Age Group of Participants	12-13
Other (explain, including the need to use special groups in the study)	

5. Is deception used in the study? If yes, explain.

No deception will be used in the study.

6. Are audio or video recordings of any type used in the study? If yes, explain.

No recordings will be used in the study

7. Confidentiality protection issues (pertains to audio and video as well as written documents).

a. What precautions will be taken to insure the privacy and anonymity of the participants (subjects)? (i.e., closed doors, private rooms, handling of written/electronic materials or artifacts, etc.).

The largest risk to the student is data protection. The students will be identified in the survey data by student ID number. This will allow for correlation of data from the beginning of the research to the findings at the end. To select students for the observational research, the students whose parents have granted permission to participate in the study will be be placed in piles by student ID number, sex, and class hour. A boy and girl from each hour will then be pulled randomly. The identity of these students will need to be known to the researcher, but their data will be collected with only the ID number attached. The surveys will be collected and put into a secure computer file. The hard copies of the surveys will be kept in a locked cabinet. The observation data collection will occur on sheets for each hour labelled m and f. The identities of the selected students will remain known only to the researcher. These will be kept in the locked cabinet as well.

b. What specific precautions will be taken to protect the confidentiality of the data (audio/video/paper/electronic etc.), both in your possession and in reporting or publication? (i.e., coding, removal of identifying information, etc.).

The largest risk to the student is data protection. The students will be identified in the survey data by student ID number. This will allow for correlation of data from the beginning of the research to the findings at the end. To select students for the observational research, the students whose parents have granted permission to participate in the study will be be placed in piles by student ID number, sex, and class hour. A boy and girl from each hour will then be pulled randomly. The identity of these students will need to be known to the researcher, but their data will be collected with only the ID number attached. The surveys will be collected and put into a secure computer file. The hard copies of the surveys will be kept in a locked cabinet. The observation data collection will occur on sheets for each hour labelled m and f. The

identities of the selected students will remain known only to the researcher. These will be kept in the locked cabinet as well.

c. Describe procedures where confidentiality may be broken by law (e.g., child abuse, suicidal intent).

As a mandated reporter, if something arises that needs to be reported I will do so. However, with the tools being used in this study, it will be outside the scope of the research and would occur in the realm of my relationship with the students as a teacher.

8. Informed Consent (include copies of all consent forms with this application.)

a. If consent is not necessary (e.g., an anonymous survey for emancipated adults), describe how you will inform all participants (subjects) of the elements of consent on the survey.

not applicable

b.Where informed, voluntary, written consent is required, describe the manner in which consent was obtained for each appropriate category:

a. Adult Participants (18 years and older - written consent required): Not applicable
b. Child Participants (under 18 years old - parent/guardian consent required): A letter will be sent home to parents. It will produced in Spanish and English. These are the two langauges identified in school records as needing translated communication for our students.
c. Institutionalized Participants (parent/guardian/conservator): Not applicable

9 . Describe any possible physical, psychological, social, legal, economic or other risks to participants (attach another page if needed).

a.If there are any potential risks, describe precautions taken to minimize risk to participants.

There are no risks

b.Describe procedures implemented for correcting harm caused by participating in the study (e.g., follow-up calls, referral to appropriate agencies):

Not applicable

10. Potential Benefit(s) of the Study

a. Describe the potential benefit(s) of the study for the participants.

The classroom methodology, mastery learning, is geared towards having all students show mastery of the material. Beyond the benefit of learning the material, the students may also have a boosted desire to learn about science further. This increased motivation may be an economic benefit down the road for students who explore careers in STEM, a increasingly desired career field.

b. Describe the potential benefit(s) for a professional audience or society at large.

There has been a push in recent years for students to work toward STEM (science, technology, engineering, and mathematics) careers. This has been seen through the congressional appropriations made to agencies like the National Science Foundation (H.R. 448). There has been growing concern that the rate of engineer graduates is decreasing and will eventually lead to a decrease in global competitiveness in the United States. From this concern there has been a call to reassess and improve K-12 science education (National Academies of the Sciences, 2007). If the method shows a relationship between motivation for science learning and the mastery learning approach eventual growth in use could increase the STEM workforce.

c. Do the benefits of your study significantly outweigh the potential risks? If no, explain.

Yes. The benefits greatly outweigh the potential risks of the study.

Part IV: Signature of Researcher(s)

As the primary researcher(s), I/we attest that all of the information on this form is accurate, and that every effort has been made to provide the reviewers with complete information related to the nature and procedures to be followed in this capstone or dissertation or faculty research.

Signature: Phillip Hutcheson_____
3/9/15_____

Researcher's/Researchers' Name(s) Date

Phillip Hutcheson <Phillip.Hutcheson@richfield.k12.mn.us> Mon, Mar 9, 2015 at 5:40 PM
To: phutcheson01@hamline.edu

>>> Brian Zambreno 3/9/2015 3:57 PM >>>
Thanks for providing me with the details of the research. Yes, you can go ahead and proceed as described.

Thanks,
Brian

Brian Zambreno
Principal, Richfield Middle School
7461 Oliver Ave. S.
Richfield, MN 55423
Office: (612) 798-6401
Fax: (612) 798-6427

>>> Phillip Hutcheson 3/9/2015 3:07 PM >>>
Hey Brian,
After our conversation today about researching at Richfield Middle School, I just wanted to touch base and make sure that I had the go ahead on your end before moving forward with Hamline's review board.

The research is related to the project: *The effects of the Mastery Learning Approach on Student Motivation in Middle Level Science*

Students with consenting parents will be taking a survey at the beginning and the end of the 7th grade genetics and heredity unit and some students will be randomly selected to be use for more detailed observation. All student data will be anonymously presented in a capstone project published in the Hamline Library.

Thanks,
Phillip Hutcheson

APPENDIX F

Consent Letter

May 1st, 2015

Dear Parent or Guardian:

I am a completing a master's degree in education at Hamline University. As part of my graduate work, I plan to conduct research beginning in mid-April. The purpose of my letter is to ask your permission for your child to take part in my research. The final product will be a printed, bound capstone (thesis) that will be shelved in Hamline's Bush Library. I may also publish or use my findings in scholarly ways in the future.

My research will be based on how the mastery learning approach affects seventh graders' motivation . Students in my class will take a motivation survey twice, once before the genetics and heredity unit and a second time at the end of the unit. I want to find out about two things: (1) if mastery learning can increase student achievement and (2) if the mastery learning approach affects student's motivation for science learning. The main benefit of the mastery learning approach is students who master curriculum are provided time exploring enrichment related to the topic and students who have not mastered all areas can spend time with the teacher identifying misconceptions and developing mastery.

At the beginning of the unit the students will take a confidential survey about their motivation for learning genetics and heredity. During the unit the students will be exploring this concepts. After assessment, the students will spend time reinforcing state standards they did not meet in closer contact with the teacher. Students who show mastery will spend time working on enrichment related to genetics and heredity. Once this all completed, the students will again take the motivation survey. In addition, six students will be randomly selected to be observed for motivated behaviors.

If your child participates in my research, her or his identity will be protected. No real names or identifying characteristics will be used. Motivation surveys will be catalogued by student ID number for the purposes of correlating results from the original survey to the end survey. Participants' grades will not be affected by my analysis of their journals. All results will confidential. This eliminates risks for your child and other participants. Also, you or your child may decide not to participate at any time without any negative consequences.

I have already received permission to do this research from my principal, Mr. Zambreno, as well as the Hamline University Graduate School of Education. Please return the permission form on the second page by May 11th. If you have any questions, please telephone me at school between 7:30-3:30. Thank you for your cooperation.

Sincerely,

Mr. Phillip Hutcheson
Richfield Middle School
7461 Oliver Ave. S.
Work Phone: 61-798-6555

Informed Consent to Participate in Motivational Survey and Observations
Keep this full page for your records.

I have received the letter about your research study for which you will be collecting data on student motivation through the use of a survey and observation data. I understand that being interviewed poses no risk for my student, that my student's identity will be protected, and that I may withdraw my student's data from the project at any time without negative consequences.

Signature _____

Date _____

Researcher Copy (***please return this portion to Mr. Phillip Hutcheson)***

Informed Consent to Participate in Motivational Survey and Observations
Keep this full page for your records.

I have received the letter about your research study for which you will be collecting data on student motivation through the use of a survey and observation data. I understand that being interviewed poses no risk for my student, that my student's identity will be protected, and that I may withdraw my student's data from the project at any time without negative consequences.

Signature _____

Date _____

APPENDIX G

Consent Letter – Spanish

1 de Mayo de 2015
Estimado Padre o tutor:

Estoy terminando un grado de maestría en educación en la Universidad Hamline. Como parte de mi trabajo de graduación, planeo llevar a cabo una investigación que comienza a mediados de abril. El propósito de esta carta es pedir su autorización para que su hijo/a participe en mi investigación. El producto final será una tesis impresa que será archivada en la Biblioteca de Hamline Bush. El resumen y producto final será catalogado en la Biblioteca Digital de Hamline Bush Commons, un sitio electrónico de búsqueda. También puedo publicar o usar mis conclusiones de forma académica en el futuro.

Mi investigación se basara en cómo el enfoque en el domino del aprendizaje afecta la motivación de los estudiantes del séptimo grado. Los estudiantes de mi clase llenarán una encuesta de motivación dos veces, la primera encuesta antes de la unidad de genética y herencia y la segunda encuesta al final de la unidad. Quiero averiguar dos cosas: (1) si el dominio del aprendizaje puede aumentar el rendimiento estudiantil y (2) si el enfoque en el dominio del aprendizaje afecta la motivación de los estudiantes para el aprendizaje de las ciencias. La ventaja principal del enfoque en el dominio del aprendizaje es que los alumnos que dominen el currículo se les proporcionara tiempo de enriquecimiento explorando temas relacionados con el tema y los estudiantes que no dominan todos los ámbitos puede pasar tiempo con el maestro/a identificando ideas erróneas y desarrollando destreza.

Al principio de la unidad los estudiantes tomaran una encuesta confidencial acerca de su motivación para aprender de genética y herencia. En esta unidad los estudiantes exploraran estos conceptos. Después de una evaluación, los estudiantes pasarán tiempo reforzando normas estatales que no conocieron en contacto directo con el maestro/a. Los estudiantes que demuestren dominio del tema pasarán tiempo trabajando en el enriquecimiento relacionados con la genética y la herencia. Una vez que este todo terminado, los estudiantes volverán a tomar la encuesta de motivación. Asimismo, se seleccionaran a seis estudiantes al azar para observar su comportamiento motivacional.

Si su hijo/a participa en mi investigación, la identidad de su hijo/a será protegida. No se utilizarán nombres reales y/o características que identifiquen al estudiante. Las encuestas de motivación serán catalogadas con el número de identificación del estudiante con el propósito de correlacionar los resultados de la encuesta original a la encuesta final. Las calificaciones de los participantes no se verán afectadas por mi análisis de sus diarios. Todos los resultados serán confidenciales. Esto elimina los riesgos para su hijo/a y otros participantes. También, usted o su niño/a puede decidir no participar en cualquier momento sin ninguna consecuencia negativa.

Ya he recibido permiso para hacer esta investigación de mi director, el Sr. Zambreno, así como de Hamline University Graduate School of Education. Por favor devuelva el formulario de permiso en la segunda página antes del 11 de mayo. Si tiene alguna pregunta, por favor llamarme por teléfono a la escuela entre 7: 30-3: 30. Gracias por su cooperación

Atentamente
Sr. Phillip Hutcheson
Richfield Middle School
7461 Oliver Ave. S.

Teléfono: 61-798-6555

Copia del Participante

Notificación de Consentimiento para Participar en la Encuesta Motivacional y Observaciones
Mantenga esta página completa para su records

He recibido la carta acerca de su investigación por la cual usted va a colectar datos sobre la motivación del estudiante a través del uso de encuestas y observación de datos. Entiendo que ser entrevistado no supone ningún riesgo para mi estudiante, que la identidad de mi estudiantes será protegida, y que puedo retirar del proyecto los datos de mi estudiante en cualquier momento y sin consecuencias negativas.

Firma _____

Fecha _____

Researcher Copy (***please return this portion to Mr. Phillip Hutcheson)***

Informed Consent to Participate in Motivational Survey and Observations
Keep this full page for your records.

I have received the letter about your research study for which you will be collecting data on student motivation through the use of a survey and observation data. I understand that being interviewed poses no risk for my student, that my student's identity will be protected, and that I may withdraw my student's data from the project at any time without negative consequences.

Signature _____

Date _____

APPENDIX H

Motivational Indicators Data

		Boy 1	Girl 1	Boy 2	Girl 2	Boy 3	Girl 3
	BWI	1	2	2	2		
	AQOT			2			
	PCOT	1	1		1		
Day 1	ECA	1	1	2	2		
	BWI	1	2	2	2		2
	AQOT			2			2
	PCOT	0					2
Day 2	ECA	0	2				2
	BWI	2	2	2	2		
	AQOT	2	2	2	2		
	PCOT		1	2	2		
Day 3	ECA	2	1	2	2		
	BWI	2		2	2	1	2
	AQOT	2	2	1	2	0	2
	PCOT		2	2	2	2	2
Day 4	ECA	2	2	2	2	2	2
	BWI						
	AQOT						
	PCOT						
Day 5	ECA						
	BWI	1	2	1	2	1	2
	AQOT	0	2	2	2		2
	PCOT		0	1	1		0
Day 6	ECA	1	1	2	2	2	1
	BWI	2	2	2	2	1	2
	AQOT	1	2	0	2		2
	PCOT			1			2
Day 7	ECA	1	2	2	2	1	2
	BWI	0	2	2	2	2	2
	AQOT				2		
	PCOT	0		2	2		1
Day 8	ECA	1	2	2	2	2	2
	BWI	1	2	2	2	2	2
	AQOT		2	2	2	1	
	PCOT			2	2		2
Day 9	ECA		2	1	2	1	2
Day 10	BWI	1	2	2	2		2

	AQOT		2	2	2		
	PCOT		1		2		1
	ECA		1	2	2		2
	BWI	0	2	2	2	1	2
	AQOT	1				1	
	PCOT	0	1	1	1	0	1
Day 11	ECA	1	2	1	2	1	2
	BWI	1	2	2	2		2
	AQOT	2	2	2	2		2
	PCOT	1	1	2	2		2
Day 12	ECA	1	2	2	2		2
	BWI	2	2	2	2	1	2
	AQOT	2					2
	PCOT		1	1			1
Day 13	ECA	2	2	2	2	1	2

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