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The Impact Of Teaching Growth Mindset On Archery Skill Achievement: An Action Research Study

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THE IMPACT OF TEACHING GROWTH MINDSET ON ARCHERY SKILL ACHIEVEMENT: AN ACTION RESEARCH STUDY

by

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DEDICATION

This dissertation is dedicated to my wife, Caroline, my three sons, Levi, Micah, and Canaan, and my parents, John and Phyllis.
ACKNOWLEDGEMENTS

There are many people who deserve to be acknowledged for their role, whether direct or indirect, in this dissertation. First, I would like to thank my family, especially by beautiful wife, Caroline, who has given nothing but encouragement and sacrifice throughout this entire process. I want to thank my parents, John and Phyllis, my sister, Suzanne, and my in-laws, Lou and Victoria Norment, who have provided much support and sacrifice along the way. Thank you, Sarah Toton for all of your statistical wisdom.

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ABSTRACT

Although setbacks and failure are common in school, especially in outdoor adventure physical education classes, the ways in which students handle those setbacks and failure impact their academic achievement and performance. This dissertation describes a problem of practice based on observations of how the researcher’s students handle setbacks and failure in his outdoor adventure education class, specifically how these setbacks and failure affect the students’ archery performance. This study examined how teaching noncognitive skills using the computer program Brainology impacts student skill performance in archery and the students’ perceptions of this impact. This study used a concurrent mixed methods action research methodology. The quantitative data showed that students had significant increases in their archery scores and Mindset Assessment Profile scores. However, a weak relationship between mindset and archery scores indicated that moving more toward a growth mindset was not related to increases in archery scores. The qualitative data indicated four themes: (1) students’ connection from Brainology to archery, (2) Brainology strategies used in archery, (3) students’ attitudes toward Brainology, and (4) factors not related to Brainology. Based on the findings, the researcher recommends a different approach to teaching growth mindset in physical education and outdoor adventure education.

Keywords: action research, mindset theory, growth mindset, fixed mindset, outdoor adventure education, archery, implicit theory of intelligence, Brainology
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LIST OF ABBREVIATIONS

EL ....................................................................................... Expeditionary Learning
MAP ....................................................................................... Mindset Assessment Profile
NASP ...................................................................................... National Archery in the Schools Program
OAE ...................................................................................... Outdoor Adventure Education
CHAPTER 1

INTRODUCTION

Obstacles, setbacks, and failure are not only part of academics, but also they are part of life (Dweck, 2006). While some students may experience major failures such as getting kicked out of school or cut from a sports team, most students will experience frequent minor setbacks and failures, such as failing an assignment or not being able to perform a given task. These minor setbacks and failures may happen daily, especially as teachers encourage students to try challenging activities with which the students may not be familiar, comfortable, or knowledgeable (Dweck, 2010). While challenging activities may lead to setbacks and failure, students often show considerable agency in choosing how to respond. They may respond to these failures in ways that are more or less productive; some will react with a distinct lack of motivation that leads them to avoid similar challenges in the future, while others will react energetically by evaluating the causes of their setback and by planning strategies to address the problems they face in the future (Aditomo, 2015).

Implicit Theories of Intelligence and Mindset Theory

The psychology of student response to failure relates to the implicit theories of intelligence, which refers to a person’s beliefs about whether people are born with a fixed level of intelligence that cannot be changed or whether intelligence is malleable (Martin, 2015). Dweck (2010) refers to this spectrum as between the fixed mindset and growth mindset. Students who show a fixed mindset will tend to believe that their intelligence is
fixed and unchangeable; when these students encounter a novel or challenging obstacle, challenge, or topic of research or classroom consideration, they will use their first reactions to this challenge to inform their interactions. Such immediate reactions and judgments will inform these students’ judgments about whether they are able or unable to perform a given task or handle a certain subject. These students do not react well to tasks that require them to show considerable effort and tenacity, and most importantly, perform hard work in order to achieve a level of competence or mastery. Instead, these students tend to assume that topics of education should come naturally, and they use initial failures as a means of exhibiting discouragement and a lack of motivation that causes them to question their abilities and intelligence (Dweck, 2010).

On the other hand, students who exhibit a growth mindset tend to believe that their intelligence and capabilities are malleable and can be developed and improved over time and with effort. In contrast to those students who exhibit a fixed mindset, students who demonstrate a growth mindset will often welcome challenging activities, even if their education and experimentation in such activities causes instances of early failure. They do not view such failure as tantamount to their inability to gain competence or mastery in that subject, but instead they tend to view such failure as a step toward mastery. They are more resilient and capable of recognizing the value that presents in failure and are consequently more able or willing to show greater effort in the future to master a complicated subject or understand an intricate or advanced task (Dweck, 2010; Meierdirk, 2016). In contrast to students who exhibit a fixed mindset, students with a growth mindset are more likely to respond to initial challenges not by shirking the task as beyond their ability, but instead by showing tenacity, attempting new strategies, and
using resources at their disposal for learning (Dweck, 2010). These students tend to view challenges not as obstacles but as learning opportunities (O’Brien, 2015).

**Outdoor Adventure Education**

Outdoor adventure education incorporates many activities that provide challenging circumstances that illuminate the mindset responses that are most necessary to development (O’Brien, 2015). Outdoor experiential education consists of educational situations in a wilderness setting and incorporates an element of adventure or challenge as a means of providing direct experience as a vehicle for education (Warren, 2005).

Students involved in the researcher’s outdoor adventure education classes engage in a range of challenging activities, most of which they will have little previous experience. These activities include archery, bouldering, ropes courses, kayaking, or backpacking. Students come to this class with their varied levels of ability and past experience, as well as varied preconceptions of such outdoor adventure education and other related activities. Into this context, these students are presented with novel challenges and their educators are placed in the unique position by which they may be able to aid these students in developing a growth-oriented mindset (Warren, 2005).

Outdoor education professionals strive to help students recognize the predetermined limitations of their own capacities that they set for themselves and to develop a growth mindset that helps them succeed in their skills achievement, as well as improve their ability to meet challenging situations through effort and perseverance (O’Brien & Lomas, 2017).

**Archery.** The action research study that follows is based on a particular focus of the researcher’s outdoor adventure class, specifically target archery. Archery is one of the
fastest growing sports in the United States. According to USA Archery (2014), the national governing body for the Olympic sport of archery, archery membership increased 105% between 2011 and 2013, and 21.6 million United States residents participated in archery in 2014, a jump from 18 million participants in 2012. An increase in youth archery participants is linked to popular presentations of the activity, particularly as a result of movies such as The Hunger Games, as well as the increasing prevalence of archery programs in public schools resulting from the National Archery in the Schools Program [NASP] (USA Archery, 2014; Responsive Management, 2015).

Archery provides many physical, psychological, and social benefits including increased higher-order thinking and self-management skills, and increased focus and concentration. Additionally, archery can improve student motivation and motor skills (Arem, 2006; Hargrove & Vercelletto, 2013; NASP History, n.d.). Archery provides excellent opportunities for students, not just with regard to learning a new skill, but as a means of learning how to react to a new situation and set of objectives – and the setbacks and failure that invariably result, at first – in a manner that leads to their exhibiting the perseverance necessary to increase skill achievement.

The National Archery in the Schools Program (NASP) curriculum forms the basis for this larger consideration. NASP is a 501c(3) non-profit educational foundation that partners with wildlife conservation agencies to teach outdoor skills. The NASP mission emphasizes outdoor skills development as beneficial because it results in students spending more time outside, as well as gaining greater levels of self-reliance, all while helping to foster character development amid a strong emphasis on nature and wildlife conservation. Many schools use the NASP curriculum to teach school-age children
archery, and provide competitive opportunities through local, state, national, and world
tournaments. (NASP Program Description, n.d.)

Theoretical Framework

Outdoor adventure education relies heavily on the work of John Dewey. In his work *Experience and Education* (1938), Dewey describes the term *experience* as well as what is necessary to imbue that experience with educational value. Student experience results from the interaction between the environment and the student (Dewey, 1938).

While nearly every student experiences failure, a student’s experience in archery will either be positive and valuable, or negative, resulting in the student quitting. Research shows that students are more likely to quit an activity if they lack self-confidence, lack initial ability, or if they face initial failure. However, ability, skills, and talent may be less important than perseverance for students to achieve a successful outcome (Sproule et al., 2011). This theoretical framework will examine social-learning theory, including self-efficacy and self-concept, and implicit theories of intelligence and mindset, which include both entity theory and incremental theory.

**Social-learning theory.** A crucial basis from which to mount this consideration is the work of Albert Bandura (1967; 1986), particularly his theories of learning and self-efficacy. As Bandura describes, learning is a process achieved in a social context. He considers how people learn from one another and discusses core concepts including observational learning, imitation, and modeling. Conceptual foundations of Bandura’s social learning theory include four ideas. First, people learn by observing the behavior of others as well as the outcomes of those behaviors. Second, learning can occur without a change in behavior. Bandura’s principles, as a result, run counter to those of behaviorism,
whose proponents argue that learning is only reflected by a permanent change in behavior (Pigot-Upshall, 2017). This is crucial because it argues that learning may occur but may not necessarily be reflected in a change in performance, such as greater classroom efficacy or in testing. Third, cognition plays a role in learning and learning is often based upon the anticipatory capacity of the learner, especially through the presence or absence of conditions of reinforcements, such as rewards or punishments, or the learner’s individual tendency or perception of his or her own degree of effectiveness (Bandura, 1967). Fourth, the environment, such as the classroom, plays a strong role in the capacity of a given learner to learn, and that an environment that is conducive to learning improves students’ ability to model their behavior on others and to gain a stronger understanding of their own efficacy.

Both modeling and reinforcement are crucial elements of social learning theory. As Bandura (1967) explains, students exemplify strong learning behaviors through the modeling of learning behavior, and as a result, struggling students may achieve stronger outcomes in their learning provided the educator has reinforced such modeling by noticing and praising not only the student upon whom behavior is modeled, but the observer as well (Bandura, 1967). Social reinforcement, as observed through the approval or disapproval of one’s peers, parents, and other significant observers forms a strong basis for determining the learner’s belief in his own self-efficacy, or in his or her ability to complete educational activities or to accomplish educational goals (Akers & Jensen, 2011). Bandura (1986) defines self-efficacy as “people’s judgments of their capabilities to organize and execute personal courses of action required to attain designated types of performances” (p. 391). Bandura also contends that a person’s
efficacy beliefs impact his or her perseverance, effort, and choice of activity (Bandura, 1997; Schunk 1991).

**Self-efficacy and self-concept.** Bandura (as cited in Usher & Pajares, 2008) theorized that people’s beliefs about their capabilities and about the outcomes of their efforts greatly influence their behavior. His social learning theory and self-efficacy beliefs help determine the choices people make, their effort levels, and the persistence and perseverance they expend during difficulties, setbacks, and failure. Not only has self-efficacy been shown to predict student academic achievement, but self-efficacy beliefs are critical determinants of human motivation and behavior (Schunk, 1991). In academic settings, they influence motivation, self-regulation, and achievement; moreover, “Self-efficacy beliefs are most likely to change during skill development, when individuals are faced with novel tasks. Although failure may occur periodically, when students notice a gradual improvement in skills over time, they typically experience a boost in their self-efficacy” (Usher & Pajares, 2008; p. 752).

Derived from the general concept of self-efficacy conceptualized by Bandura (1986), Schunk (1991) proposed the construct of academic self-efficacy, a type of academic motivation in terms of personal expectancy. It is a person’s perception that he or she can perform a given task at a certain level (Schunk, 1991). Current research shows academic self-efficacy is a stronger predictor of achievement than ability (Britner & Pajares, 2006; Usher & Pajares, 2008). A closely related concept to academic self-efficacy is the term academic self-concept. The general term self-concept can be defined as “a person’s self-perceptions formed through experience with and interpretation of his or her environment” (p. 4); and, similar to self-efficacy, has a range of domains including
academic, physical, and social self-concepts (Cohrssen, Niklas, Logan, & Tayler, 2016). Students with higher academic self-concepts are usually willing to invest more effort into their academic work; moreover, students who are confident in their ability in a specific area are more likely to persevere, expend effort, and succeed than are students with less belief in their ability. Marsh, Cairns, Relich, Barnes, and Debus (1984) found that attributions of success to ability and effort are positively correlated, and both are positively correlated to academic self-concept. Additionally, after failure, attributions of ability and effort are both negatively correlated with self-concept. The distinction between academic self-efficacy and academic self-concept could explain why some students may be confident in their ability with certain concepts within a discipline yet lack the confidence in their ability in the entire domain (Denissen et al., 2007; Ferla, Valcke, & Cai, 2009). For example, a student in outdoor adventure education may be confident in his or her ability to demonstrate proper archery form (self-efficacy), but believes he or she is not good at archery (self-concept).

Self-efficacy and self-concept are multi-dimensional and include a range of domains; thus, the research findings in the academic domain regarding the relationship between academic self-efficacy, academic self-concept, effort, and achievement are also found in the physical domain (Ommundsen, 2006). Some studies have suggested that self-efficacy is a major determinant of activity choice, willingness to expend effort, performance, and persistence in sport and physical education (Ommundsen, 2001a; Ommundsen, 2003; Ommundsen, 2006; Sami Kalaja et al., 2007). In sport and physical activity, research has shown little or no association between outcome expectancy and behavior.
**Attribution theory.** One of the foundational theories from which this study was based is attribution theory. Attribution theory is concerned with causal inferences, or the perceived reasons why a particular event occurred (Weiner, 1985). This has significant implications for the educational process, and it has been demonstrated that “causal attributions influence the likelihood of undertaking achievement activities, the intensity of work at these activities, and the degree of persistence in the face of failure” (Weiner, 1972, p. 213). Thus, these behaviors will influence the degree of learning. Attribution theory involves a three-stage process: 1) behavior must be observed or perceived; 2) behavior is intentional; and 3) behavior is attributed to internal or external causes (Weiner, 2010). The causal dimensions of behavior, or how people explain their successes or failures, are locus, stability, and controllability.

**Locus.** The locus dimension is the perception of the cause of an event as being either internal or external to a person (Judge & Bono, 2001). Internal attribution is attributing causes that are within a person such as personal effort or ability, and external attribution is attributing causes not within a person such as the weather or another person. Internal attribution is related to increased self-efficacy and self-esteem (Gist & Mitchell, 1992; Judge & Bono, 2001). When students believe their effort led them to success, self-efficacy and self-esteem increases.

**Stability.** The stability dimension refers to the cause of the behavior either being stable or unstable across time and circumstances (Mikulincer, 1988). Stable causes are ones that change little such as personality traits, whereas unstable causes are ones that are temporary such as illness. Students who attribute failure to stable causes often experience worsened subsequent performance after a setback and tend give up easier (Mikulincer,
However, attributing failure to unstable causes prevents the negative effects of setbacks on subsequent performance, and students are more likely to persevere.

*Controllability.* The controllability dimension refers to the extent to which a person can influence the cause of an event. Although controllability is similar to locus of control, it should be separated (Weiner, 2010). For example, a person’s aptitude is an internal but uncontrollable attribution. While some internal causes are controllable and others are not, all external causes are uncontrollable.

The various combinations of locus, stability, and controllability attributions greatly impact students’ academic motivations and persistence at a given task (Weiner, 1985). If a student attributes academic failure or success to factors that are internal and controllable, such as effort, then he or she is likely to show persistence and increased motivation (Dweck, 2000). On the other hand, the opposite is true when students attribute failure and success to uncontrollable external factors.

It is important to note that self-serving bias is, in part, assumed to influence the attributional process (Roesch & Amirkhan, 1997). A self-serving attributional bias refers to the tendency to attribute favorable events to oneself and unfavorable events to external causes. This attributional style serves to enhance self-esteem following success and protect it following failure. Both self-serving bias and Weiner’s model for attributions both include hedonistic motivations, which are motivations based on the pursuit of pleasure. Weiner’s model differs from the self-serving attributional bias style in that Weiner’s model does not view hedonistic motivations as the sole motivations underlying the attributional process, while the self-serving bias implies that all people who succeed,
or fail, should attribute alike and the motivation is hedonistic in nature (Roesch & Amirkhan, 1997).

In the early 1970’s attribution theory formed a basis of the field of social cognition (Dweck, 2018). However, there were two branches – one that embraced a more purely cognitive form, and the other investigated more motivational and emotional consequences of different explanations of people’s behaviors. Weiner (1972) pioneered the latter branch, which consequently, influenced Carol Dweck’s research on implicit theories of intelligence and mindset.

**Implicit theories of intelligence and mindset.** Implicit theories of intelligence are a person’s fundamental beliefs about whether his or her intelligence can be changed (Bernardo, 2012; Dweck, 2006). Individuals who tend to view intelligence as an unchangeable, inborn trait or entity hold an entity belief or an entity theory, whereas those with who tend to view intelligence as that which can be increased through effort and developed over time hold an incremental belief or incremental theory (Blackwell et al., 2007). It is important to note that the term *implicit theories of intelligence,* which refer to entity theory and incremental theory, is synonymous with *mindset theory,* with the terms *fixed* and *growth* mindsets broadly reflecting entity and incremental theories about intelligence respectively (Martin, Bostwick, Collie, & Tarbetsky, 2017). The author most important to this consideration is Carol Dweck, from whom mindset theory and the concepts of fixed and growth mindset originate. Individuals’ behaviors and beliefs are often influenced by their implicit beliefs about intelligence being malleable or inherent and fixed (Dweck, 2000; Dweck, 2006). Their beliefs about their intelligence affect how they respond to achievement challenges and obstacles (Dweck & Leggett, 1988;
Henderson & Dweck 1990), differences in the degree of social stereotyping (Levy, Stroessner, & Dweck, 1998), and their predictions of others’ future behaviors (Chiu, Hong, & Dweck, 1997).

The qualities of individuals with a fixed mindset are thus vastly limited in terms of their potential for academic achievement. When students view intelligence as fixed, they will tend to value looking smart, and will overwhelmingly seek to avoid poor performance (Dweck, 2008; Dweck, 2010).

Fixed mindset students tend to avoid effort in their academic endeavors based on their internalization of the idea that if someone has the ability, then success should come naturally. These students report feeling “dumb” when attempting to work hard on a challenging or novel goal or subject (Dweck, 2010). As a result, students with fixed mindsets will tend not to handle setbacks and failure well and in a crucial psychological point, will tend to believe that any such setback necessarily makes them question their intelligence, leading them to become discouraged or defensive (Martin, 2015), withdraw from classroom activities, blame others, accept failure, or even consider cheating, if success does not come immediately (Dweck, 2010).

By contrast, students who possess a growth mindset are described as tending to “view challenging work as an opportunity to learn and grow,” will embrace the challenge that comes with new concepts and difficult novel objectives, and will often express understanding that “even geniuses have to work hard” (Dweck, 2010, p. 16). As opposed to students who present a fixed mindset, those with a growth mindset tend to respond to failure or setbacks by maintaining a positive attitude and will tend to remain involved and
persevere toward their goals, as well as pursue alternative resources to help them get back on track (Martin et al., 2017).

One important theoretical basis for differentiating between the fixed and growth mindset in educational objectives can be extrapolated from the work of McClelland et al. (1989). These researchers explain that the growth mindset is the product of different motivational factors that they separate into self-attributed and implicit motives. Self-attributed motives are those that are conscious and explicit, and that are derived from environmental factors, such as direct instructions or expectations from an educator. Implicit motives, by contrast, are often subconscious and will often be combined with social incentives as a means of informing behavior (McClelland et al., 1989). Based on this consideration, while implicit motives will generally sustain spontaneous behavioral trends over time due to the pleasure that is often associated with the activity explicitly imposed, self-attributed motivation is more difficult to seek out or determine and tends to track with social motivational factors (McClelland et al., 1989; Martin et al., 2017). As a result, these researchers argue that the key means of effectuating motivational effectiveness and instilling a growth mindset in a given student is through implicit motivation. This motivation is more basic and is derived from affective experiences, whereas self-attributed motives are based on cognitively elaborated constructs.

The growth and fixed mindset result in different school behaviors (Dweck, 2010). If a student views intelligence itself as fixed or otherwise unchangeable, he or she will value the social perception of being smart and talented and tend to view novel experiences or challenges as being negative, due to the risk of failure or poor performance, rather than as important opportunities to learn (Dweck, 2010). To this end,
some students will tend to believe that “their intelligence [or skills] can be developed,” thus embracing a growth mindset, whereas others who exhibit a fixed mindset “believe that [their intelligence and skills are] fixed” (Dweck, 2010, p. 243). More specifically, Blazer (2011) provides evidence that indicates that the prevalence of these mindsets is roughly even; approximately 40 percent of students have a growth mindset, 40 percent of students have a fixed mindset, and 20 percent do not indicate that their learning behaviors are determined by either mindset (Blazer, 2011). Because there is an inherent risk and difficulty in outdoor adventure education, there is a strong tendency of students with fixed mindsets to easily give up on these activities following setbacks and failure (Davidson, Ewert, & Chang, 2016). Students with a fixed mindset who fail to commit to novel tasks after initial failure or difficulty can be adversely affected in a range of areas, not least of which is their psychomotor development (Vermette & Kline, 2017). Much of the current literature provides theoretical frameworks and constructs to help provide a foundation and guide for the action research study. Chapter 2 of this dissertation will present a more extensive review of the extant literature.

**Problem of Practice Statement**

Students with a fixed mindset will find it difficult to perform classroom tasks for which their motivation is hampered by a preconception or anticipation of failure as motivated by initial difficulty or setbacks (Dweck, 2006). Often due to fear of public humiliation, students who have experienced one or more instances of initial failure will begin to believe that they do not have the ability to be successful. These students tend to give up in their attempts to master tasks and begin to focus instead on preserving their self-esteem and reputations; they justify their lack of perseverant effort by an internalized
understanding that they are incapable of performing a given task, and they tend to give up easily in the face of initial failure (Brophy, 1998; Dweck, 2010).

There are several reasons why students may be quick to give up in the face of novel challenges. Silver (2012) argues that there are implicit social messages that stress the idea that success is based on talent and ability, not effort. In addition, struggle, failure, and vulnerability, which are often poorly emphasized in education and in the media, and the widespread phenomenon of overnight stardom presents an unrealistic view of success achieved in the absence of hard work (Silver, 2012).

Due to these factors, the researcher has often witnessed students in his outdoor adventure education classes quickly giving up after experiencing failure, especially when trying the more difficult activities such as archery, bouldering, kayaking, backpacking, or team-building challenges, such as those on a low ropes course. As a result, these students’ psychomotor skill development and achievement are adversely affected, resulting in their low scores in archery, poor performance in kayaking and bouldering, and an unwillingness to complete challenges on a low ropes course. In this experiential physical education instruction, because many activities not only involve physical exertion but also psychomotor skills, the researcher noticed that students are generally quick to give up in the face of initial failure, most notably in their attempts at archery.

In the researcher’s outdoor adventure classes, his students look forward to participating in archery more than any other activity; however, he often finds that after the archery unit, many students have not enjoyed the unit as much as they initially expected. Upon asking these students to describe the reason for their change in attitude,
most of them explain that the activities were more difficult than they had expected, or they kept missing the target, or they never could hit a bullseye.

Students who are unsuccessful in archery will often justify their disinterest in the face of failure by explaining that they are simply not skilled enough to be proficient at sports like archery, or by claiming that they are not strong enough to use the equipment. As a result, while some students (even in the face of initial failure), will show increased archery assessment scores throughout the unit, many students show little to no increase in scores. This can be related to their mindset. As described by Arem (2006) with regard to archery, “if students are not successful they may become discouraged and lose motivation to continue participation” (p. 34). Thus, these students’ reason for failure is not due to their failure to master archery techniques the first time they pick up a bow, but instead to their lack of persistence or unwillingness to practice and expend effort learning and correcting their technique. Students with fixed mindsets believe that they cannot improve through effort and perseverance, and by correlation, will tend to view other successful students as having natural archery ability.

In the light of these factors, the focus of this action research project is on teaching students how to develop a growth mindset during the archery unit and assessing this emphasis as a factor of its effect on archery scores.

**Purpose Statement**

The purpose of the proposed action research study is to increase student skill achievement in outdoor adventure education activities and classes at the researcher’s school, especially activities that require psychomotor skills, such as archery. The
intended goal of this study is to discover whether teaching students to employ a growth mindset has a positive effect on their archery scores.

Recent literature suggests that students’ success in outdoor adventure programs may be attained through linking outdoor personal development and psychology, such as mindset theory (O’Brien, 2015). Mindset theory offers a model that considers how beliefs regarding the self can transform into powerful motivational processes, such as through the interpretation of significant “patterns of cognition (thinking), affect (feeling) and behavior (doing)” (O’Brien, 2015, p. 19). This action research study will help to determine the impact that teaching the growth mindset has on skill achievement. Increased skill achievement in outdoor adventure classes may, as a result of this psychological emphasis and the increased effort that students bring to this activity, lead to their increased participation in similar activities, thereby allowing more students to enjoy the health benefits of outdoor adventure physical activity.

There is much scholarship on mindset theory. Carol Dweck is one such author and is one of the most well known for coining the terms fixed mindset and growth mindset (Aditomo, 2015; Mawer, 2014). However, nearly all the research examining the effect of a growth mindset on student achievement and motivation (including that of Dweck) is contextualized in core subject areas such as math, science, ELA, and social studies. In addition, while many studies examine student participation and motivation in physical education and outdoor adventure education, these studies often fail to incorporate mindset theory. O’Brien (2015) is one of the only authors to address mindset theory within an outdoor and physical activity-based environment; however, her study considers an Outward Bound course, rather than psychology in a school setting.
O’Brien (2015) concludes that an understanding of mindset theory and ability to emphasize a growth mindset in an explicit manner can maximize the strengths of this educational method. Thus, through providing scientific evidence regarding personal growth, and by implementing “empirically validated intervention techniques,” an emphasis on the growth mindset stands to “compliment the outdoor experience and strengthen the learning” (O’Brien, 2015, p. 19).

By teaching growth mindset in the archery unit, the researcher will seek to intervene and improve students’ mindset toward experiential learning through a greater understanding of how growth and fixed mindsets manifest, while teaching students a skill that extends beyond the classroom. Mindset theory offers a theoretical model based on extensive research that can provide a framework to use in supporting the researcher’s students, and in helping them to overcome challenges and failures throughout their lives (O’Brien, 2015).

**Study Rationale**

Archery is becoming commonplace in physical education programs (Ballard & Chase, 2004). Students are still required to meet state and national physical education standards, which include psychomotor, cognitive, and affective development (Brett, 2015; Holt/Hale, & Persse, 2015). Unfortunately, many students view these learned skills – the product of perseverance and effort – as fixed elements. The idea of the natural athlete – that is, someone who has high psychomotor skill ability without having to commit themselves to the necessary effort and practice – is especially discouraging to students with a fixed mindset and a lower relative level of skill ability (Vermette & Kline, 2017). Moreover, the idea of athletic ability as innate (the view often taken by those who
exhibit a fixed mindset) has been shown to be inconclusive (Baker, 2007). As a result “key psychological behaviors such as motivation and learning strategies” are perhaps as important to the “development [of talent]…both in sport and other performance areas” as genetic factors (Gray & Plucker, 2010, p. 365).

The rationale for this work is based on the idea that outdoor adventure educators may fail to recognize the importance of mindset, as it has been defined in this work, among the students they teach. Archery skill achievement, as well as general outdoor skills achievement, is as much the product of motivation and perseverance as innate talent, and it is the view of this researcher that such a motivated and perseverant mindset will have a measurable increase on archery skills achievement among students. Additionally, research supports that students who are taught to employ growth mindsets can are able to attain significant increases in their levels of achievement. Furthermore, the researcher believes this intervention may have positive social justice implications in the researcher’s outdoor adventure class. Research suggests that a growth mindset can close the achievement gap between Black, Hispanic, and White students, as well as that which presents between males and females (Warren, 2005). Fostering a
growth mindset in students may serve as a powerful alleviation to some of the social justice issues present at his school and in his classes. Not only may it help encourage more minority and female students to take the researcher’s class in the future as a result of decreased stereotype threat found in many adventure activities, but it may also reduce gender bias and foster leadership potential in these students.

**Research Questions**

Students with fixed mindsets exert little effort on difficult tasks, and usually only attempt activities in which they are confident they will succeed (Blazer, 2011). Because employing a growth mindset has the potential to increase achievement, participation, motivation, and perseverance, the following research questions guide the present study:

RQ1: How does implementing and emphasizing the growth mindset in an outdoor adventure education curriculum using the computer program *Brainology* impact student archery scores during an archery unit?

RQ2: How do students perceive their archery ability in relationship to their mindset?

RQ3: How will students explain any significant changes in archery scores?

**Research Design**

The best method for this action research study was a concurrent mixed methods study utilizing both quantitative and qualitative research methods (Teddlie & Yu, 2007). In a concurrent mixed methods design, the researcher collects both quantitative and qualitative data during the same stage; however, the researcher may give priority to one form of data over the other (Castro, Kellison, Boyd, & Kopak, 2011). Quantitative research methodologies involve the collection and analysis of quantifiable, often
numerical data. In addition, quantitative data also include concrete ratings of attitudes, perceptions, interests, or feelings as expressed on a numerical scale. Such data can be collected via questionnaires, surveys, rating scales, checklists, and tests (Mertler, 2014). Techniques of quantitative data collection are efficient in that data may be collected from many individuals simultaneously. To this end, a quantitative data collection methodology may be optimized by focusing on a single subject, setting, or event; therefore, this action research study focused on an archery unit in the researcher’s outdoor adventure education class.

Quantitative data may present less depth when compared to qualitative techniques, which involve less concrete terms and data. Therefore, in order to provide more depth, rigor, and validity to the study, the researcher also collected qualitative data. Qualitative research methodologies involve the collection of data that consists of descriptive, narrative accounts (Mertler, 2014). Such data may be collected via interviews, observations, journals, or existing records and documents. This data, as a form of social inquiry, provided an understanding of certain social phenomena in the researcher study (Renz et al., 2018). The benefit of using a mixed methods research design is that both the quantitative and qualitative data may provide a better understanding of the problem than either type of data alone (Creswell, 2005).

**Setting.** This action research study took place at a middle school in Lexington, South Carolina in two of the teacher researcher’s sixth grade outdoor adventure education classes. The researcher’s school is a public sixth-eighth grade school with 1,145 students consisting of the following demographics: 27% of students are on the Free and Reduced Lunch program and 8% have IEP’s. Seventy-five percent of students are white, 8% are
African American, 6% are Hispanic, 6% are Asian, 5% are of two or more races, and 49% are male and 51% are female (J. Dean, personal communication, July 18, 2016). The researcher’s outdoor adventure education class counts as a physical education credit. There are three outdoor education teachers, all teaching identical semester-long classes including two eight grade classes, two seventh grade classes, and two sixth grade classes.

**Sample.** This study consisted of 50 sixth grade students in both of the researcher’s outdoor adventure education classes. Each sixth grade class consisted of 25 students. The sample included 29 males and 21 females; 36 White, 6 Black, 5 Hispanic, 2 Asian, and 1 Indian. The sampling method used was convenience nonprobability sampling due to the nature of the action research study. This grade level was chosen because in the researcher’s own observation, sixth graders tend to give up more quickly and tend not to try as hard, especially after initial failure, compared to other grade levels, and show a greater likelihood to attribute their poor achievement to an innate inability.

**Intervention.** This study used the *Brainology* curriculum, specifically the summer school curriculum published by Mindset Works, Inc. *Brainology*, an online computer software program, is a growth mindset intervention that relates the concept of brain neuroplasticity to academic improvement. The summer school curriculum consisted of online lessons with classroom-based lessons to supplement the online learning. The students used their school-issued iPads to complete the online lessons, which consisted of an introduction and four 30-minute units that showed students how they can grow and strengthen their brains through practice and effort. They also completed eleven classroom-based lessons that consisted of direct instruction from the researcher,
cooperative activities, and worksheets. More details about the intervention are presented in Chapter 3 of this dissertation.

**Data collection methods and instruments.** This study first quantitatively determined students’ baseline archery skill abilities using a standardized international style archery shooting assessment that was modified to accommodate the timeframe of the study, and two Mindset Assessment Profile surveys to determine students’ initial mindsets. At the end of the unit, a second archery skills assessment determined the impact teaching growth mindset had on their archery skills achievement levels, and the same two Mindset Assessment Profile surveys were given to determine the impact teaching growth mindset had on their mindsets. Qualitative data was collected via a semi-structured focus group interview, the researcher’s observations and field notes, and student reflections and worksheets within the *Brainology* curriculum.

**Data analysis.** Quantitative data was analyzed using descriptive statistics and inferential statistics. Descriptive statistics used in this study included calculating the mean, standard deviation, and change score for the archery and MAP scores. Inferential statistics were used to infer the effectiveness of the *Brainology* program. A paired t-test was used to compare the average performance and variability between the students’ scores prior to and after using the *Brainology* curriculum. The researcher used simple Pearson correlations to determine the degree of correlation between archery scores and mindset scores. After the researcher calculated the change scores for each student’s archery scores, the researcher split the class into fixed mindset (MAP score ≤ 28) and growth mindset (MAP scores ≥ 29) groups and calculated the average archery change score for each mindset.
Qualitative data was analyzed using the constant comparison method. This method records social phenomena and classifies them using inductive category coding, then compares them across categories (Dye, Schatz, Rosenberg, & Coleman, 2000). This helped interpret the quantitative data, provide multiple perspectives of what was being studied, increase the validity of the study, and decrease researcher bias (Renz, Carrington, & Badger, 2018). The qualitative data helped determine how students perceive their archery ability in relationship to their mindset and how they explain any significant changes in their archery scores.

**Dissertation in Practice Overview**

Chapter One of this Dissertation in Practice (DiP) has introduced the reader to the theories of implicit intelligence and mindset as these theories relate to achievement, participation, perseverance, and grit. It has described the identified problem of practice (PoP) in outdoor adventure education classes, as well as the purpose for this action research study, and presented the research questions central to this consideration. A theoretical framework as been established, and the methodology of the action research study to follow has been presented.

Chapter Two of this DiP will review the related relevant literature on fixed and growth mindset, implicit theory of intelligence, outdoor adventure education, and archery in outdoor adventure education. Chapter Three will explain the mixed methods research methodology that was used to collect and analyze collected data and report findings. Chapter Four of this DiP will report the data findings relative to the identified PoP and interpret the results of the study. Chapter 5 will provide an overview and summary, suggestions for policy and future research, and draw conclusions about the incorporation
of growth mindset into an outdoor adventure curriculum through an action plan and its effects on student skill performance, including ways in which data derived can be incorporated into other school and outdoor-focused curricula across the U.S. and around the world.

Due to the benefits of physical education, it is imperative that students receive high quality physical education (Ommundsen, 2001a). Adventure outdoor activities are notable among students’ physical education options because they involve major opportunities for setbacks and failure, in the face of which students must learn how to cope in order to increase learning and achievement (Duckworth, 2015). This work examined the impact of teaching a growth mindset on increasing skill performance in an outdoor adventure education classroom and revealed the effect of implementing and emphasizing the growth mindset in an outdoor adventure education curriculum as it manifested in the form of student scores during an archery unit (O’Brien, 2015). Skill and cognitive development were considered and this work considered the impact that non-cognitive skill development, especially that grounded in mindset theory, can have on an outdoor adventure curriculum.

**Glossary of Key Terms**

*11 Steps to Archery Success* – created by NASP (n.d.), these are 11 tips used for successful shooting; they include (1) stance, (2) nock arrow, (3) bow hand set, (4) draw hand set, (5) pre-draw, (6) draw, (7) anchor, (8) aim, (9) shot set-up, (10) release, and (11) follow-through and reflect.
**Action Research** – Systematic inquiry conducted by administrators, counselors, or teachers to gather information about how teaching methodologies or school operations, or how students learn (Mertler, 2014).

**Entity Theory** – Commonly referred to as “fixed mindset,” it is the belief that intelligence or ability is a fixed quantity that an individual either does or does not possess (Dweck, 2010; Dweck, Walton, & Cohen, 2014). If a student views intelligence as being fixed or otherwise unchangeable, he or she will value the social perception of being smart and talented and tend to view novel experiences or challenges as being negative due to the risk of failure or poor performance, rather than as important opportunities to learn (Dweck, 2010).

**Incremental Theory** – Commonly referred to as “growth mindset,” it is the belief that intelligence or ability is a changeable quantity that can be increased with effort and learning, and can be developed over time (Dweck, 2010; Dweck et al., 2014). Students who demonstrate a growth mindset will often take on challenging activities, even if they experience initial failure. They do not view such failure as an innate inability in that subject; but rather they tend to view such failure as a step toward mastery. They are more resilient and recognize the value of challenge and failure and usually show greater effort in the future to master a complicated task (Dweck, 2010; Meierdirk, 2016).

**Implicit Theory of Intelligence** – Commonly referred to as “Mindset Theory,” it is a person’s fundamental beliefs about whether his or her intelligence and abilities can be changed (Bernardo, 2012; Dweck, 2006). Individuals’ behaviors and beliefs are often influenced by their implicit beliefs about intelligence being malleable or inherent and fixed (Dweck, 2000; Dweck, 2006). Individuals’ beliefs about their intelligence affect
how they respond to achievement challenges and obstacles (Dweck & Leggett, 1988; Henderson & Dweck 1990), differences in the degree of social stereotyping (Levy, Stroessner, & Dweck, 1998), and their predictions of others’ future behaviors (Chiu, Hong, & Dweck, 1997).

**Outdoor Adventure Education** - Educational situations that take place in a wilderness/outdoor setting and have an element of adventure or challenge often used to educate through direct experience (Warren, 2005).

**Target Archery** – Archery that involves shooting a certain number of arrows from a specific distance at one target. Shooting is scored by adding up the points for the location that each arrow that strikes the target (Darst & Pangrazi, 2004).

**Brainology** – Created by Carol Dweck in 2007, Brainology is a computer program that encourages growth mindset. This computer program “leads users through activities and challenges developed around the assumption that intelligence is malleable and can be improved through effort and application” (Donohoe, Topping, & Hannah, 2012, p. 642).

**Archery Skill Achievement** – Archery skill achievement can be measured both quantitatively as archery scores on a target, and qualitatively as archery shooting form. Archery is a closed skill – that is, the environment does not change – compared to an open skill such as soccer, where the environment is constantly changing; however, there are various approaches to measuring archery skill achievement (Woods, 2001). The most common measurement of skill achievement, especially in the K-12 educational setting, comes from the National Archery in the Schools Program (NASP).
CHAPTER 2

LITERATURE REVIEW

As student desire for adventure physical education activities shifts away from traditional physical education activities, archery is becoming commonplace in physical education programs (Ballard & Chase, 2004). Students are still required to meet state and national physical education standards, which include psychomotor, cognitive, and affective development (Brett, 2015; Holt/Hale, & Persse, 2015). Unfortunately, many students view these learned skills – the product of perseverance and effort – as elements with which someone is born. The idea of the natural athlete, that is, someone who has high psychomotor skill ability without having to commit themselves to the necessary effort and practice, is especially discouraging for students with a lower relative level of skill ability and the belief that intelligence and ability are innate (Gray & Plucker, 2010).

Students with what Carol Dweck (2010) call a fixed mindset will find it difficult to perform classroom tasks for which their motivation is hampered by a preconception or anticipation of failure as motivated by initial difficulty or setbacks. Often due to fear of public humiliation, students who have experienced one or more instances of initial failure will begin to believe that they do not have the ability to be successful. These students tend to give up in their attempts to master tasks and begin to focus instead on preserving their self-esteem and reputations; they justify their lack of perseverant effort with an internalized understanding that they are incapable of performing a given task, and tend to give up easily in the face of initial failure (Brophy, 1998; Dweck, 2010). Much of the
research regarding natural performance ability, which shows exceptional athletic ability to be innate (the view often taken by those who exhibit a fixed mindset), is inconclusive (Baker, 2007). While there is evidence to indicate that skills proficiency can be linked to a genetic predisposition, research has also shown that “key psychological behaviors such as motivation and learning strategies” are also highly important to the “development [of talent]…both in sport and other performance areas” (Gray & Plucker, 2010, p. 365).

Therefore, teaching growth mindset – the idea that intelligence and ability can be increased through effort (Dweck, 2006) – in an outdoor adventure education program reminds students who may have a fixed mindset that skill and talent can be learned and developed and can be used as grounds for encouraging these students to put forth their best effort in order to increase their achievement.

**Problem of Practice**

Students who give up and quit after experiencing failure will often have their psychomotor skill development and outdoor sports achievement adversely affected (Haarens et al., 2015). However, this researcher has witnessed that student interest in such activities – though it varies – will invariably peak when it comes to performing archery. Unfortunately, in this researcher’s experience, students rarely enjoy the unit as much as they had initially expected. Upon asking these students to describe the reason for their change in attitude, most of them explained that it was more difficult than they expected, they kept missing the target, or they could never hit a bullseye.

Students who are unsuccessful at archery will often justify their own disinterest after initial failure by explaining that they are simply not skilled enough to be proficient at sports like archery. These students are typical of the fixed mindset. They believe that
they cannot improve through effort and perseverance and by correlation also may view other successful students as having natural or innate archery ability (Dweck, 2015). In light of these factors, the focus of this action research project is on teaching students how to develop a growth mindset during the archery unit via the computer program Brainology and on assessing the result of this emphasis and its effect on archery scores.

**Rationale for the Problem of Practice**

The purpose of the proposed action research study is to increase student skill achievement in outdoor adventure education activities that require strong psychomotor skills, such as archery. The intended goal of this study is to determine whether teaching students to employ a growth mindset through use of the computer program Brainology, has a positive effect on their archery scores. Recent literature suggests that students’ success in outdoor adventure programs may be attained through linking outdoor personal development and psychology, such as mindset theory (O’Brien, 2015). Additionally, recent research has shown that Brainology has a positive impact on student confidence and classroom achievement, especially in reading skills (Saunders, 2013), and in science (Esparza, Shumow, & Schmidt, 2014); however, there have been no studies examining the impact of Brainology on psychomotor skill achievement.

This action research study will help to determine the impact that teaching a growth mindset through the use of an online computer program will have on skill achievement in an outdoor adventure class. By teaching growth mindset using the Brainology computer program in an archery unit, this researcher will seek to improve an outdoor education archery class’s mindset toward overcoming not only challenges in
learning archery skills, but also in facing challenges which will manifest throughout their lives (O’Brien, 2015).

**Underlying Causes of the Problem**

There are several reasons why students may be quick to give up in the face of adversity. Research on personal and situational determinants of students’ beliefs about their achievement in physical education have been influenced by social-cognitive theories of motivation and control. Evidence shows that “the achievement belief systems people construct have important implications for the way they interpret and emotionally respond in achievement settings” (Ommundsen, 2001a, p. 220). One potential determinant is students’ achievement goal approach, including implicit theories of ability in which students believe their ability level is fixed, or that it can be increased through effort (Dweck, 2010; Dweck & Leggett, 1988). Other potential underlying causes are students’ lack of self-regulation (Ommundsen, 2003; Ommundsen, 2006), perceived ability (Jackson-Kersey & Spray, 2013), student self-efficacy (Bandura 1986; Chase, 2001; Ryan & Dziewaltowski, 2002), and teacher self-efficacy (Dweck, 2007; Ferrer-Caja & Weiss, 2000). Indirectly related to student achievement in physical education is the students’ participation in after-school physical activity. Omundsen and Kvalo (2007) found that “young people’s decisions about after-school physical activity seem heavily influenced by past experiences in PE, such that a sense of boredom, lack of choice, incompetence and negative peer evaluation negatively influence pupils’ motivation to participate in sports outside PE” (p. 386).

Silver (2012) argues that there are implicit social messages which stress the idea that success is based on talent and ability rather than effort. Additionally, struggle,
failure, and vulnerability, which are often poorly emphasized in education and in the media, and the widespread phenomenon of “overnight” stardom presents an unrealistic view of success achieved in the absence of hard work (Silver, 2012). It is likely that some combination of these factors is causing this larger problem.

**Organization of the Chapter**

This review will consider a range of scholarly works and findings, which will inform the following action research study. As this work is a pedagogical consideration, particularly as derived from the theoretical work of Carol Dweck, this work will consider Dweck’s work in some detail, as well as the antecedent theoretical learning theory work of Albert Bandura. Mindset theory will be considered extensively, especially as it relates to physical education. Considerations of the difference between self-attributed and implicit motives will follow, as well as other psychological theories and studies such as achievement goal theory, which support Dweck’s theories and assertions. Methodological considerations will be presented, especially by O’Rourke et al. (2014), that consider ways of inducing students to embrace a growth mindset in their education, including the computer program *Brainology*. In addition to Dweck’s work, Duckworth’s (2015) concept of grit and the ways in which its definition of persistence differs from the growth mindset will be explored, as well as other studies that investigate the concepts of commitment, motivation, and perseverance as they relate to educational objectives and skill development. Self-efficacy, achievement, and other cultural factors, particularly the emphasis on innate talent fostered in the U.S. and other western cultures, will also be considered. Finally, the many benefits of outdoor and adventure education will be presented.
The materials presented in this chapter came from articles in online databases and books related to the psychosocial influences of motivation and achievement in academic and physical education settings. The researcher primarily used the search engines Education Source, ERIC (EBSCO), SAGE Journals, PsychInfo, and Physical Education Index; and included important keywords such as motivation, self-efficacy, self-concept, achievement goal theory, implicit theory of intelligence, growth mindset, fixed mindset, stereotype threat, self-regulation, and perceived ability. From these related articles and books, the search was refined and focused on these factors in physical education and outdoor adventure education settings.

The purpose of this review is to discuss relevant scholarly works and findings that provide a theoretical foundation and context for the following study as it relates mostly to mindset theory. There is much scholarship on mindset theory, particularly that of Carol Dweck, most well-known for coining the terms fixed mindset and growth mindset (Aditomo, 2015; Mawer, 2014). However, most of the research examining the effect that growth mindset has on student achievement and motivation, including that of Dweck, is contextualized to central subject areas such as math, science, ELA, and social studies rather than physical education or outdoor adventure education. This literature review seeks to identify theories and concepts related to implicit theories of intelligence in order to provide a holistic view of the psychosocial factors influencing motivation, achievement, and what causes students to persist when faced with setbacks and failure, as well as to find ways to teach growth mindset in the classroom.
Historical Perspectives on Physical Education, Outdoor Adventure, and Archery

In 1820, physical education was first introduced into the US school system as a result of changes in the curriculum, which included the introduction of gymnastics and care for the human body (Park, 1983). In 1823, the Round Hill School in Northampton, Massachusetts, was the first school in the United States to make it an integral part of their school’s educational program. It was not until 1855 in Cincinnati, Ohio, that physical education became a formal requirement in the school system. However, physical education did not become a widespread formal requirement until after the civil war, when many states put the physical education requirement into law. In the early 1900’s gymnastics and sports were prominent in school institutions and were a standard part of formal education. By 1950, many colleges and universities in the United States offered physical education majors. As a result of the Korean War, American boys were seen as not as physically fit as their European counterparts; thus physical education shifted from a focus on gymnastics to physical fitness, which included jumping, throwing, and push-ups to get them ready for military service. In the late 1900’s, commitment to physical education declined as a result of poor curriculum and economic issues. Furthermore, an emphasis on other subjects and electives began to replace physical education classes. Throughout the years, several global and national events have altered the course of physical education in America (Freeman, 2012). Although physical education is often cut when there are curriculum reorganizations and budget cuts, it is an essential part of a comprehensive educational system.

The Society of Health and Physical Educators (SHAPE, 2015) recently identified the following components as essential for quality PE programs: (1) environment and
policy, (2) curriculum, (3) appropriate instruction, and (4) student assessment. One
barrier to student engagement in PE is the continued use of traditional multi-activity PE
curricula (Bulger & Housner, 2009; Ennis, 2014). Traditional multi-activity curricula,
which are usually short units of instruction focused on team sports (Kirk, 2006), have
been criticized as problematic for several reasons. The most important reason is that
highly skilled athletic students tend to dominate the activities; therefore, participation of
less skilled students significantly decreases. Moreover, when PE curricula is reduced to
team sports alone, students are unable to develop the confidence and competencies that
are needed to participate in alternative forms of physical activity such as rock climbing,
kayaking, and archery, which include many lifelong benefits (Braga, Elliott, Jones, &
Bulger, 2015). Effective PE curriculum development should consider students’
geographical environment, cultural backgrounds, and interests in what Braga et al. (2015)
call a curriculum that is “culturally and geographically relevant” (p. 63). In their study,
which examined middle school students’ perceptions of culturally and geographically
relevant content in physical education, they found that PE content should be meaningful,
innovative, relevant, and challenging. Furthermore, the middle school students, which
were located in a geographic and culturally similar context as this researcher’s school,
considered archery as one of their most desired PE activities. As a result of this paradigm
shift in recent years, more outdoor adventure-based PE programs, which take into
consideration student culture and geography, have emerged as an alternative to traditional
multi-activity curricula (Ballard & Chase, 2004).

Historically, outdoor adventure education has been influenced by global and
national events. In the early 1700’s the conservation movement, in which many famous
writers were significant contributors by romanticizing the outdoors, had a significant impact on outdoor recreation (Webb, 2001). This led to outdoor recreation events, and in turn led to organized outdoor recreation clubs. As worldwide interest grew in outdoor adventure activities, more formal worldwide organizations began to emerge such as The Boy Scouts of America and Outward Bound (Phelps, 1980; Outward Bound, n.d.).

Recently, scholars have recognized the benefits of outdoor adventure education or at a minimum incorporating non-traditional recreational activities such as archery into the traditional PE curriculum. Benefits include providing novelty that may spark student interest and motivation for involvement, increased social and emotional development in students, inclusion of students of all abilities and from different cultural backgrounds, and a renewed interest for the teacher through continued learning and dynamic instruction (Ballard & Chase, 2004). Archery is one such activity that provides many of these benefits, and also fits well with both the traditional PE curricula and the outdoor adventure education curricula.

Archery is one of the oldest known activities. It is unclear how long the bow and arrow have existed, but the earliest archeological evidence suggests the bow and arrow originated in Africa over 70,000 years ago (Maschner & Mason, 2013). From there, its use spread throughout Asia and North America. Although the bow was originally primarily used for hunting, competitive archery in Middle East and Asia, especially in Korea, China, and Japan helped to influence modern competitive archery in the United States (Haywood & Lewis, 2006; Guttmann, 2004; Wang, 2004; Zhou, 2015). The invention of the firearm resulted in a sharp decline in the use of the bow and arrow; however, King Henry VIII promoted archery as a sport in England in order to preserve
and maintain interest. As a result, archery societies in the 1600’s established archery as a competitive sport. In the early 1800’s competitive archery clubs became popular, but it was not until the early 1900’s that archery was found in physical education programs in the United States (Coleman, 1935). There have been barriers that have hindered its participation rate in schools, which include safety concerns, lack of equipment, lack of space, and lack of teacher training (NASP, n.d.). However, archery, specifically target archery, has grown in popularity in recent years as more clubs and organizations have emerged such as the National Archery in the Schools Program, which offer a safe and standardized curriculum designed for grades 4-12 schools, teacher training, and equipment, as well as organized competitive opportunities for students of all ability levels and demographics. The two most popular forms of archery are field archery and target archery (Darst & Pangrazi, 2004). While field archery involves shooting multiple targets of various distances, sizes, and shapes, target archery involves shooting a certain number of arrows from a specific distance at one target. Shooting is scored by adding up the points for the location where each arrow strikes the target (Darst & Pangrazi, 2004). As archery continues to grow in popularity, it provides much benefit to the PE and outdoor adventure curricula. However, archery does present challenges, many of which may result in lack of student motivation or persistence in shooting (Haywood & Lewis, 2006).

**Mindset**

Dweck (2010) presents a range of pedagogical resources that educators may employ to instill a growth mindset in their students. The first of these is to create a culture of risk taking, one through which students are not necessarily praised for the completion of a given task, but for the effort they have shown and the persistence they displayed,
both of which are more beneficial to students’ long-term effectiveness than praising them for being smart. Second, educators must identify students for whom tasks come easily and help them to display or maintain a growth mindset by assigning tasks that require these students to “stretch.” That is, they must show a level of effort proportionate with that which is shown by their peers, and which is sufficient to maintain their interest in the material, as a factor of its complexity or difficulty (Dweck, 2010).

In addition, students’ sense of mastery as derived through persistence can be enhanced through the application of measures that help students to foster a sense of progress, to ensure that students understand that through persistence, their skills and knowledge can increase (Dweck, 2010). Through the application of pre-tests given at the start of a semester (which students will invariably fail), student understanding of the necessity of effort as a precursor to success can be instilled. Finally, the fixed mindset can be mitigated even in failure by placing such failure on a continuum as is done by a Chicago school cited by Dweck that does not give its students failing grades, but instead labels failing papers with encouraging marks such as “not yet,” which provide the students with tacit incentives to apply themselves more in the future.

In Dweck’s (2008) work Mindset, she argues that it is crucial to provide students with effective encouragement and the tools for persistence, partly because the difference between the growth and fixed mindset is extended to define the difference between learners and non-learners. This is a crucial distinction that stresses the relevance of these concepts; put simply, the work argues that there is no benefit to the fixed mindset and that educators must do everything in their power to help these students to overcome the many challenges they face to become more like their growth-oriented peers.
Fear, in particular, is a key indicator and predictor of the likelihood of an individual to be consumed and hampered by a fixed mindset. In an early comparison, the author explains that infants “stretch their skills daily,” and are some of the strongest examples of individuals who possess a beneficial growth mindset (Dweck, 2008, p. 16). The enthusiastic learning skills and behaviors that infants possess are qualities that often are ended by the development of the fixed mindset (Dweck, 2008). From the moment children develop the capacity for self-evaluation, some of them will begin to fear challenges and seek to develop what are essentially self-protective behaviors through which they can avoid the fear of being unintelligent (Dweck, 2008). Therefore, the logical basis of the fixed mindset is a fallacy into which many individuals may fall in order to avoid risks, not necessarily of hard work, but of being labeled (whether by themselves or by others) as inadequate. The best example of the difference between these two mindsets can be found in a survey Dweck (2018) performed at the University of Hong Kong in which students were asked whether they agreed with the statement “You have a certain amount of intelligence, and you can’t really do much to change it” (Dweck, 2008, p. 17). Students who agreed with this statement are described as possessing a fixed mindset. By contrast, subjects with a growth mindset were more likely to agree with the statement, “You can always substantially change how intelligent you are” (Dweck, 2008, p. 17).

A range of other psychological factors is associated with students who have a fixed mindset. As described by Murphy and Thomas (2008), the difference between the fixed and growth mindset (whether students view intelligence as fixed or malleable) is an important indicator of student development and achievement in the range of educational
objectives (Murphy & Thomas, 2008). Through a consideration of the impact of either mindset on students’ capacity toward success in a collegiate computer science program, these researchers found that students who possess a fixed mindset are “more likely to exhibit a helpless response to substantial challenge” (Murphy & Thomas, 2008, p. 271). By contrast, students who exhibit a growth mindset are more likely to display a mastery-oriented response and welcome the challenge that a given educational regime can present (Hong, Chiu, Dweck, Lin, & Wan, 1999). These researchers’ consideration is crucial for the finding that these different motivational mindsets are directly correlated to the presence or absence of self-esteem. Students with a fixed mindset are more likely to experience decreases in self-esteem as a result of their inability, or perception of ineffectiveness, when confronted with a substantial challenge or a situation for which they are unprepared. By contrast, students with a growth mindset are more likely to maintain their self-esteem, even when confronted with failure because they attribute such failure to a lack of effort rather than a lack of intellectual ability (Murphy & Thomas, 2008). As a result, growth-oriented students are more likely to increase their efforts toward sustained pursuits, rather than believe that failure is a result of personal inability (Grant & Dweck, 2003).

While the studies considered have been quick to label the differences between students who are able to present greater effort in the face of adversity and contrast them with those who believe their talents to be innate and limited, few aside from Dweck have provided concrete solutions for instilling the sought-after growth mindset. O’Rourke et al. (2014) consider one such potential policy through the medium of computer games. They outline a computer game that directly incentivizes effort, as well as the use of
strategy and incremental progress, as a means of instilling growth mindset behaviors in schoolchildren (O’Rourke et al., 2014). O’Rourke et al. found that the online computer game helped low-performing students, whose behaviors are often more indicative of a fixed mindset, to persist in order to complete the educational objectives. As a result, they had greater perseverance after a challenge (O’Rourke et al., 2014). This study offers many implications for classroom application. Guided software such as this game can provide students with a means of enhancing their own personal efficacy and perseverance. Thus, it is likely to result in more effective future outcomes than those that are explicitly taught by an educator or implied by peers.

An individual student’s ability to persevere may be directly related to his or her mindset about his or her abilities. In one study, Aditomo (2015) tested the growth mindset model to determine whether students’ beliefs about their ability influence their motivational response to achievement and setbacks or failure. This study sought to understand why some students show resilience after setbacks, while others lose motivation and incur negative consequences (Aditomo, 2015). The study suggested that having a growth mindset about academic ability prompted students to attribute their ability to effort and adopt mastery goals, which reduced demotivation when students encountered academic setback and in turn led to increased academic achievement.

Claro and Paunesku (2014) investigated Chilean students to discover whether mindset could predict academic achievement and if there were differences in mindset for students with different SES, genders, or geographical areas. After controlling for extraneous variables, this study found that students who had a growth mindset showed higher levels of academic performance. The researchers also observed that mindset
differs vastly across socioeconomic status levels and that “poor students are more likely to have a fixed mindset” than their wealthier peers (Claro & Paunesku, 2014, p. 4).

In Hochanadel and Finamore’s (2015) consideration of literature about the growth mindset and about learning and persistence, the researchers examined how educators can foster a growth mindset and ‘grit’ – or perseverance – in their students. These researchers examine students who have growth mindsets and fixed mindsets and explain that students who value effort possess a growth mindset and tend to perceive ability as a malleable skill (Hochanadel & Finamore, 2015). Conversely, students who feel that “intelligence is inherent and unchangeable exert less effort to succeed and have a fixed mindset,” and are more likely to describe their own capacities as inherent or permanent (Hochanadel & Finamore, p. 48). These researchers conclude that a growth mindset can be fostered and students’ ways of thinking can be changed through explicit instruction.

Crane (2013) synthesizes various literature themes, including those that relate to motivation and participation in physical activity. Through exploring the relationship of activity patterns during adolescence to future participation habits, the researcher supports the importance of motivating adolescents to participate in physical activity. In addition to the inherent benefits of physical activity, Crane found that “family, friends, peers and teacher relationships determine an individual’s degree of motivation” to engage in physical activity (Crane, 2013, p. 38). As a result, it can be argued that such relationships are influential to a student’s proclivity toward developing a fixed or growth mindset.

**Grit**

One factor crucial to this consideration of the fixed and growth mindsets is grit (Duckworth, Peterson, Matthews, & Kelly, 2007). As described by Hochanadel and
Finamore (2015), grit is closely related to the growth mindset and is described as a factor of students’ abilities to persevere when faced with adversity. Students who possess skills that result in showing grit will often show confidence and “passion and perseverance for long-term goals” (Hochandel & Finamore, 2015, p. 47). Therefore, one can argue that grit is a skill (and an educational goal) that can coexist with the growth mindset; thus, students who possess grit may also show a growth mindset as they are inclined to view unfamiliar experiences and classroom requirements not as impassable barriers, but rather as a means by which they can gain new skills and foster their own learning capacities.

The implications for the classroom environment are considered and Hochandel and Finamore (2015) argue that educators’ influence is pivotal. In this regard, students can be taught how to manifest grit and educators must make a point of emphasizing this quality in their students’ responses to adversity and failure.

The work of Duckworth et al. (2007) is closely related to that of Dweck with respect to revealing other personality factors that are just as crucial to academic and overall success as innate talent. These authors consider persistence to be a factor of grit, a personality aspect that they describe as emphasizing “long-term stamina rather than short-term intensity” in the completion of a task (Duckworth et al., 2007, p. 1089). Individuals who possess a high degree of self-control but only a moderate degree of grit may “effectively control [their] temper” or stick to a diet, but they will also “switch careers annually” (Duckworth et al., p. 1089). Thus, this distinction portrays grit and overall measures of persistence as distinct from motivation and as aligning with achievement purpose. Goals that people with grit set for themselves are often far greater than those of the motivated individual. Such goals are often “deliberately…extremely
long-term” aims from which they do not “swerve…even in the absence of positive feedback” (p. 1089). In addition, individuals with grit may be aware that they show high levels of persistence, as opposed to individuals whose motivation is more subconscious and based on extrinsic factors (Duckworth et al., 2007).

In light of these factors, Duckworth, et al. (2007) portray the growth mindset as being tied to the presence of grit and argue that achievement is the “product of talent and effort;” and, persistent effort is a “function of the intensity, direction, and duration of one’s exertions toward a goal” (p. 1098). While both grit and mere motivation are factors of the growth mindset toward persistent achievement, only grit reflects hard work in the face of a major challenge and an individual’s willingness to exert him or herself without switching objectives. Essentially, Duckworth et al., (2007) discard innate skill as a concept; however, motivation and persistence must be present in the pursuit of a major long-term goal without deviation. This concept, which they call “follow-through,” is just as crucial to achievement as a growth mindset.

**Goal Commitment and Persistence**

An important consequence to the presence or absence of the fixed or growth mindset in education is the presence of goal commitment factors. As described by Hollenbeck et al. (1989), goal commitment can best be defined as the “determination to try for a goal,” combined with the “persistence in pursuing [the goal] over time” (Hollenbeck et al., 1989, p. 19). Moreover, the presence of goal commitment factors will also imply that the student is unwilling to lower or abandon the goal, resulting in goal commitment, which is used interchangeably with goal acceptance (Hollenbeck et al., 1989).
Hollenbeck’s et al. (1989) work presents a range of situational variables that can increase the commitment the individual shows to a given action, especially in situations, such as those in the classroom, where educational objectives are presented as external constraints. Goal commitment factors can include the strong desire for people to appear rational and consistent to their peers, leading them to resist changing an established course of action once it has been presented, for fear of being seen as inconsistent (Hollenbeck et al., 1989). Therefore, fear of social ostracism can be a powerful predictive factor with respect to individuals’ likelihood of showing persistence toward the accomplishment of difficult tasks once others know about it. Additionally, individuals may possess a high desire for achievement, and accomplish complicated tasks or find the motivation and energy necessary to do so due to this desire (Hollenbeck et al., 1989).

In particular, goal attainment is better facilitated through the presence of explicit goals, which are more effective than vague intentions for students’ participation; additionally, goal attainment results in greater and continued motivation (Propst & Koestler, 1998). When a goal is challenging and the individual is successful at accomplishing the goal, it is more likely that he or she will continue in the activity in the future (Propst & Koestler, p. 322). While achieving goals is linked with greater self-efficacy, the core finding of this work is the link between explicit goals and the sense of mastery, especially as a product of the differentiation between the fixed and growth mindset.

If students with fixed mindsets are presented with a vague goal, they are more likely to perceive their failures as results of innate inability; while those with a growth mindset, similarly, may be unable to understand whether they have accomplished a given
goal at all. As a result, this work argues that outdoor educational tasks as a path toward a
greater sense of self-efficacy often rely on the educator to present explicit goals for
student completion. Students’ success or failure and their perception of their abilities as
innate are closely linked to an effective mentoring process and explicit goal-setting
(Propst & Koestler, 1998). Therefore, students who are unable to set effective goals may
be more likely to show a fixed mindset, and those who are able to set effective goals are
more likely to show a growth mindset.

Growth mindset is often a factor of persistence as a measure of the individual’s
ability to persevere when confronted with novel or complicated problems or objectives.
Therefore, especially with respect to this study’s focus on students, it is necessary to
consider persistence in greater detail. As described by Lufti and Cohen (1987), because
persistence is a crucial factor in predicting students’ academic achievement as well as
their general development of personality, the researchers presented a questionnaire and
scale designed to evaluate the presence of indicators of persistence in students in Israel
(Lufi & Cohen, 1987). Of particular note is the focus of this scale, which did not focus on
academic pursuits in general, but instead focused on persistence in gymnasts. This scale
was shown as an effective means of differentiating between active gymnasts (who
showed greater persistence) and dropout gymnasts (who, for a range of reasons likely tied
to Dweck’s fixed mindset) were unable to accomplish their goals (Lufi & Cohen, 1987).
The studies presented show that both effective goal setting and persistence when
introduced to challenging tasks are associated with the growth mindset. Moreover,
persistent commitment in pursuing an effective goal may provide a powerful means to
which students can develop the growth mindset and show high achievement in novel and
difficult tasks.

**Achievement Behavior and Cultural Factors**

There are a range of conditions that predict a growth mindset. As presented by
Nicholls (1984), achievement behavior is one such quality described as behavior
“directed at developing or demonstrating high rather than low ability” (Nicholls, 1984, p.
328). This behavior is often directly related to individuals’ past performance or
knowledge, and in particular is related to his or her understanding that increases in
mastery indicates competence. It also shows that this behavior relates achievement to
effort rather than to innate ability (Nicholls, 1984).

The study by Nicholls (1984) is important to this consideration because it presents
another basis from which to contrast the fixed and growth mindset. Individuals who
possess these achievement behavior qualities will be able to gain from their past
experiences and they can see that the amount of effort contributes to their achievement.
By contrast, those who show a fixed mindset are more likely to be hindered by their past
experiences and believe that any additional effort, other than what they have already
given, will not result in achievement.

O’Neill (2011) presents a compelling picture of the fixed mindset in a study of
young musicians. In this work, O’Neill determined that many of the musicians held the
personal belief that any musical achievements they were able to obtain came because of
their “special, inherent musical talent or ability” (O’Neill, 2011, p. 33). This author links
this belief to particular cultural factors, especially those present in the United States and
other western nations. In essence, the connection between this belief and a fixed mindset
is a problem that they link to the overemphasis on innate talent in western societies (O’Neill, p. 33). Additionally, O’Neill (2011) argues that the idea of innate talent has negative impacts in the classroom and other growth-oriented contexts because musical talent, among many other disciplines, is rarely a matter of innate ability as much as it is reflective of “expertise through deliberate practice” (O’Neill, 2011, p. 33). However, individuals who continue to show a fixed mindset are the result of both a cultural emphasis on child prodigies, as well as perceiving experienced musicians, whose performances often appear natural and effortless, as having an innate ability for which practice and effort were not necessary. Therefore, the fixed mindset may not necessarily be a personal failure on the part a student, but instead a failure of perception, which is reinforced by a persistent cultural emphasis (O’Neill, 2011).

**Performance and Mastery Climates, Self-regulation, and Socialization**

It is crucial for physical and outdoor educators to foster a learning environment conducive to the development of a growth mindset toward skills attainment. Although physical activities are challenging, Ommundsen (2001a) argues that it is crucial to prevent the formation of a performance environment. A performance environment, which relates to the fixed mindset, is an environment where learning takes place through an emphasis on “interpersonal competition, public evaluation, and normative feedback” (Ommundsen, 2001a, p. 141). While there are some benefits to this environment, students who enter into it with a fixed mindset may have their mindset reinforced. Instead, Ommundsen (2001a) argues for the establishment of a mastery climate. This climate emphasizes participation behavior and self-improvement in tasks that require optimal
challenge and effort (Ommundsen, 2001a). By emphasizing effort, students will be more likely to explore their abilities and challenge themselves.

Ommundsen and Kvalo (2007) indicate that the mastery climate, which cannot typically be tested through standardized means, is one that is best attained by emphasizing teacher autonomy. In their study, they found that the mastery climate, as facilitated by an autonomous educator, had a positive impact on intrinsic motivation and a negative influence on factors of “amotivation” that are linked to the fixed mindset (Ommundsen & Kvalo, 2007). The autonomous educator is a teacher who “supports freedom, enables and encourages initiative and choice in pupils, and shares in their perspectives when solving problems or offering advice. The opposite…is when the PE teacher is directive, authoritarian and pressuring” (Ommundsen & Kvalo, 2007, p.388). Amotivation is simply defined as a lack of motivation (Jackson-Kersey & Spray, 2013). As with other studies, this work emphasized that promoting competence in students enhances levels of interest as well as enjoyment in the performance of tasks in physical education.

Ultimately, the contrast between the fixed and the growth mindset may be best illustrated by the difference in cognitive regulatory capacity. As described by Ommundsen (2003), motivation often relies on the students’ abilities to self-regulate their responses to novel challenges, especially in physical education. Students with a fixed mindset have insufficient self-mastery, a concept comprised of metacognitive/elaboration strategies where students are able to meet challenges with dynamic thinking as well as effort regulation and adaptive help-seeking (Ommundsen, 2003). Students with a growth mindset are capable of understanding the limitations of their own ability and responding
to a problem with effort; however, they can regulate such effort and ask for help when necessary. Therefore, the growth mindset embodies a strong degree of personal effort and action regulation.

It can be argued that students who are capable of meeting dynamic challenges with tenacity possess a greater self-concept than students whose expectations of their own performance are static. As described by Ommundsen (2005), the idea of self-concept is one, which is broadly defined as an organized schema that contains both episodic and semantic memories about the self, and as a system through which self-relevant information is processed (Ommundsen, 2005). Thus, students with a growth mindset are likely to not only show greater self-regulatory ability, but also have a superior vision of themselves. Students with high self-concepts are more likely to react to novel challenges with enthusiasm or tenacity because they do not believe intelligence and ability are innate and unchangeable (Ommundsen, 2005).

Finally, positive socialization was shown to be a factor that predicted the development of the growth mindset necessary to succeed in physical education. As described by Ommundsen and Vaglum (1992), physical education (particularly in organized team sports) was shown to be predictive of the prevention or moderation of the development of antisocial behavior among young students. The measures of positive social behavior identified in the article show ways in which students can show greater tenacity in their commitment to physical education activities. Ommundsen and Vaglum (1992) show that students whose mindsets may be fixed (and whose abilities may be thought innate or unchangeable) can potentially change their mindset through commitment to a team or other group of peers.
Related research shows that in order to develop psychosocial constructs such as self-efficacy, growth mindset, and grit, students must engage in experiences that change their beliefs about intelligence and ability being malleable (Blackwell et al., 2007). Dweck (2007; 2010) discovered that directly teaching such constructs could lead to increased achievement. *Brainology*, an online computer software program, is a growth mindset intervention that relates the concept of brain neuroplasticity to academic improvement. Neuroplasticity is the idea that the brain can grow, change, and expand its capacity for learning (Doidge, 2007; Dubinsky, 2010; Faulkner et al., 2008). According to Mindset Works, Inc. (2015),

The *Brainology*® program is a research-based, award-winning blended-learning program for students in grades 4-9 that improves motivation and achievement by teaching a growth mindset. Through interactive animations and classroom activities, students discover how the brain works and how it gets stronger and smarter through effort and learning, boosting their confidence in their potential, desire to learn, and willingness to work hard. They also learn and practice effective strategies to accelerate learning and growth. (p. 1)

*Brainology* consists of an introduction and four 30-minute units that show students how their brains can grow and become stronger through practice and effort, similar to that of muscles. The program uses the animated characters Chris, Dahlia, and Dr. Cerebrus to help students learn about how the brain works, as well as to help teach them self-regulation techniques, healthy habits, study techniques, and skills to assist them in becoming effective learners (Mindset Works, Inc., 2015). A few studies have shown the
effectiveness of Brainology and its impact on helping students develop the growth mindset and increase academic achievement. Donohoe et al. (2012) found that the program led to a significant increase in mindset scores from pre- to post-test for the intervention group, while the control group did not have a significant increase. Other studies have shown that Brainology may have a positive impact on student confidence and classroom achievement in math (Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Blackwell et al., 2007; Dweck, 2008a), reading (Saunders, 2013), and in science (Esparza, Shumow, & Schmidt, 2014). However, there have been no studies examining the impact of Brainology on psychomotor skill achievement or archery. This is the first study that uses Brainology as an intervention to examine these constructs.

Summary

This literature review provides the research problem of practice, the rationale and underlying causes of the problem of practice, the purpose, key concepts, and a thorough review of related constructs and variables pertaining to the problem of practice. There is much research about the related constructs and variables including: mindset theories (Dweck and Legget, 1988; Dweck, 2000; Dweck, 2010), grit (Duckworth et al., 2007; Hochandel & Finamore, 2015), goal commitment (Hollenbeck et al., 1989), performance and mastery climates (Ommundsen, 2001a), and self-regulation (Ommundsen, 2003). While some of these psychosocial constructs have been theorized for decades, others are relatively new. These constructs have been shown to have a positive relationship with student academic achievement, particularly a growth mindset. While relatively few studies have examined the impact of mindset theory in the physical education and
outdoor adventure education setting, these studies have shown a positive relationship between students with a growth mindset and skill achievement.

The related research not only shows a strong relationship between these constructs and achievement, but it also shows the degree to which these constructs influence students’ motivation to learn and their willingness to participate in learning. Although each of the constructs discussed in the literature review impacts student motivation and achievement, this action research study primarily focuses on growth mindset. This study seeks to determine how teaching and emphasizing the growth mindset through the computer program *Brainology* will impact student archery skill achievement and students’ perceptions of their growth mindset in relation to significant changes in their archery scores. The following chapter will discuss the methodology of this action research study.
CHAPTER 3

METHODOLOGY

This chapter begins with an overview of the Problem of Practice and research questions, followed by an outline of the research methodology that was used to answer the research questions.

Problem of Practice

Students in the researcher’s outdoor adventure education classes are usually quick to give up in the face of adversity and failure, especially in archery. They attribute their failure to lack of natural archery talent, and as a result, contend that they will not be able to shoot well. Thus, they usually give little to no effort for the rest of the archery unit.

Research Questions

The purpose of this action research study was to determine how implementing growth mindset impacts archery shooting scores and students’ perceptions of their archery ability during an archery unit. The study is guided by the following research questions:

1. How does implementing and emphasizing the growth mindset in an outdoor adventure education curriculum using the computer program *Brainology* impact student scores during an archery unit?

2. How do students perceive their archery ability in relationship to their mindset?

3. How will students explain any significant changes in archery scores?
This action research study sought to determine the degree to which teaching students a growth mindset in addition to the standardized archery curriculum will have an impact on students’ archery shooting scores and their perceptions of their archery ability in relation to their mindset through a mixed-methods action research methodology.

**Design of the Study**

Many research paradigms are available to educational researchers, but the one most appropriate for this study is action research in which the classroom teacher is the researcher studying his own setting and which “focuses on the concerns of teachers (not outside researchers) and engages teachers in the design, data collection, and interpretation of data around a question” (Dana & Yendol-Hoppey, 2014, p. 8). This research tradition provides many benefits that allow teachers to be participants and collaborators in the research process, which include generating knowledge and theories from research that is grounded in the realities of educational practice, allowing teachers to investigate their own problems, and making teachers more likely to enact change based on the knowledge they create (Dana & Yendol-Hoppey, 2014). This researcher decided to use action research for the benefits mentioned above. He wants to investigate a problem specific to his classroom in order to increase student motivation, participation, and achievement in archery. He wants to improve his practice as a teacher and find ways that positively impact students. Herr and Anderson (2005) note that the action research spiral consisting of iterative cycles of plan-act-observe-reflect remains consistent through all developmental stages (Herr & Anderson, 2005). This study used Mertler’s (2014) process of conducting action research, which consists of planning, acting, developing, and reflecting.
Planning. The first step of the action research process is planning. Planning an action research study consists of identifying and limiting a topic of interest, gathering information, reviewing the related literature, and developing a research plan. During the planning process, the researcher initially reflected on common issues in his classroom, identified and narrowed down his topic to growth mindset and archery, and then conducted a review of the related literature in order to create his research questions.

The goal of action research is to improve a specific practice (Mertler, 2014). When reflecting on areas for improvement in the researcher’s outdoor adventure class, the researcher realized that students struggle with skill development and performance in a variety of activities, most noticeably archery. Moreover, students’ poor performance seemed to be related to their effort and quickness to give up when they were not successful and to their belief that they were not naturally good at that particular skill. The researcher discussed these observations with colleagues and gathered more information after identifying and narrowing the topic. The researcher then gathered information through classroom observation and reflection to narrow the topic focus and conducted a literature review.

Through discussions with the other outdoor adventure education teachers at the researcher’s school, he identified a problem of practice, which not only affects this researcher’s specific classroom but also appears to be a problem in outdoor adventure classes in general. In short, students who lack self-confidence in their ability are more likely to quit; moreover, ability, skills, and talent may be less important than perseverance for students to achieve a successful outcome (Sproule et al., 2011). From this problem, the researcher decided to focus the action research study on non-cognitive
skills rather than cognitive or psychomotor interventions. Although being able to demonstrate proper archery form is an important factor for success, this work draws upon the theory that there is more to achievement – especially long-term achievement – than cognitive and psychomotor skills.

Through the discussions with colleagues and the literature review, the researcher was introduced to mindset theory, its impact on school achievement, and the Brainology computer program, which combined to become the basis of his research focus and questions.

The last step of the action research planning phase is developing the research plan, which includes the study design and data collection techniques. During the development of the research plan, the teacher-researcher develops research questions and hypotheses and identifies variables and factors central to the action research investigation. For the qualitative part of this study, the independent variable in this action research study is the Brainology program, which will be presented to all archery students and which is hypothesized to have a positive effect on students’ understanding of the growth mindset. The dependent variables are the archery shooting scores and Mindset Assessment Profile scores both at the beginning of instruction, and at the end of the program. The qualitative themes and factors that were explored include perceptions of their archery ability in relation to their mindsets and their explanations of any significant changes in archery scores.

**Acting.** Although there are multiple ways to collect data, the researcher both quantitatively and qualitatively collected data using a concurrent triangulation mixed-methods design (Castro, Kellison, Boyd, & Kopak, 2011; Mertler, 2014). In a concurrent
triangulation mixed methods design, quantitative and qualitative data are collected at the same time in one stage. The data is analyzed separately, and then it is compared and/or combined. Each type of data is analyzed separately and is used to cross-validate, confirm, and corroborate the findings. Since the concurrent triangulation design may allow the strengths of one data collection method overcome the weakness of the other method, the collection of open-ended qualitative data is often used to help expand the quantitative data (Castro, Kellison, Boyd, & Kopak, 2011). This mixed methods research design allows for a more in-depth evaluation approach that will not only create quantitative evidence for the outcome but will also provide insights on how and why the intervention produced certain intended and unintended effects (Mertler, 2014).

**Developing.** In the developing stage of action research, changes, revisions, or improvements occur, and the teacher-researcher develops an action plan for future actions (Mertler, 2014). The action plan, which was continually evaluated, revised, and monitored for effectiveness, was the proposed strategy for future action based on the results of the study. In the developing phase of this study, the researcher will use the results of data analysis on student mindsets and archery skill achievement, interpretations of those results, and conclusions based on the interpretations in order to develop a plan to improve teaching and the outdoor adventure education program. The action plan for this research study is discussed in Chapter 5.

**Reflecting.** The fourth and final stage of the action research process is the reflecting stage, which includes summarizing, sharing, and communicating the results of the study and reflecting on process. In this phase of the action research study, the researcher identifies stakeholders and shares the results of his study.
Procedures

Eight months prior to the study, the researcher contacted Mindset Works to inquire about research opportunities using the Brainology curriculum. The researcher also submitted the research proposal to the Institutional Review Board for the University of South Carolina, as well as the Institutional Review Board for Lexington School District One. Since Mindset Works offers different options for implementing Brainology, it was determined by both the researcher and Mindset Works that the Summer School Guide would be the best implementation for this research study. Furthermore, it was determined that due to time constraints of the study, the researcher would use the recommended 15-day, 30 minutes per day Brainology Summer Core Curriculum. The Summer Core Curriculum is a shortened version of the full, stand-alone Brainology Curriculum that is well suited as a supplement to a teacher’s curriculum and includes lessons with the highest leverage for changing mindsets among students (Mindset Works, 2015).

Four weeks prior to the study, Mindset Works provided the researcher with access to MindsetMaker, a course consisting of five modules that prepare teachers to support their students in developing positive motivation in the classroom through learning about key research findings in psychology and neuroscience and applying them to classroom practice. Mindset Works then provided the researcher with the Brainology curriculum and all necessary supporting materials, which included one teacher access code and sixty student access codes. The researcher completed the online Brainology program to see the program from the students’ perspectives and to plan lessons accordingly.

The content of the archery unit was modified in order to allow time to conduct the study. The NASP curriculum includes shooting from both the 10-meter and 15-meter
shooting lines. The researcher followed the standardized National Archery in the Schools Program with the exception of allowing students to shoot from 15 meters. Not shooting from 15 meters does not affect the validity of this study.

The first day of the archery unit began on the 10th week of the semester with an introduction to archery in the researcher’s classroom. On days two and three, students received safety instruction via a PowerPoint and teacher demonstration in the classroom.

On days four through ten, the researcher provided instruction on archery shooting including form and accuracy. Students had the opportunity to practice their form and accuracy in the classroom using a string bow and on the archery range shooting from 10 meters. At the conclusion of the NASP archery unit on day eleven, students completed the pre-assessment shooting test. The pre-assessment shooting test was intentionally conducted after the students had learned shooting form and accuracy with practice time, but before implementing Brainology. The pre-assessment was given at this time rather than at the beginning of the archery unit to eliminate the possibility that a change in student shooting scores was the result of the researcher’s instruction on form and accuracy rather than the result of growth mindset strategies learned from Brainology. Most sixth graders have no experience with archery, so it was expected that scores would have increased from the very beginning of the unit to the end regardless of treatment as a result of the teacher’s instruction.

On day twelve, the researcher administered the Mindset Assessment Profile pre-assessment for intelligence and archery ability via paper and pencil. The researcher explained why the pre-assessment was being given, reminded students that it would not be counted for a grade, and encouraged them to answer honestly. Students were made
aware that all answers were confidential. The researcher then read each statement aloud from the Mindset Assessment Profile while the students read them silently. After students completed the assessment, the researcher collected them and placed them in a locked filing cabinet. The researcher then introduced the students to Brainology and explained the purpose of the research study, emphasized how it relates to archery, and gave students time to ask questions regarding the study.

On days fourteen through thirty-three, students used the Brainology program with five strategically planned non-consecutive days of shooting practice in order to incorporate what they had learned from Brainology into their archery practice. On day thirty-four, the Mindset Assessment Profile post-assessments were given in the same manner as the pre-assessments, and on day thirty-five, the archery post-assessment was given. After quantitative data collection was complete, the researcher analyzed the data, created a focus group, and conducted a semi-structured interview ten days later.

**Research Context**

The context of this action research study is the school at which the researcher currently teaches, a public sixth-eighth grade school with 1,145 students located in a suburban setting in Lexington, South Carolina. The researcher initially taught physical education, then designed the outdoor adventure education course that he currently teaches. The school schedule includes seven, 45-minute class periods each day with a Crew class three days a week. EL Education (2015) explains that “crew is a ritual, a coming together, and the creation of a close-knit student community…[c]rew is a place where character education, adventure, and team building are intentional, assuring success for all students” (p.1). Student demographics are as follows: 27% of students are on the
Free and Reduced Lunch program and 8% have IEP’s. Seventy-five percent of students are white, 8% are African American, 6% are Hispanic, 6% are Asian, 5% are of two or more races, and 49% are male and 51% are female (J. Dean, personal communication, July 18, 2016).

This school is in Lexington School District One, the eighth largest district for student enrollment in South Carolina with 24,997 students; over the last 10 years, it has grown by an average of 533 students per year. The on-time graduation rate is 87.7% with 71% college matriculation rate. The district has over 2,030 teachers, 69.8% having a master’s degree or higher. The average student to teacher ratio for grades 6-8 is 23.2 to 1. The demographics are 75.14% white, 10.86% African American, 7.44% Hispanic, and 6.56% other. Of the 24,997 students in the district, 35.76% receive Free and Reduced Lunch. (Lexington School District One, 2016). This school in particular has 70 teachers, 4 counselors, 3 administrators, 2 nurses, 1 media specialist, 1 resource officer, and employs the Expeditionary Learning model. This model does not subscribe fully to one particular educational theory/discourse; however, it combines elements of progressivism, social reconstructionism, and essentialism.

Beesley, Clark, Barker, Germeroth, and Apthorp (2010) state the following about expeditionary learning programs:

Expeditionary learning programs provide opportunities for students and teachers to be engaged in authentic and meaningful education. These experiences are meaningful because the students can apply the skills and experiences gained in this unique experience to many of the challenges they will face in the future. The authenticity stems from the mode of operation of the program. (p. 4)
The subject school’s mode of operation is focused not only on core academics and standards, but also on authentic experiential education and character development as well. Character development is taught through habits of scholarship, which include tenacity, leadership, communication, collaboration, and integrity, the instruction of and emphasis of which are interwoven with the school’s academic curriculum and daily learning targets.

In addition to the core curricular elements, students have a variety of related arts classes from which to choose, including band, art, physical education, orchestra, chorus, STEM, drama, dance, musical theater, and outdoor adventure education (also referred to as outdoor adventure or outdoor experiential education). Outdoor adventure education counts as a physical education credit. There are three outdoor education teachers, all teaching identical semester-long classes including two eighth grade classes, two seventh grade classes, and two sixth grade classes.

**Sample**

The sample for this action research study included two of the researcher’s semester-long sixth grade outdoor adventure classes during the same semester. This grade level was chosen because in the researcher’s own observation, sixth graders tend to give up more quickly and tend not to try as hard – especially after initial failure – compared to other grade levels, and show a greater likelihood to attribute their poor achievement to an innate inability. The sample size was 50 (N=50) with 25 students in each class. This was an adequate number of students for the short time frame given to collect and analyze the data. The sampling method used was convenience nonprobability sampling due to the nature of the action research study. In an action research study, the teacher-researcher
studies his or her own classroom, so in this context, this researcher will not be able to randomize data, nor include data from classes that this researcher does not personally teach (Mertler, 2014).

**Intervention**

The researcher wanted to teach the students how to have and employ a growth mindset. During the literature review, the researcher discovered the program *Brainology* published by Mindset Works, Inc. as well as several studies that have used this program. *Brainology* offers various implementation strategies and timeframes, in which the teacher chooses how many days and how much time to spend on *Brainology*, and which lessons to teach based on different implementation schedules provided by Mindset Works, Inc. For example, *Brainology* can be used as a stand-alone course in which the teacher has the option to implement the full curriculum of fifty lessons, or the teacher can choose a modified version in which he or she can implement fewer lessons over a shorter time frame. After careful planning of this study and discussion with Mindset Works, it was determined that the most appropriate curriculum was the summer school curriculum, which consisted of four online lessons with eleven classroom-based lessons to supplement the online learning. Although it is called the summer school curriculum, Mindset Works, Inc. assured the researcher that it could be used during the regular school year, and it would be appropriate for the length of his study. See Figure 3.1 for the implementation schedule used for this study.

The online portion consisted of an introduction and four 30-minute units that show students how their brains can grow and become stronger through practice and
**Brainology® Sample Implementation Schedule for Brainology as a Content Area Supplement**

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro-1</td>
<td>Intro-2 (online)</td>
<td>Intro-3</td>
<td>1-1 (online)</td>
<td>1-3 (online)</td>
</tr>
<tr>
<td>Day 6</td>
<td>Day 7</td>
<td>Day 8</td>
<td>Day 9</td>
<td>Day 10</td>
</tr>
<tr>
<td>1-4</td>
<td>1-5</td>
<td>2-1</td>
<td>2-2 (online)</td>
<td>2-5</td>
</tr>
<tr>
<td>Day 11</td>
<td>Day 12</td>
<td>Day 13</td>
<td>Day 14</td>
<td>Day 15</td>
</tr>
<tr>
<td>3-2 (online)</td>
<td>3-3</td>
<td>3-4 &amp; 3-5</td>
<td>4-2 (online)</td>
<td>4-5</td>
</tr>
</tbody>
</table>

*Figure 3.1.* Summer curriculum implementation guide used in this study.

Effort, similar to that of muscles. The students used their school-issued iPads to complete the online lessons. See *Figure 3.2* for a screenshot of the online interface.

*Figure 3.2.* Screenshot of online *Brainology* interface used in this study.

Students also completed eleven classroom-based lessons that consisted of direct instruction from the researcher, cooperative activities, and worksheets. Throughout the *Brainology* unit, some of the lessons had supplemental worksheets. The researcher provided the students with a digital copy of the worksheets in which they could use
software to write or type on the worksheet using their iPads. For example, the worksheet
BRAINOLOGY STUDY PLAN JOURNAL (see Figure 3.3) asked students to list strategies
they used and how those strategies worked. It then asked three reflection questions. Prior
to the students’ beginning the worksheet, the researcher specifically asked the students to
list the strategies from Brainology they used thus far during archery shooting practice,
how well those strategies worked, and to reflect on those strategies. The researcher
conducted a class review of each worksheet after that particular lesson, and the students
emailed the researcher their completed worksheets.

Figure 3.3. Brainology Study Plan Journal worksheet used in this study.
Role of the Researcher

The researcher is a certified K-12 physical education teacher with nine years of teaching experience, seven of which are at the school where this action research study took place. The researcher taught traditional multi-sport PE for three years, then developed the outdoor adventure education curriculum that he currently teaches. He teaches six, semester-long outdoor adventure classes each day, which include two 8th grade classes, two 7th grade classes, and two 6th grade classes. He has been teaching outdoor adventure education at his current school for six years.

Action research is usually performed by insiders within an organization who see it as a way to problem-solve, professionally develop, and reflect on their own practice (Herr & Anderson, 2005). Often in this type of research, the practitioner serves as the researcher. In the following action research study, the teacher was the researcher studying the outcomes of a program in his own setting in order to increase student motivation, participation, and achievement. The researcher determined that Brainology would be the best intervention for teaching students how to develop a growth mindset and apply that growth mindset to an archery unit. As a teacher and a researcher simultaneously, this researcher had to ensure that he treated his personal and professional self as an insider committed to the success of the actions under study rather than as an outside observer (Herr & Anderson, 2005).

Data Collection Instruments

Data was collected both quantitatively and qualitatively using a variety of instruments, which help to triangulate the data. Quantitative data was collected via the NASP archery shooting assessment scorecard (See Appendix A), the Mindset
Assessment Profile (Intelligence) survey (See Appendix B), and the Mindset Assessment Profile (Archery) survey (See Appendix C).

**Quantitative data collection instruments.** The NASP shooting assessment is an archery assessment that quantitatively measured the student’s ability to accurately shoot a bow and arrow at a target. All students used a Genesis Original bow with Easton 1820 arrows shooting at an 80cm target from 10 meters (see Appendix D for NASP equipment specifications). This assessment used the official NASP scorecard in which the researcher bubbled in the score for each arrow the archer shoots, depending on which ring the arrow hits on the target face (See Appendix D). The target consists of 10 rings – the outermost ring is worth a score of one point. Each consecutive ring closer to the middle is worth one point higher, with the innermost ring (bullseye) worth 10 points. Any arrow that lands on the line between two rings was awarded the higher score. If a student hit the scoring face of the target, but the arrow bounced off, that student received another arrow. Missing the target completely resulted in a score of 0 for that arrow.

The Mindset Assessment Profile (Intelligence), published by Mindset Works, Inc., is a Likert-scale survey consisting of 10 questions. It is pulled from a few different measures that assess different constructs related to mindset, that is, their general perceptions about the malleability of intelligence (Dweck, 1999), the importance of learning and performing perfectly (Midgley et al., 1998), and attitudes toward effort and mistakes (Blackwell, 2002; Blackwell et al., 2007). The possible responses for students were: Disagree A Lot (1), Disagree (2), Disagree A Little (3), Agree A Little (4), Agree (5), Agree A Lot (6).
The Mindset Assessment Profile (Archery) is a duplicate of the Mindset Assessment Profile (Intelligence), except the researcher replaced certain words or phrases about intelligence with ones about archery. For example, question 1 on the MAP (Intelligence) stated, “No matter how much intelligence you have, you can always change it a good deal.” The researcher replaced the word intelligence with archery ability. Thus, question number 1 on the MAP (Archery) stated, “No matter how much archery ability you have, you can always change it a good deal.” See Appendix C for the complete modified survey. The researcher chose to modify the language in this assessment from cognitive language to psychomotor language. Although intelligence includes both the cognitive and psychomotor domains of learning (Martin & Morris, 2013) the researcher felt that students may interpret the word intelligence as only pertaining to the cognitive domain and not see the relationship between intelligence and psychomotor ability. Moreover, the researcher wanted to make the questionnaire more specific to archery. Changing the language in each question to make it more specific to archery measured students’ mindsets in regards to their archery ability, that is, their perceptions about the malleability of archery ability, the importance of learning and performing perfectly in archery, and attitudes toward effort and mistakes during archery. Although the MAP (Intelligence) has been validated, the MAP (Archery) has not been validated. It is beyond the scope of this study to validate this scale.

**Qualitative data collection instruments.** Qualitative data was collected via a semi-structured focus group interview, the researcher’s field note observations, and reflections and worksheets in the *Brainology* program. The researcher used two guiding questions for the focus group interview (See Appendix F). The focus group was audio
recorded using the researcher’s iPad as well as the researcher’s iPhone for backup. The audio recordings were transcribed by a professional online company. Each day of the study, the researcher recorded his general observations after each class on his computer in an Excel document. The students’ journal reflections were part of the online Brainology program. Students recorded their entries on their iPads. The reflection entries were stored online, and the researcher could access them through his computer.

The researcher provided the students with a digital copy of the Brainology worksheets, which were then imported into a software program on the students’ iPads, which allowed them to write or type on the worksheet. The worksheets were categorized into four types: Connect It, Check It, Practice It, and Apply It (Mindset Works, Inc., n.d.). Only the Connect It and Practice It worksheets were used in the Brainology Summer School Curriculum. The Connect It worksheets helped activate students’ prior knowledge and increase their interest in the content of the upcoming unit. The Practice It worksheets gave students the opportunity to interact with the information for the purpose of increasing their understanding of the content and learning to use their knowledge independently.

**Data Collection Methods**

For the quantitative component of this research design, a quasi-experimental one-group pre-test/post-test design was used. This design uses a pre-test, treatment, and post-test, as determined and catalogued through the use of quantitative study. Therefore, quantitative data was collected via pre- and post- archery assessments, and MAP (Intelligence) and MAP (Archery) surveys. Qualitative data collection methods included
a semi-structured focus group interview, direct observation, and student reflections and worksheets.

**Quantitative data collection.** Pre-test data was first collected using a modified version of the standardized international scoring archery pre-assessment and post-assessment published by NASP (see Appendix G for the NASP assessment criteria) and both MAP surveys. Post-test data was collected using the same instruments and methods as the pre-test instruments and methods.

**Archery shooting assessment.** This assessment was modified by excluding shooting from the 15-meter distance. Due to time constraints of the study, students only had time to shoot from 10 meters. As a result, the researcher only assessed the students from the 10-meter distance. They shot one unscored practice round consisting of 5 arrows from a 10-meter distance, followed by three scoring rounds of 5 arrows each. Each arrow was scored based on where it hit the target (see Appendix H for NASP scoring protocols). After each scoring round, students walked to their targets and stood beside them without touching any arrows. The researcher called out the score for each arrow while bubbling in the arrow score on a NASP scorecard. The student verified that the teacher called out the correct score, then initialed the scorecard to ensure all scores were accurate. After the final round, all scoring arrows (30 total) were added together for a total score. The highest possible score was 50 for each round (all 5 arrows hit the bullseye) and 300 for the entire assessment. After collecting all student scores, the researcher put this data into an Excel spreadsheet. This archery skills assessment was used because it uses standardized protocols, equipment, and scoring methods published by the National Archery in the Schools Program.
**Mindset Assessment Profile (Intelligence).** Data was also quantitatively collected using the Mindset Assessment Profile published by Mindset Works. The researcher administered the MAP (Intelligence) the day after the archery shooting test, which was the first day of the intervention. The researcher gave each student a survey, explained the purpose of the survey, and read the directions aloud while the students read them silently. The researcher also read each question on the survey while they read them silently and gave students time to answer the question before reading the next one. After the MAP (Intelligence) was completed, the researcher collected them.

**Mindset Assessment Profile (Archery).** Immediately after administering the MAP (Intelligence) survey, the researcher immediately repeated the same process for the MAP (Archery) survey. The researcher gave each student a survey, explained the purpose of the survey, and read the directions aloud while the students read them silently. The researcher informed the students why he changed the language from intelligence to archery. The researcher also read each question on the survey while the students read them silently and gave them time to answer the question before reading the next one. After the MAP (Intelligence) was completed, the researcher collected them. Prior to the study, the researcher pilot tested the modified MAP (Archery) survey with three 6th grade students. The students reported that they understood each question and no changes were needed.

**Qualitative data collection.** Qualitative data was collected concurrently with the quantitative data from a focus group, daily observation, student reflections, and student worksheets in *Brainology.*
Focus group. To collect qualitative data, the researcher formed a focus group consisting of eight students using purposive sampling based on the results of the quantitative data. The researcher created student profiles based on the quantitative data and selected two students from each profile group that attempted to represent the class demographics based on sex and ethnicity. This group consisted of one Black female, one Hispanic female, four White males, and two White females. All the males were white due to the lack of male diversity in their specific categories, and in the class in general. The researcher used the class quantitative analysis to create profile groups. From the quantitative analysis, the researcher determined that a significant archery score change between pre- and post-assessments was > 30 points, and a significant MAP score change was > 3 points. The researcher determined that a 30-point change in archery scores was significant because that was equal to one standard deviation from the mean archery change score. The researcher determined that a three-point change for MAP scores was significant because a change of greater than three points meant that the student moved to a different MAP Profile group according to the MAP Chart. The researcher used this guide to group students into one of four categories: (1) students who had a significant increase in both their MAP scores and archery shooting score, (2) students who had a significant decrease in both their MAP scores and archery shooting score, (3) students who did not have a significant increase or decrease in any of their scores, and (4) students who had a significant increase or decrease in their MAP scores but not their archery score and vice versa.

The researcher conducted the semi-structured focus group interview during his one-hour planning period guided by two questions. The interview questions were initially
pilot-tested on three 6th grade students to ensure grade-level appropriateness and understanding. The students reported that the questions were clear and did not need to be changed. During the interview, the researcher asked the first question, and gave the students about a minute to think about their answer. Then the researcher allowed the students to answer when they felt comfortable, and in no particular order. When a student’s answer needed more clarification or was of interest to the researcher, he probed deeper. The focus group was audio recorded using an iPad as well as the researcher’s iPhone for backup. The focus group audio recordings were then transcribed by an online company.

**Researcher’s daily observations.** The researcher also collected qualitative data based on his daily observations, which were recorded in an Excel spreadsheet journal. After each class, the researcher spent a few minutes noting observations and reflections about the class and specific students.

**Student reflections.** Throughout the online Brainology lessons, students had the chance to reflect on what they learned in a particular section. The reflections were optional and were stored in the students’ E-Journals. The reflections were specific to a concept that was learned in the program, but the researcher continuously encouraged students to reflect with an archery mindset. That is, students were encouraged to think about how the reflection could apply what they just learned in Brainology to archery.

**Student worksheets.** Additionally, throughout the Brainology curriculum, students completed worksheets as part of the lessons. The researcher provided the students with a digital copy of the worksheets, which were then imported into software to write or type on the worksheet. The researcher conducted a class review of each
worksheet after that particular lesson, and the students emailed the teacher their completed worksheets.

Data Analysis

In a concurrent mixed methods study, both quantitative and qualitative data are collected and analyzed at the same time (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007). The data is analyzed separately, and then it is compared and/or combined. In this study, the both types of data were collected concurrently throughout the study. Each type of data was analyzed separately and was used to cross-validate, confirm, and corroborate the findings. Since the concurrent triangulation design may allow the strengths of one data collection method overcome the weakness of the other method, the collection of open-ended qualitative data in this study was used to help expand the quantitative data (Castro, Kellison, Boyd, & Kopak, 2011). This allows the researcher to address various types of questions, validate one form of data with the other form, or to transform the data for comparison. When analyzing quantitative data, teacher-researchers can utilize descriptive and/or inferential statistics depending on the nature of the study (Mertler, 2014). Descriptive statistics are categorized as measures of central tendency, measures of dispersion, or measures of relationship. Measures of central tendency describe the collective level of attitude, opinion, or performance of a group, while measures of dispersion describe the variance in the group. When analyzing qualitative data, teacher-researchers can use inductive analysis, in which the researcher codes the data and identifies patterns and themes in order to create a framework for presenting the key findings of the study (Saldana, 2013).
Quantitative data analysis. The researcher analyzed the quantitative data using descriptive statistics and inferential statistics. Descriptive statistics used in this study included calculating the mean, standard deviation, and change score for the archery and MAP scores. Because the researcher measured the impact that teaching growth mindset has on students’ archery skill achievement, measures of central tendency and measures of dispersion were used to provide a basic description of individual and collective student achievement. Inferential statistics were used to infer the effectiveness of the Brainology program. A paired t-test was used to compare the average performance and variability between the students’ scores prior to and after using the Brainology curriculum. Not only did the researcher determine if Brainology had an impact on student achievement, but the researcher was able to quantify to what extent student archery achievement was affected. The researcher used simple Pearson Correlations to determine the degree of correlation between archery scores and mindset scores. After the researcher calculated the change scores for each student’s archery scores, the researcher split the class into fixed mindset (MAP score ≤ 28) and growth mindset (MAP scores ≥ 29) according to the MAP Chart (Intelligence) in Appendix I. The researcher then calculated the average archery change score for each mindset. This was calculated to see, on average, the extent to which fixed mindset students’ archery scores changed and the extent to which growth mindset students’ archery scores changed. Quantitative data is displayed in chart and graph format.

Qualitative data analysis. The researcher qualitatively analyzed the focus group interview, the field note observations, and reflections and worksheets from Brainology using the constant comparison method (Dye, Schatz, Rosenberg, & Coleman, 2000). The
nature of the research questions and the answers that the researcher was seeking influenced the coding choices he made (Saldana, 2013). For the beginning stages of all qualitative data analysis, the researcher’s coding processes included splitting the data into individually coded segments. After initial coding schemes, which included initial coding, descriptive coding, and structural coding, were applied to all the qualitative data, the researcher subcoded the data to narrow the classification scheme. As Saldana (2013) notes, these coding schemes are appropriate to studies with a wide variety of data forms such as interviews, field notes, worksheets, and journal entries. Throughout analysis, the researcher used different coding schemes depending on the data source, and then categorized data into emerging themes. During the latter stages of qualitative data analysis, the researcher’s coding processes both “literally and metaphorically constantly compared, reorganized, or focused the codes into categories, prioritized them to develop ‘axis’ categories … and synthesized them to formulate a central or core category” (Saldana, 2013, pp. 51-52).

The focus group audio recordings were recorded on the researcher’s iPad, and then transcribed by an online company. The researcher read and coded the transcription multiple times, highlighting key words, phrases, and sentences using a variety of coding schemes as proposed by Saldana (2013). The transcriptions were first coded using a combination of initial coding and in vivo coding. Because the researcher was an inexperienced qualitative researcher, the researcher used these coding methods to “prioritize and honor the participant’s voice” (Saldana, 2013, p. 91). Furthermore, the researcher used emotion coding to analyze the participants’ attitudes toward the Brainology program and causation coding to analyze the participants’ explanation of
significant changes in their shooting scores. The coded data were then categorized on an Excel spreadsheet in order to identify patterns. The researcher created profiles for each student in the focus group and reorganized the coded data to identify patterns. These patterns were then organized into overarching themes (Saldana, 2013). Although the researcher attempted to pick a diverse focus group, the researcher chose not to analyze the sample based on diversity due to the overall lack of diversity with the sample.

Initial coding was used to code the researcher’s field note observations, students’ reflections, and students’ worksheets from Brainology in order to serve as a starting point to help the researcher with further exploration (Saldana, 2013). Moreover, descriptive coding was used on all data to gain a basic understanding of what was going on in the study, and structural coding was used to examine comparable segments’ relationships, commonalities, and differences. In addition to the coding schemes mentioned above, the researcher reviewed the students’ journal reflections and used magnitude coding to analyze the number of reflections completed, the length of the reflection, and the mention of archery during the reflection in order to help corroborate the other data and to get an idea of the magnitude of the students’ involvement in Brainology. For the data analysis in this study, the researcher primarily focused on the reflections of the students from the focus group. Each form of data analysis was used to corroborate or dispute any findings from the other data.

**Ethical Considerations**

One of the primary responsibilities of the teacher-researcher is to ensure that action research adheres to ethical standards by the ethical treatment of students, colleagues, and data. To ensure a research study protects human rights, most school
districts use a Human Subjects Review Board or Institutional Review Board to review the proposed research. After the research design is selected, it is important for teacher-researchers to obtain permission and informed consent from their students and their students’ parents for all data that will be collected (Mertler, 2014).

For this action research study, the first step when planning and designing the study was to make sure that the study could not physically or psychologically harm any participant. Next, the proposed study was submitted to the district’s Institutional Review Board for approval. Due to the nature of the action research study, consent and assent forms were not required for all participants. However, a consent form was sent home to all students participating in the focus group and their parents to ensure the students understand the nature of the study and focus group, what would be asked of them, and that they could choose not to participate at any time without penalty. Students were given one week to return the forms. When the focus group students received the consent forms, the researcher also sent an email to their parents informing them that an informed consent form had been sent home with their child and reminded them of the due date to return the form. A second email was sent to the parents and students five days later reminding them of the informed consent form. All students returned the consent form.

If any student did not want to participate in the study, he or she was not required to participate, and there was no penalty; however, all students chose to participate. All students remained anonymous by being assigned a student identification number. Students in the focus group were given pseudonyms. At any time during the study, if a student wished to no longer participate, then his or her wishes were honored. It was important that all students received equal treatment throughout the study.
Since the researcher’s primary responsibility is to teach, another ethical consideration manifests itself in the form of ensuring that the proposed action research does not hinder the researcher’s normal teaching. Throughout the archery unit, some instructional time was used for data collection, but the majority of the study took place within the context of normal classroom activity. Thus, the least degree of disruption resulted from this data collection in a manner that benefited the researcher’s students, the researcher, and the outdoor adventure education program in general. All data that was collected digitally was stored on the teacher’s password-protected laptop and iPad, all data that was collected by paper was stored in a locked filing cabinet.

**Rigor and Trustworthiness**

In action research, it is imperative that teacher-researchers show both rigor and trustworthiness in the study to help ensure that the results are free from bias, accurate, and believable (Mertler, 2014). Rigor helps to ensure that the results are relatively free from bias. The quantitative rigor of this action research study, that is its accuracy of the data, instruments, and research findings, is established through the use of a standardized archery curriculum, a published survey that draws from valid and reliable sub-scales, and a slightly modified version of this survey that makes it more relevant to archery. Quantitative rigor is increased by the use of both descriptive and inferential statistical analysis. On the other hand, the qualitative rigor, or trustworthiness, of this action research study are established though multiple instruments that include a semi-structured focus group interview, teacher observations and field notes, and reflections and worksheets in the *Brainology* curriculum (Golafshani, 2003). Trustworthiness is increased through the use of triangulation, or using multiple data sources and data
collection techniques (Gunawan, 2015). Comparing the quantitative results with the qualitative results and the qualitative results with each other increases the overall rigor of this study. For example, the researcher compared what the students said in their focus group interview and what they wrote in their reflections and worksheets to what the researcher observed. The use of these multiple quantitative and qualitative data sources and data collection techniques greatly increases the validity of the results and conclusions of this action research study.

**Summary**

While it is important for physical educators to teach students psychomotor and cognitive skill development, many students are unable to handle the setbacks and failure that accompany novel or challenging physical activities. Dweck (2006) found that the way students view their own intelligence and abilities are related directly to school achievement. Although studies on Dweck’s Mindset Theory explore a student’s cognitive achievement, this action research study seeks to determine how teaching growth mindset through the computer program *Brainology* impacts psychomotor skill development in an outdoor adventure physical education class.

Based on observations of how this researcher’s students handle setbacks and failure in target archery and how such failures affect their archery performance, this work’s research questions sought to examine the impact of teaching noncognitive skills on archery skill performance, students’ perceptions of how their mindsets impacted their archery scores, and students explanations of any significant changes in their archery scores. This study took place the researcher’s outdoor adventure education class with 50 of his 6th grade students. During the planning phase, the researcher identified a problem
in his classroom that requiring improvement, reviewed the related literature, identified research questions that guided this study, and developed a research plan for data collection and analysis. The acting phase involved collecting and analyzing data. A concurrent triangulation mixed methods action research methodology was employed in which the researcher collected and analyzed both quantitative data in the form of pre- and post-test archery shooting scores and MAP scores, and qualitative data in the form of a focus group interview, researcher observation notes, and student reflections and worksheets throughout the Brainology program. Quantitative data was analyzed using both descriptive and inferential statistics, while the qualitative data was analyzed using inductive analysis, in which the researcher coded the data, and identified patterns and themes in order to create a framework for presenting the key findings of this study. The researcher discussed ethical considerations for this study to ensure that this study adhered to ethical standards and protected human rights through the ethical treatment of students, colleagues, and data. Finally, the researcher discussed the rigor and trustworthiness of this study, which helps to ensure that the results are credible, accurate, and relatively free from bias.
CHAPTER 4

FINDINGS

This chapter begins with an overview of the Problem of Practice, research questions, and methodology. This is followed by the quantitative and qualitative findings of this action research study.

Problem of Practice

Students in the researcher’s outdoor adventure education classes tend to show characteristics of a fixed mindset. They attribute their failure to lack of natural ability and are quick to give up, citing that they will not be able to get better because they are “just not good at archery.” Thus, when they start shooting poorly, rather than giving more effort, they usually lose motivation to shoot or try to get better for the rest of the archery unit. The purpose of this action research study was to determine how implementing a growth mindset impacts archery shooting scores and students’ perceptions of their archery ability during an archery unit.

Research Questions

This action research study sought to determine the degree to which teaching students growth mindset in addition to the standardized archery curriculum will have an impact on students’ archery shooting scores and their perceptions of their archery ability in relation to their mindset through a mixed-methods action research methodology. This study is guided by the following research questions:
(1) How does implementing and emphasizing the growth mindset in an outdoor adventure education curriculum using the computer program *Brainology* impact student scores during an archery unit?

(2) How do students perceive their archery ability in relationship to their mindset?

(3) How will students explain any significant changes in archery scores?

**Methodology**

The goal of this action research study was to increase students’ mindset as a growth mindset and measure the mindset’s effect on students’ archery ability as well as their perceptions about their archery ability. The researcher taught the standardized National Archery in the Schools Program curriculum, followed by the *Brainology* curriculum published by Mindset Works, Inc.

A concurrent triangulation mixed methods action research methodology was employed in which the researcher collected and analyzed both quantitative and qualitative data at the same time. Quantitative data, which measured students’ archery ability and their mindset about intelligence and archery ability was collected using the NASP shooting protocol, Mindset Assessment Profile, and a modified Mindset Assessment Profile, respectively. Descriptive statistics were calculated between pre- and post-test for these instruments. Additionally, paired t-tests and Pearson Correlations were calculated to determine the significance of pre- and post- implementation scores.

Qualitative data, which examined students’ perceptions about the impact of having a growth mindset on archery scores was collected in the form of a focus group interview, researcher observation notes, and student reflections and worksheets throughout the *Brainology* program. Qualitative data analysis included using inductive analysis, in which...
the researcher coded the data, and identified patterns and themes in order to create a framework for presenting the key findings of this study.

This chapter will describe the results and interpretations of the researcher’s action research study implementing a growth mindset program to increase archery ability. The results of each instrument, archery shooting assessment, Mindset Assessment Profile (Intelligence), Mindset Assessment Profile (Archery), focus group, field note observations, and student reflections and worksheets will be described.

**Archery Shooting Test Results**

Students were given a modified version of the NASP Shooting Assessment (see Appendix G). This assessment measured the student’s ability to accurately shoot arrows at a target. There was a significant difference between the pre-test ($M = 69$, $SD = 31.5$) and post-test ($M = 92$, $SD = 27.8$) scores, $t(49) = 4.89$, $p < 0.001$. The pre-test and post-test archery shooting scores mean and standard deviation are shown in Table 4.1.

Table 4.1

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Pre-Test Mean</th>
<th>Pre-Test Standard Deviation</th>
<th>Post-Test Mean</th>
<th>Post-Test Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archery Shooting Test</td>
<td>69</td>
<td>31.5</td>
<td>92</td>
<td>27.8</td>
</tr>
</tbody>
</table>

*Note. $p < 0.001*

**Mindset Assessment Profile (Intelligence) Results**

The Mindset Assessment Profile (Intelligence) measured students’ mindsets, that is, their general perceptions about the malleability of intelligence, the importance of learning and performing perfectly, and attitudes toward effort and mistakes (Mindset
The possible responses for students were: Disagree A Lot (1), Disagree (2), Disagree A Little (3), Agree A Little (4), Agree (5), Agree A Lot (6). For questions with odd numbers (1, 3, 5, 7), the students’ scores corresponded with the number of their answer choice. For questions with even numbers (2, 4, 6, 8), the students’ scores were reverse-scored – Disagree A Lot (1) = 6, Disagree (2) = 5, Disagree A Little (3) = 4, Agree A Little (4) = 3, Agree (5) = 2, Agree A Lot (6) = 1. Scores for each student were added up by the researcher and a total score was calculated. The researcher used the MAP Chart (Intelligence) (See Appendix I) to determine the MAP group and a description of the MAP group. For the Mindset Assessment Profile (Intelligence) there was a significant difference between the pre-test \( M = 29, SD = 7.3 \) and post-test \( M = 33, SD = 6.0 \) scores, \( t(49) = -4.54, p < 0.001 \). The mean score of 29 for the pre-test indicated the class MAP group was G1, which indicates the weakest growth mindset. People in this group usually share the same beliefs with people in the F1 group, which is the weakest fixed mindset. See Figure 4.1 for an explanation of the MAP (Archery) groups.

People in the G1 group usually believe the following: “You are unsure about whether you can change your intelligence. You care about your performance and you also want to learn, but you don’t really want to have to work too hard for it.” The mean score for the post-test indicated the class MAP group was G2. People in the G2 group usually believe the following: “You believe intelligence is something that you can increase. You care about learning and you’re willing to work hard. You do want to do well, but you think it’s more important to learn than to always perform well.” The pre-test mean score of 29 indicates that the class had a weak growth mindset. There was a statistically
significant increase in the MAP (Intelligence) score from pre- to post-test, which indicates that students moved more toward a growth mindset as a result of the intervention. The MAP (Intelligence) pre-test and post-test MAP scores and MAP groups are shown in Table 4.2.

Table 4.2

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Pre-Test Mean</th>
<th>MAP Group</th>
<th>Post-Test Mean</th>
<th>MAP Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindset Assessment Profile (Intelligence)</td>
<td>29</td>
<td>G1</td>
<td>33</td>
<td>G2</td>
</tr>
</tbody>
</table>

*Note. p < 0.001*
Mindset Assessment Profile (Archery) Results

The Mindset Assessment Profile (Archery) measured students’ mindsets in regards to their archery ability – that is, their perceptions about the malleability of archery ability, the importance of learning and performing perfectly in archery, and attitudes toward effort and mistakes during archery. This survey was modified by changing the language in each question to make it more specific to archery (see Appendix C). The possible responses for students were: Disagree A Lot (1), Disagree (2), Disagree A Little (3), Agree A Little (4), Agree (5), Agree A Lot (6). For questions with odd numbers (1, 3, 5, 7), the students’ scores corresponded with the number of their answer choice. For questions with even numbers (2, 4, 6, 8), the students’ scores were reverse-scored – Disagree A Lot (1) = 6, Disagree (2) = 5, Disagree A Little (3) = 4, Agree A Little (4) = 3, Agree (5) = 2, Agree A Lot (6) = 1. Scores for each student were totaled by the researcher and a total score was calculated. The researcher used the MAP Chart (Archery) (See Appendix J) to determine the MAP group and a description of the MAP group. For the Mindset Assessment Profile (Archery) there was a significant difference between the pre-test ($M = 31, SD = 5.2$) and post-test ($M = 33, SD = 7.1$) scores, $t(49) = -2.40$, $p = 0.020$. The mean score for the pre-test indicated the class MAP group was G1, which is the weakest growth mindset. People in this group usually share the same beliefs with people in the F1 group, the weakest fixed mindset. See Figure 4.2 for an explanation of the MAP (Archery) groups.

People in the G1 group usually believe the following: “You haven’t really decided for sure whether you can change your archery ability. You care about your archery score and you also want to learn archery, but you don’t really want to have to work too hard for
Figure 4.2. Mindset Assessment Profile (Archery) Chart used to determine MAP (Archery) group and description.

it” (Mindset Works, Inc., 2015, p. 24). The mean score for the post-test indicated the class MAP group was G2. People in the G2 group usually believe the following: “You believe archery ability is something that you can increase. You care about learning archery and you’re willing to work hard. You do want to do well, but you think it’s more important to learn archery than to always score well” (Mindset Works, Inc., p. 24). The MAP (Archery) pre-test and post-test MAP scores and MAP groups are shown in Table 4.3.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Pre-Test Mean</th>
<th>MAP Group</th>
<th>Post-Test Mean</th>
<th>MAP Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindset Assessment Profile (Archery)</td>
<td>31</td>
<td>G1</td>
<td>33</td>
<td>G2</td>
</tr>
</tbody>
</table>

Note. \( p = 0.020 \)
**Pearson Correlation Results**

Simple Pearson Correlations were calculated in order to see the relationship between the MAP change scores and archery change scores. Due to the limitations of this study, these correlations are not intended to draw conclusions outside of the researcher’s classroom to the general population, but rather to see what kind of relationship, if any, there was between students moving toward a growth mindset and changes in archery ability. The researcher calculated the mean change score between pre- and post-test for both MAP assessments and the archery shooting assessment. Pearson Correlations were then conducted for pre- and post-test MAP (Intelligence) change scores and archery change scores $r(48) = -0.18, p = 0.215$, which reveal a very weak insignificant negative relationship. Although a negative relationship is revealed, the correlation is so weak that it can be concluded that there is no relationship between a change in MAP (Intelligence) scores and a change in archery scores. Figure 4.1 shows the relationship between the MAP (Intelligence) change scores and archery change scores.

Next, Pearson Correlations were conducted for pre- and post-test MAP (Archery) change scores and archery change scores $r(48) = 0.08, p = 0.569$, which revealed a very weak insignificant positive relationship. Although a positive relationship is revealed, the correlation is so weak that it can be concluded that there is no relationship between a change in MAP (Archery) scores and a change in archery scores. Figure 4.2 shows the relationship between the MAP (Archery) change scores and archery change scores.

The simple Pearson Correlations indicate that the relationship between students moving more toward a growth mindset and an increase in archery scores is so weak that it can be concluded that there is no significant relationship even though the class averages
Figure 4.3. Correlation between MAP (Intelligence) change scores and archery change scores.

Figure 4.4. Correlation between MAP (Archery) change scores and archery change scores.
for both mindset and archery scores significantly increased. This finding indicates that most students who had increases in their archery scores had little to no change in their MAP scores, and students who increased in their MAP scores had little change in their archery scores. One possible explanation for this is the small sample size. A larger sample size may have shown a stronger relationship.

**Mindset Versus Archery Change Score**

After it was revealed that there was little to no relationship between moving more toward a growth mindset and an increase in archery scores, the researcher probed deeper and examined to what extent having a certain mindset at post-intervention had on the students’ archery change scores. The researcher calculated the average archery change score for students with a fixed mindset as indicated by their post-test MAP (Intelligence) score. He also did this for students with a growth mindset. Twenty-two students had MAP scores that indicated a fixed mindset post-intervention. These students increased, on average, 6.5 points on their archery assessment from pre- to post-test. Twenty-eight students had MAP scores that indicated a growth mindset post-intervention. These students increased, on average, 36 points on their archery assessment from pre- to post-test. This finding suggests that students who employ a growth mindset have the potential to increase their archery ability much more than students with a fixed mindset.

**Focus Group Findings**

The researcher created a focus group of eight students based on the quantitative analysis. From the quantitative analysis, the researcher determined that a significant archery score change between pre- and post-assessments was > 30 points, and a significant MAP score change was > 3 points. The researcher determined that a 30-point
change in archery scores was significant because that was equal to one standard deviation from the mean archery change score. The researcher determined that a three-point change for MAP scores was significant because a change of greater than three points meant that the student moved to a different MAP Profile group according to the MAP Chart. The researcher used this guide to group students into one of four categories: (1) students who had a significant increase in both their MAP scores and archery shooting score, (2) students who had a significant decrease in both their MAP scores and archery shooting score, (3) students who did not have a significant increase or decrease in any of their scores, and (4) students who had a significant increase or decrease in their MAP scores but not their archery score and vice versa. The purpose of the focus group was to gain a better understanding of the quantitative data, specifically how students explain any significant changes in their archery scores and their perceptions of their archery ability in relation to their mindset.

**Focus group profile.** The focus group consisted of eight students using purposive sampling based on the results of the quantitative data. The researcher selected two students from each profile group that attempted to represent the class demographics based on sex and ethnicity. Matt and Sarah were selected from profile group 1, James and Ryan were selected from profile group 2, Tracy and Alex were selected from profile group 3, and Haley and Diana were selected from profile group 4. The focus group consisted of one Black female, one Hispanic female, four White males, and two White females.

**Matt.** Matt is a White male whose pre-test MAP scores indicated a weak growth mindset and pre-test archery shooting score was below the class average. At post-test, he had significant increases in both his MAP scores and archery shooting score.
Sarah. Sarah is a Black female whose pre-test MAP scores indicated a weak fixed mindset and pre-test archery shooting score was below the class average. At post-test, she had significant increases in both her MAP scores and archery shooting score.

James. James is a White male whose pre-test MAP scores indicated a weak fixed mindset and pre-test archery shooting score was above the class average. At post-test, he had significant decreases in both his MAP scores and archery shooting score. His archery shooting post-test score was below the class average.

Ryan. Ryan is a White male whose pre-test MAP (Intelligence) score indicated a strong growth mindset, MAP (Archery) score indicated a moderate growth mindset, and pre-test archery shooting score was above the class average. At post-test, he had significant decreases in both his MAP scores and archery shooting score.

Tracy. Tracy is a White female whose pre-test MAP (Intelligence) score indicated a weak fixed mindset, MAP (Archery) score indicated a weak growth mindset, and pre-test archery shooting score was above the class average. At post-test, she had insignificant changes in both her MAP scores and archery shooting score.

Alex. Alex is a White male whose pre-test MAP scores indicated a weak fixed mindset, and pre-test archery shooting score was above the class average. At post-test, he had insignificant changes in both of his MAP scores and archery shooting score.

Haley. Haley is a White female whose pre-test MAP scores indicated a weak growth mindset, and pre-test archery shooting score was above the class average. At post-test, she had significant increases in both of her MAP scores, both indicating a strong growth mindset, but an insignificant decrease in her archery shooting score.
Diana. Diana is a Hispanic female whose pre-test MAP scores indicated a moderate growth mindset, and pre-test archery shooting score was below the class average. At post-test, she had insignificant decreases in both MAP scores, but a significant increase in her archery shooting score. Table 4.3 shows the pre- and post-test archery, MAP (Intelligence), and MAP (Archery) scores for each student in the focus group.

Table 4.3

<table>
<thead>
<tr>
<th>Name</th>
<th>Intelligence MAP pre-test</th>
<th>Intelligence MAP post-test</th>
<th>Archery MAP pre-test</th>
<th>Archery MAP post-test</th>
<th>Archery shooting pre-test</th>
<th>Archery shooting post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matt</td>
<td>32</td>
<td>38</td>
<td>30</td>
<td>36</td>
<td>54</td>
<td>102</td>
</tr>
<tr>
<td>Sarah</td>
<td>19</td>
<td>37</td>
<td>28</td>
<td>32</td>
<td>36</td>
<td>68</td>
</tr>
<tr>
<td>James</td>
<td>28</td>
<td>22</td>
<td>26</td>
<td>21</td>
<td>88</td>
<td>55</td>
</tr>
<tr>
<td>Ryan</td>
<td>43</td>
<td>35</td>
<td>34</td>
<td>26</td>
<td>106</td>
<td>71</td>
</tr>
<tr>
<td>Tracy</td>
<td>28</td>
<td>30</td>
<td>32</td>
<td>31</td>
<td>80</td>
<td>81</td>
</tr>
<tr>
<td>Alex</td>
<td>26</td>
<td>26</td>
<td>25</td>
<td>26</td>
<td>101</td>
<td>104</td>
</tr>
<tr>
<td>Haley</td>
<td>29</td>
<td>40</td>
<td>32</td>
<td>41</td>
<td>78</td>
<td>64</td>
</tr>
<tr>
<td>Diana</td>
<td>35</td>
<td>33</td>
<td>34</td>
<td>32</td>
<td>45</td>
<td>111</td>
</tr>
</tbody>
</table>

Explanation of Significant Changes in Archery Scores

One purpose of collecting focus group data was to explain any significant changes in archery scores. The researcher defines a significant change in archery score as an increase or decrease of more than 10 points from pre- to post-test. Based on the focus group interview, four themes emerged among the six students who had a significant change in their archery scores: (1) students’ connection from Brainology to archery, (2) Brainology strategies used in archery, (3) students’ attitudes toward Brainology, and (4) factors not related to Brainology.
Students’ connection from Brainology to archery. Students in the focus group often discussed making or not making a connection between what was taught in Brainology to archery. The researcher defines this connection as the student’s ability to relate and apply the concepts and strategies learned in Brainology to archery. The online Brainology program did not specifically mention archery, although it did make several references to sports, such as basketball. During the follow-up lessons, the researcher attempted to relate what was taught in Brainology to what was being learned in archery and how to apply certain growth mindset concepts and strategies from Brainology to archery.

Students who made a connection. The students who had significant increases in their archery scores and both MAP scores indicated that they made a strong connection between Brainology and archery. Sarah reported:

I made a connection to archery because it talked about the brain and how your memory works. My biggest connection to Brainology was memory because…I’d be on the course and like, oh, working memory…if you remember something, and then you can like remember that on the range, it can help you a lot, like with the eleven steps. When you helped us apply what we learned in Brainology, it just all made sense to me.

Matt reported:

So every time I learned something new in Brainology, I’d think oh, I can use this in archery by doing this. And I made the connection. I felt like when we were learning Brainology, I was focused on how it could help me in archery.
Both Sarah and Matt demonstrate that they were actively seeking ways in which the strategies learned in *Brainology* could be applied to archery in order to make them better shooters.

The student who had a decrease in both MAP scores and a significant increase in archery scores reported making somewhat of a connection during the intervention, but now feels like she can see the connection more clearly in hindsight. Diana reported:

I guess I didn’t really see a connection between *Brainology* and archery at the time, you know, but sometimes I remember using some of the things we learned in *Brainology*, so I guess I realized afterward that my hard work made me better at archery.

It appears that although Diana did not perceive making a connection during the intervention, she realized that in hindsight, she made a connection because she applied some of the strategies from *Brainology* to archery. In the focus group, all the students who had significant increases in their archery scores all reported understanding how *Brainology* could relate to archery. Furthermore, all of these students’ post-test MAP scores indicate that they had a growth mindset. Even though Diana’s MAP scores decreased somewhat, she still demonstrated a growth mindset.

**Students who did not make a connection.** Students who had significant decreases in their archery scores and both MAP scores reported not making any connection between *Brainology* and archery. Ryan reported, “I don’t think *Brainology* helped because I didn’t see a connection to archery from it.” However, Ryan did see a connection between *Brainology* and science, but was unable to make the connection to Outdoor Education, specifically archery: “If you were doing it for like science it makes
sense, how the brain works, but in Outdoor Ed about archery I don’t see the point of it.”

In regards to *Brainology*, James noted:

> It was good examples, because I remember the boy and the girl would take something that they did to the other guy, and he would say how that affects the brain, but none of that stuff had anything to do with archery.

Both Ryan and James’ answers suggest that the application from a program that did not specifically mention archery to shooting practice was possibly too abstract. Their attitude toward *Brainology*, which will be discussed later, may have also been a barrier to their ability to make the connection. Although this section examines students’ who had significant changes in their archery scores, it should be noted that the students who did not did not have significant changes in their archery scores and both MAP scores reported not making the connection from *Brainology* to archery.

The student who had an increase in both MAP scores and a significant decrease in archery scores reported not making a connection. Haley reported, “I just don’t like, see the full connection to *Brainology* in archery. Even though you talked about archery, the program did not.” Haley confirms that the researcher discussed archery during the *Brainology* intervention. However, her response suggests that there was a disconnect between *Brainology*’s lack of mentioning archery and the researcher’s attempt to connect *Brainology* to archery. This is possibly a significant finding and will be discussed further in this chapter and in Chapter 5. Three of the students who did not make a connection to archery had post-test MAP scores indicating a growth mindset, while two of the students’ MAP scores indicated a fixed mindset. These students who had growth mindsets post-intervention also had growth mindsets prior to the intervention. This data suggests that
making a connection between *Brainology* and archery may be a strong predictor of an increase in archery ability. The justification for this is discussed in the next section.

**Brainology strategies used in archery.** Another theme that emerged from the focus group was applying strategies learned in *Brainology*. This theme was strongly related to the students’ abilities to make a connection between *Brainology* and archery. Students who made a connection between *Brainology* and archery were more likely to apply the strategies learned from *Brainology* while shooting. The researcher believes the application of these strategies was also the result of the researcher requesting that students try specific strategies during archery shooting practice.

**Students who used strategies from Brainology during archery.** Students who used strategies from *Brainology* all had significant increases in their archery scores. These are the same students who made a connection between *Brainology* and archery. The two students who had significant increases in their archery scores and both MAP scores reported often using strategies learned in *Brainology* during archery shooting practice. Sarah reported, “I used square breathing and the memory to remember what we learned the following day.” When asked how she specifically used square breathing for archery, she said:

I would breath in for 4 seconds, then hold it and shoot. Then breathe out for 4 seconds. I did it for like every shot.” She also reported, “The working memory and sensory memory…I’d be on the course and like, oh, working memory…if you remember something, and then you can like remember that on the range, it can help you a lot, like with the eleven steps. So, I focused on how to remember the eleven steps, and it made me shoot better.
Matt reported:

So I used square breathing because like you said, breathing is a big part of concentration and archery. I also used square breathing like when I was stressed out, like on my archery test, things like square breathing helped me calm down and shoot better.

Both Sarah and Matt discuss specific strategies they used, which they perceived helped make them shoot better. Although these students only reported square breathing and memory, their reflections and worksheets also mentioned strategies used such as info search, repetition, and increased effort and focus. For example, Matt mentioned that he used the strategy info search to find more information about the 11 steps to help him gain a better understanding so he could shoot better. Info search is a strategy in which students use various resources to find out more information on a topic in which they have little understanding or need clarification. In the context of this study, students used an info search to find out more about archery shooting form and other strategies that led to increased shooting scores. Sarah mentioned using the strategy of repetition for remembering the 11 steps so that she could say them in her head while she was shooting to improve her shot form.

There was a direct application of the strategies from Brainology to archery that the researcher attempted to show the students. For example, in the 11 Steps to Archery success, the ninth step is Shot Set-up. In this step, the archer takes a deep breath, holds his or her breath, relaxes and focuses on the target, then slowly releases the bow string. The square breathing strategy from Brainology teaches students how to use breathing in order to remain calm and focus. Part of square breathing is holding the breath. Therefore, the
researcher showed students how they could use square breathing at the time of the shot-set-up step.

The student who had a decrease in both MAP scores and a significant increase in archery scores reported using strategies learned in *Brainology*. She reported that she tried to use some of the strategies the researcher encouraged the class to use. Diana reported:

*Brainology* helped me with the way it would teach me what the brain needed to think hard and work hard, so I used the *Brainology* strategies you talked about to keep me working hard to get better at my [archery] form and shot grouping, and it looks like it worked.

Although Diana did not mention specific strategies such as square breathing, she felt like the strategies that she used allowed her to keep putting in more effort in order to get better. The students who reported successfully implementing those strategies had significant increases in their archery scores. Moreover, they perceived that those strategies made a positive impact on their archery ability. These students also reported making a connection between *Brainology* and archery. It appears that because those students were able to make the connection of how growth mindset strategies learned in *Brainology* applied to archery, they then perceived that the strategies would help them be better archers. Thus, they were willing to apply those strategies.

**Students who did not use strategies from Brainology during archery.** Students who had significant decreases in their archery scores and both MAP scores reported not using any strategies. One student did not even attempt to use any strategies. Ryan reported, “I didn’t use any strategies. I never attempted to use them because I did not know how they would help me.”
James also did not use any strategies while shooting. He reported that he thought about the strategies like square breathing but said he was overanalyzing the strategies. According to James:

I thought about those strategies you kept telling us to use and like how they were going to make me a better shooter, but I just kept thinking and thinking and got so focused on those strategies that I stopped thinking about archery and just having fun. I guess I was overanalyzing everything and got stressed out, so I just decided to not use any strategies and just shoot.

Ryan’s answer suggests that he perceived that the strategies were not meaningful and would not help him. Because Ryan did not see how Brainology applied to archery, it is apparent that he did not see what was learned in Brainology as being useful for archery. James also did not make the connection between Brainology and archery, so when he was thinking about using strategies during archery practice, he could not apply those strategies to his shooting practice. He overanalyzed how to use the strategies, which he reports made him stressed. His answer suggests that he was trying to cognitively make the connection, but was not able to, thus it decreased his enjoyment of archery. Therefore, he decided not to use strategies in order to have fun. Unlike Ryan, who did not feel the strategies were useful, it is possible that James did not know how to use the strategies, therefore, he quickly gave up rather than asking the researcher for help.

The student who had a significant increase in both MAP scores and a significant decrease in archery scores reported not using any strategies. Haley reported:
When we were shooting during practice time and during the archery shooting test, I was not thinking about *Brainology* strategies. I probably should have but it’s like my mind could only focus on certain things.

Archery is a sport that relies more on cognitive ability than physical ability. Haley’s answers suggest that she may have seen the benefit of using the strategies in hindsight, but at the time, she did not have the mental capacity to apply *Brainology* strategies to archery. Although Haley reported not making a connection between *Brainology* and archery, unlike Ryan who felt like the strategies would not work, and James who could not apply the strategies, Haley may have been so focused on her archery form, shot grouping, or hitting the bullseye that she either did not want to attempt any strategies or forgot to use them.

The students who reported that they did not implement strategies had significant decreases in their archery scores. Unlike the group who used the strategies, these students also reported not making a connection between *Brainology* and archery. It appears that because those students were not able to make the connection of how growth mindset strategies learned in *Brainology* applied to archery, they then perceived that the strategies would not help them be better archers. Thus, they did not attempt to apply those strategies, or felt uncertain if the strategies would help them.

**Students’ attitudes toward *Brainology***. Students’ attitudes toward *Brainology* and their perceptions of the helpfulness of the program toward archery appeared to be a significant factor in how well the students made the connection between growth mindset and archery and how much effort they gave during the implementation. Students’ attitudes toward *Brainology* varied.
**Positive attitude toward Brainology.** The two students with an increase in archery scores and both MAP scores reported enjoying *Brainology* because they could see the benefit of it. They reported that they thought *Brainology* helped them become better archers. The student with an increase in archery score and decrease in MAP scores, reported mixed feelings about *Brainology*. Diana reported:

> I liked it, but then it was kind of like I didn’t like it. It’s like I’m in between. It kind of took away the time of me trying to practice shooting. But I liked it because my scores went up. I guess I would say overall I liked it.

The data suggests that students who liked *Brainology* may have taken it more seriously or may have expended more effort to try to connect what was learned in *Brainology* to archery. There is possibly a reciprocal relationship between having a positive attitude toward *Brainology* and having an increase in one’s archery score. These students indicate that seeing their archery ability increase (i.e. the reward of implementing the strategies from *Brainology*) made them have a positive attitude toward the program.

**Negative attitude toward Brainology.** The two students with a decrease in archery scores and both MAP scores were adamant that they did not like *Brainology* and did not see how it was useful, nor did they think it helped. They thought *Brainology* was boring and did not like it because they perceived it took away from their shooting time. The student with a decrease in archery score and increase in both MAP scores reported that she did not like *Brainology* because she thought it took away from her shooting time. Haley reported, “I didn’t like doing it because it was a nice warm day and we could have been outside shooting, but we had to stay inside and do the *Brainology* stuff.” There are several potential explanations as to why students’ attitudes toward the *Brainology*
curriculum varied. The researcher has observed in the past that students perceive his outdoor adventure class to be fun. Sometimes, students come to his class with the expectation that they will go outside and play every day. Students tend to resist academic-type work like taking notes, indoor lessons, research projects, and written assessments. Because Brainology is an academic program, and its content did not specifically discuss outdoor adventure or physical education, students may have been more resistant to the intervention because they wanted to go outside and participate in something that they perceived to be more fun. These students thought that Brainology was taking away from their shooting time and may have expended less effort as a result of lack of motivation. Their attitudes toward Brainology appeared also to be related to how great of a connection they made between Brainology and archery. The data suggests that students who did not like Brainology may not have taken it as seriously or may not have given as much effort to try to connect what was learned in Brainology to archery.

Factors not related to Brainology. Students who had significant changes in their archery scores all reported factors not related to Brainology that they believed could have impacted their scores. The factor not related to Brainology that was reported to have a positive impact on archery scores was extra practice outside of school. Factors that were perceived to decrease student scores included lack of practice time in class, stress, and test anxiety.

Extra practice outside of school. The factor not related to Brainology that was perceived to increase student scores was extra practice at home. The two out of the three students who had significant increases in archery scores reported that they had a bow and arrows and they practiced shooting at home. Matt reported, “I think I had a little extra
help at home actually. When I went home, my dad and I would go out in the backyard and shoot for fun, so that probably also made me a little better.”

Diana reported:

I practiced it at home because my sister, well I have a lot of siblings, they helped me at home, and they would teach me how to do it and help me a little bit, so that helped me. They have the same bows we use and have taken this class before. I would shoot with them at home and they gave me some tips.

It is uncertain why some of the students practiced at home. It is possible that their enjoyment of archery made them seek additional opportunities to shoot outside of class. These students could have also sought opportunities to shoot outside of class in order to get better, which would be indicative of a growth mindset. Regardless, extra practice at home could have played a significant role in increasing their archery scores.

Lack of practice time in class. One of the factors not related to Brainology that students with significant decreases in their archery post-test score perceived to impact their archery scores is lack of shooting practice time in class. One student perceived that lack of practice time negatively impacted his archery score while the other two students perceived that lack of practice time prevented an increase in their archery scores. Ryan reported:

I think practice makes the biggest difference. I think that’s why my archery shooting score went down. It was because I wasn’t able to shoot every day. I was expecting to do a lot better on my archery shooting post-test and I didn’t. I feel like I didn’t get enough practice time.

James reported:
If we weren’t in [the classroom], I can understand why somebody would want us to like, listen to [Brainology] and read stuff on it, but I don’t really think it did anything to me because if we were outside shooting rather than all those days we were doing like, Brainology and stuff, then I think I would have gotten better on my scores.

Haley also mentioned lack of practice time, “I felt like I could have gotten better if I could shoot more.” The students who felt like they did not receive enough practice time in class make an interesting point. Practice is related to the growth mindset (Dweck, 2006). Some students need more practice time than others in order to achieve. Due to the time constrains of this study, the intervention timeframe allowed for 5 additional days of shooting practice. Not having enough practice time may have prevented students from having a greater increase in their archery scores, although the quantitative data shows that there was a significant increase in the class average archery scores from pre- to post-test.

**Stress and test anxiety.** Although Haley mentioned lack of practice time during class, she felt like the greatest factor in her decreased archery post-test score was stress and test anxiety. She reported:

I went from good to bad, and then I got all stressed out on the post-test. I was so stressed out and I kind of panicked and lost focus. I was just like freaking out. I was so nervous and felt like I was shooting bad which made me shoot worse during the test.

When asked why she was so nervous, she said she thought the post-test was for a grade.

James reported that he felt like his scores went down because he was overthinking everything and got stressed. He reports, “I was just a little stressed out because I was
overthinking everything, so I shot bad. Once I started shooting bad, I just kind of gave up.”

When analyzing the cause of Haley’s stress and anxiety, which she perceived made her perform poorly on the archery test, it is noted that she believed the test would count for a grade. Prior to the study, and before every assessment, the researcher reminded students that it was not for a grade, but he encouraged students to try their best. During the interview, when Haley said that she thought it was for a grade, the other students in the focus group immediately responded and reminded her that the researcher told them several times it was not for a grade. Haley responded, “Well, I guess I didn’t hear that part.” This may explain the data for many students who had increases in MAP scores and decreases in archery scores. Haley had a growth mindset and perceived that her archery ability was good during shooting practice, but because she thought the post-test was for a grade, then her stress and anxiety made her perform poorly. If other students, like Haley, believed the archery post-test would count for a grade, then the stress and test anxiety may have overcome their ability to employ growth mindset strategies, resulting in a decreased archery score. James, on the other hand, shows classic signs of a fixed mindset (Dweck, 2006). Once he became stressed and anxious, he started performing poorly. In his mind, this can be seen as failure. His response to failure was to give up. This is corroborated by his MAP post-test scores of 22 and 21 for intelligence and archery, respectively, which indicates a fixed mindset.

The students from the focus group provide insight on their perceptions of the phenomena that impacted their archery scores. Figure 4.5 depicts the perceived impacts
on archery post-test shooting scores and their relationships for students with a significant change in their shooting score.

![Diagram](image)

**Figure 4.5.** Students’ perceived impacts on archery post-test shooting scores.

**Student Perceptions Of Their Archery Ability In Relation To Their Mindset**

Another goal of this study was to see how a change in students’ mindsets impacted their perceptions of their archery ability, and how they explain their archery ability in relation to their mindset. It was expected that students who had a post-test MAP score indicating a growth mindset would perceive their archery ability as something that increased or could increase as a result of implementing growth mindset practices and strategies. Furthermore, it was expected that students who had a post-test MAP score
indicating a fixed mindset would perceive their archery ability as something that decreased, stayed the same, or was not able to change.

**Perceived increase in archery ability.** The three students from the focus group who had significant increases in their archery scores all perceived that their archery ability increased. The two students who had increases in all their scores perceived that both of their post-test MAP scores were accurate, indicating that they had a growth mindset. Matt reported:

> At first I was unsure about this whole thing and if I could get better at archery, but by the end, I feel like I can do well at archery. I think the difference between my first score and my second score was that I realized that I have to work hard to do better. I think that is why I increased.

He also reported, “The more I started thinking I had grown, the more I got into a growth mindset about things, the more I felt like I had improved my scores.”

Sarah’s response is similar:

> I think the MAP description is true and explains how I like to perform. I was not sure if I could increase my archery ability at first. I cared about my shooting scores and wanted to learn archery, but I did not want to have to work too hard. By the end of the Brainology thing, I believed I could increase my archery ability. I wanted to get better and work hard. And now I think I am a better archer because of that.

These two students indicate that changing more toward a growth mindset leads to a perceived increase in archery ability. Their quantitative data also supports this indication. Matt’s response also suggests that there may be a reciprocal relationship
between mindset and archery ability; that is, as his perception of his archery ability increased, it helped foster a growth mindset.

The student with a significant decrease in MAP scores and a significant increase in archery scores perceived that her archery ability increased a little and her mindset moved more toward a growth mindset. Diana reported:

When I think about it now, I feel like I am more growth mindset. I am willing to make mistakes, even though my MAP description says I’m not. I feel like the whole time when we were shooting, I was not really sure if I could change my archery ability. I was surprised that my shooting scores went up so much. I feel like I worked hard to get better, so I think I’m probably a little bit better at archery.

Diana’s response is similar to Matt and Haley’s response; however, her MAP score decreased. It is important to note that although both of her MAP scores decreased, they were not significant decreases as they only dropped by two points. Additionally, her post-test MAP scores both indicate a growth mindset. This data helps clarify why the Pearson Correlations may have indicated that there was a very weak relationship between MAP change scores and archery change scores. However, Pearson Correlations do not take into consideration fixed mindset versus growth mindset. As noted earlier, students with a post-test growth mindset had a much greater increase in archery scores than students with a fixed mindset. Diana also perceived that her MAP scores were not an accurate reflection of her current mindset.

**Perceived archery ability did not change.** The students who had significant decreases in their archery scores and the students who had no significant changes in their
scores all perceived that their archery ability did not change and stayed the same. The two students who had significant decreases in all of their scores both perceived that their archery ability stayed the same from pre- to post-test. One student perceived that his mindset stayed the same and did not move more toward a fixed mindset, while the other student felt that he moved more toward a fixed mindset. Ryan reported, “I feel like the first [MAP] score, the pretest score, compares to me more because I think I can change my archery ability by putting in practice but without practice I can’t really grow.”

James reported:

I don’t like to have to work for things too much. Sometimes when I have to work hard to learn, it’s just easier to like, not learn. I guess maybe this made me think that I can’t really get that much better at archery. By the end, this is how I felt. I think that’s why my MAP score went down to a 21.

In regards to his archery ability, James reports, “I don’t think I got worse at archery, but I know I didn’t get better. Maybe this has something to do with my mindset, but I’m not sure.” Ryan feels that he has more of a growth mindset than what is indicated by his post-test. When asked why he thought his MAP score decreased if he feels that he has more of a growth mindset, he reported that he was not confident about the MAP questions because he saw that his archery score decreased so much. He feels like he cannot get better at archery unless he has more practice time.

The two students who did not have significant changes in their scores both perceived that their archery ability stayed the same. One student perceived that her MAP post-test scores were somewhat accurate, while the other perceived that his MAP post-test scores should have been higher and indicated a growth mindset. Tracy reported:
I didn’t think I got worse at archery but I didn’t feel like I got better. I am still not completely sure if I can change my archery ability and I’m still unsure if I can change my intelligence. I believe [my mindset is] in the middle.

Alex reported:

I feel like after *Brainology*, even though all my scores stayed the same, the MAP scores should have been a little higher. I think I could change my archery ability if I keep working hard. Right now, I feel like my archery ability is still the same, but I think it could get better in the future.

Tracy indicated uncertainty with her perceptions. It was the researcher’s observations during the intervention that Tracy seemed wary about the intervention. She never saw a connection from *Brainology* to archery and was uncertain how it was going to help her. Her quantitative data supports her perceived uncertainty in that it was expected that students who did not make a connection between *Brainology* and archery, did not use strategies from *Brainology*, and perceived that their mindset and archery ability did not change would not show significant changes in MAP scores or archery scores. Alex, on the other hand, perceived that he had more of a growth mindset than what was indicated on his MAP scores. His answer supports this perception because he said he thinks he could change his archery ability if he kept working hard.

The student with a significant increase in MAP scores and a significant decrease in archery scores perceived that her archery ability stayed the same, but her mindset moved more toward a growth mindset. Haley reported:

I really feel like my archery ability is something that I can increase and I like a challenge. I believe it is best to work hard in order to get better. I feel like I
definitely have a growth mindset, but it’s hard to know how I am as an archer because I totally freaked out on the shooting test. All the stress and anxiety made me shoot bad, so I just don’t know if I’m a better archer or not.

Haley shows signs of a growth mindset; however, her inability to control and combat her stress and test anxiety is possibly an indicator that her mindset may not be as strong as she perceives. On the other hand, the one-time archery assessment may not be an indicator of her archery ability. If, during practice, Haley was consistently shooting well, then her archery post-test score may be more of an indication of her inability to control her stress and anxiety rather than a reflection of her archery ability.

**Triangulation of Findings**

Triangulation, a method used in research, uses multiple data sources in order to strengthen the design so that there is an increased ability to interpret findings (Renz, Carrington, & Badger, 2018). Triangulating data has the potential to provide multiple perspectives of what is being studied, increase the validity of the study, and decrease researcher bias. In order to triangulate the data, the researcher gathered multiple types of data from multiple sources. In addition to the quantitative archery test and both MAP surveys and the qualitative focus group interview, the researcher also collected data via student reflections and worksheets within the *Brainology* curriculum, as well as his daily observations in the form of field notes. The triangulation of this data increases the rigor and trustworthiness of the study. The following section will describe how the field notes, reflections, and worksheets were used to help interpret the findings.

**Teacher observations and field notes.** Throughout the study, the researcher wrote daily field notes and observations in a journal after each class. One significant
observation the teacher made was students’ interest and attitude toward *Brainology*. The teacher noted that some students were very enthusiastic about the program, some were indifferent and appeared to complete the work simply because it was asked of them, while others did not take it seriously, often complained about having to do *Brainology*, and were consistently asked to stay on task. The researcher specifically wrote down the names of the two students whose scores significantly decreased (James and Ryan), and made notes that these two students, along with a few others were consistently reminded to stay on task and complete their work. These observations support the notion that several students from the focus group saying that they did not like *Brainology* because they thought that it took away from their outside shooting time. The students who were very enthusiastic about the intervention, like Matt and Sarah, most likely saw the relevancy and benefit to archery. As their performance increased, so did their enjoyment and perceived usefulness of *Brainology*. The students who were indifferent may have benefitted somewhat through passive learning. For example, Alex realized that he would have to work harder and expend more effort in order to get better at archery. Although Alex was indifferent to *Brainology* and his scores did not change significantly, he showed signs of a growth mindset. This may indicate that simply doing the required work because it was asked of him may have been beneficial. The students who had no interest in *Brainology* and actively resisted it may have given little effort, regardless of their mindset, because they did not see the benefit of the program and were only seeking the enjoyment of participating in archery rather than actively trying to increase their archery ability.
Another significant observation the researcher made during the study was students asking how *Brainology* could make them a better archer? The researcher noted multiple times that students asked this question. This observation supports the finding that many students from the focus group did not make a connection between *Brainology* and archery, and further suggests that the researcher may not have adequately explained how *Brainology* and a growth mindset connected to archery. The researcher noted in his journal that he had explained at a later time the connection between *Brainology*, growth mindset, and archery ability. Based on the focus group interview, Sarah specifically mentioned the researcher’s reference to the connection between *Brainology* and archery. It is possible that students who did not make a connection between *Brainology* and archery may not have been paying attention when the researcher was explaining the connection, or perhaps the researcher did not do an adequate job of making and reinforcing that connection during the intervention. This observation is significant because five out of the eight students from the focus group did not see the connection between *Brainology* and archery, while two made strong connections, and one had a weak connection in hindsight.

**Reflections and worksheets.** Throughout the online *Brainology* lessons, students had the chance to reflect on what they learned in a particular section. The reflections were optional and were stored in the students’ E-Journals. The reflections were specific to a concept that was learned in the program, but the researcher continuously encouraged students to reflect using an “archery mindset.” That is, students were encouraged to think about how the reflection could apply what they had just learned in *Brainology* to archery. Based on the researcher’s analysis of the reflections, the researcher found no meaningful
difference in the number of reflections completed, the length of the reflection, the depth of the reflection and the mention of archery during the reflection. The researcher believes that because the reflections were optional, students may not have put in as much effort.

Throughout the *Brainology* unit, some of the lessons had supplemental worksheets. The researcher provided the students with a digital copy of the worksheets in which they could use software to write or type on the worksheet using their iPads. The researcher conducted a class review of each worksheet after that particular lesson, and the students emailed the researcher their completed worksheets. The worksheets also support some of the other data. For example, the worksheet *BRAINOLOGY STUDY PLAN JOURNAL* (see Figure 4.6 and Figure 4.7) asked students to list strategies they used and how those strategies worked. It then asked three reflection questions. Prior to the students’ beginning the worksheet, the researcher specifically asked the students to list the strategies from *Brainology* they used thus far during archery shooting practice, how well those strategies worked, and to reflect on those strategies. A student immediately asked what if they had not used any strategies? The researcher then instructed the students to list strategies they planned to use the next time they shoot and make a guess as to how those strategies will help them. Matt, who had significant increases in his scores, followed directions, listed strategies, and reflected on how they helped him. Ryan’s responses on the worksheet referenced strategies from *Brainology* he used in Latin class, which indicated that he did not follow directions.
**Figure 4.6.** Ryan’s Brainology Study Plan Journal

Ryan’s responses on this worksheet indicate that he did recall some strategies learned in *Brainology*; however, he was either unable to apply those strategies to archery, so he discussed Latin, or he was not paying attention to the researcher’s directions. This worksheet supports Ryan’s perception that *Brainology* is more useful in an academic class rather than an outdoor adventure class.


**Figure 4.7. Matt’s Brainology Study Plan Journal**

Matt’s worksheet provides two more strategies that he used in addition to square breathing. During the focus group interview, Matt only mentioned square breathing as a strategy he used. During the reflection on the worksheet, he perceives that square breathing and the info search were the most effective strategies. The researcher believes that all of these strategies, and perhaps the combination of multiple strategies, may have
played a significant role in increasing Matt’s archery scores. Overall, the reflections and worksheets support the other data from this study.

Summary

The quantitative findings suggest that there was a significant increase in the archery shooting scores and both Mindset Assessment Profile scores, indicating that the class’s average archery shooting ability increased and their mindsets moved more toward a growth mindset from pre- to post-test. However, simple Pearson Correlations indicated a very weak relationship between changing more toward a growth mindset and a change in archery score. The Pearson Correlations may not be as strong of a predictor as a comparison of change scores between students with a fixed mindset post-intervention compared to students with a growth mindset post-intervention. Students with a growth mindset, on average, had much greater increases in their archery scores from pre- to post-intervention than students with a fixed mindset. Qualitative data was collected in the form of a semi-structured focus group interview, researcher observations and field notes, and reflections and worksheets from Brainology. The qualitative data was analyzed, and the findings help corroborate and interpret the quantitative data. Students who had significant increases in their archery shooting score and both MAP scores reported making a strong connection between Brainology and archery, applying growth mindset strategies to their archery practice, and had a favorable attitude toward Brainology. They perceived that their archery ability increased along with their growth mindset and they believe that the strategies they used from Brainology, as well as some factors besides Brainology, helped increase their archery ability. Furthermore, they attributed having a growth mindset to an increase in their archery ability. Students who had significant decreases in their archery
shooting score and both MAP scores perceived that their archery ability stayed the same, but one student perceived that his mindset moved more toward a fixed mindset, while the other felt that his stayed the same. Based on all the data collected, both students did not take *Brainology* seriously nor want to do the program. Both students attributed poor archery post-test performance to extraneous variables rather than their lack of using strategies from *Brainology*. Students who had no significant changes in their scores perceived that their archery ability stayed the same while one student perceived her mindset stayed the same and the other student perceived his mindset moved more toward a growth mindset. These students appeared to be indifferent toward *Brainology*. They did not use any *Brainology* strategies while practicing shooting, but they did not attribute their lack of significant change in archery scores with any other outside factors. With regards to the students who had an increase in archery scores and a decrease in MAP scores or vice versa, the data is inclusive in explaining why these students’ scores varied and went in opposite directions. It appears that students who had significant increases in archery scores but moved more toward a fixed mindset may attribute other factors besides *Brainology* to their increased scores such as extra practice at home. These students may not see a direct connection from the *Brainology* program to archery, and thus feel as though their mindset decreased, and thus led to decreased MAP scores. It is important to note that a decrease in MAP score may not indicate that a student has a fixed mindset, but rather not as strong of a growth mindset after the intervention. On the other hand, students who had significant decreases in archery scores but moved more toward a growth mindset may also attribute factors besides *Brainology*, such as stress, test anxiety, and lack of practice time in class to their decreased archery score. Although they feel that
their archery ability did not decrease, and could have even increased along with their mindset, they could have had a bad day shooting.

The researcher hypothesized that students who moved significantly more toward a growth mindset would show an increase in archery scores, would attribute their increase in archery ability to having a growth mindset, and would explain significant changes in archery scores as relating to what was learned in *Brainology*. For the most part, this is true other than those students who also attributed their increases in archery scores to factors besides *Brainology*. These other factors could, however, still be a product of an increased growth mindset learned from *Brainology*. For example, these students may have believed that to get better, they needed to work harder; therefore, they practiced at home.

The researcher hypothesized that students who moved significantly away from a growth mindset would show a decrease in archery scores and would attribute their decrease in archery ability to innate or uncontrollable factors related to a fixed mindset. One student attributed his decreased archery score to anxiety on the day of the test. His qualitative data indicated he had a fixed mindset. The other student attributed his decreased archery score to lack of practice time in class. He also felt that his mindset was more of a growth mindset than the MAP post-tests indicated.

The researcher hypothesized that students without significant changes in scores would be indifferent toward *Brainology* or would not take it seriously. Since their mindset did not move more toward a growth mindset, they would not be able to increase their archery ability by employing growth mindset strategies. The researcher found that overall, this appeared to be the case.
The researcher hypothesized that students whose scores varied (i.e. an increase in their archery score but a decrease in their MAP scores or vice versa) would attribute their scores to various factors. It was not expected that so many of the students would be in this category, however, many of their scores did not change significantly. Chapter 5 will discuss the implications and recommendations based on the findings.
CHAPTER 5

IMPLICATIONS AND RECOMMENDATIONS

This chapter begins with a review of the purpose of this DiP, the guiding research questions, methodology, and findings of this action research study. This is followed by the action plan, and then implications, which include classroom, social justice, and future research implications of this action research. Finally, this chapter concludes with limitations of this action research study.

Purpose of Study

The purpose of this action research study was to determine how implementing a growth mindset impacts archery shooting scores and students’ perceptions of their archery ability during an archery unit.

Research Questions

The study is guided by the following research questions:

(1) How does implementing and emphasizing the growth mindset in an outdoor adventure education curriculum using the computer program Brainology impact student scores during an archery unit?

(2) How do students perceive their archery ability in relationship to their mindset?

(3) How will students explain any significant changes in archery scores? This action research study sought to determine the degree to which teaching students growth mindset in addition to the standardized archery curriculum will have an impact on
students’ archery shooting scores and their perceptions of their archery ability in relation to their mindset through a concurrent mixed-methods action research methodology.

**Methodology**

A concurrent triangulation mixed methods action research methodology was employed in which the researcher collected and analyzed both quantitative data in the form of pre- and post-test archery shooting scores and MAP scores, and qualitative data in the form of a focus group interview, researcher observation notes, and student reflections and worksheets throughout the Brainology program. Quantitative data was analyzed using both descriptive and inferential statistics, while the qualitative data was analyzed using inductive analysis, in which the researcher coded the data, and identified patterns and themes in order to create a framework for presenting the key findings of this study.

**Findings**

The quantitative data showed that students had significant increases in their archery scores, MAP (Intelligence) scores, and MAP (Archery) scores. However, simple Pearson Correlations showed that there was such a weak relationship between mindset and archery score, it can be concluded that moving more toward a growth mindset was not related to increases in archery scores. However, a comparison between the archery change scores for students with a fixed mindset versus a growth mindset as indicated on the MAP survey indicated that students who had a growth mindset post-intervention had much greater increases in their archery scores than students with a fixed mindset. The qualitative data helped provide an explanation and deeper understanding of the quantitative data. The qualitative data indicated that students who were able to make the
connection between *Brainology* and archery, apply strategies learned in *Brainology* to archery shooting, and had a positive attitude toward *Brainology* were more likely to have significant increases in their archery scores. Furthermore, it was determined that shooting practice at home may have had a positive impact on archery scores. Students who did not see a connection between *Brainology* to archery, did not use any strategies from *Brainology*, and had an unfavorable attitude toward *Brainology* were more likely to have decreases or no significant changes in their archery scores. Moreover, it was determined that lack of practice time in class and stress and test anxiety may have negatively impacted archery scores or at least prevented an increase in scores.

**Action Plan**

In the developing stage of action research, changes, revisions, or improvements occur, and the teacher-researcher develops an action plan for future actions (Mertler, 2014). The action plan, which will be continually evaluated, revised, and monitored for effectiveness, is the proposed strategy for future action based on the results of the study.

In the developing phase of this study, the researcher will use the results of data analysis on student mindsets and archery skill achievement, interpretations of those results, and conclusions based on the interpretations in order to develop a plan to improve teaching and the outdoor adventure education program.

The data revealed that there was a significant increase in archery skill achievement and movement toward a growth mindset. Based on the researcher’s observations, students seemed to not give up as quickly even when they were not shooting well. Although the quantitative data revealed that there was no relationship between an increase in MAP scores and an increase in archery achievement, the
qualitative data suggest this could be due to the students’ inability to make a connection between growth mindset based on what was learned during Brainology, and its usefulness in archery. It is likely that the researcher did not communicate the relevancy well enough. Based on the students with significant increases in their scores, it appears that if a connection is made, it may have a substantial impact. The researcher believes that the most significant finding is when comparing archery change scores from pre- to post-intervention, students who had a growth mindset post-intervention increased, on average, greater than five times as many points as students with a fixed mindset.

The data suggests that if Brainology is to be used again, the researcher needs to do a better job of ensuring that students are able to make the connection between Brainology and archery. One method of doing this is through formative assessments. It is the researcher’s opinion that Brainology may not be the best intervention for teaching growth mindset in his outdoor adventure class, although the researcher will continue to use strategies like square breathing in archery. Therefore, the researcher’s action plan will consist of implementing growth mindset strategies into various units he teaches with more emphasis on the connection and relevancy between growth mindset and the content being taught. The researcher will modify his growth mindset instruction to focus more on the content being taught rather than what students consider a more academic feel. As Ryan reported, “If you were doing it for like, science it makes sense, how the brain works, but in Outdoor Ed, about archery, I don’t see the point of it.” Many students may have missed the connection between Brainology and archery because Brainology has a more academic feel rather than an adventure feel. The researcher will examine the impact of implementing different growth mindset strategies into other units as well as archery,
making it more relevant, and create a new action plan. Additionally, the researcher plans to work with the other two outdoor adventure education teachers at his school to implement growth mindset strategies and study the impact in other classrooms.

The fourth and final stage of the action research process is the reflecting stage, which includes summarizing, sharing, and communicating the results of the study, and reflecting on the process. In this phase of the action research study, the researcher will share the results of his study with his administration and the two other outdoor adventure education teachers. From this point, there are other opportunities to share the results of his study. For example, teachers have a weekly department meeting and once a month the school has a faculty meeting. At each meeting, teachers are encouraged to share and present professional learning information beneficial to the school. Additionally, this researcher’s school district has a content area meeting monthly in which all the physical/outdoor education teachers from the district meet for professional development. This is another opportunity to share the results of the study. Other opportunities in the future, such as state conferences or publications, will also be taken into consideration.

**Implications**

This section describes the implications of incorporating a growth mindset intervention into an outdoor adventure education class. First, it will describe the classroom implications, then the potential social justice implications on a larger scale and in the researcher’s classroom, and finally implications for future research.

**Classroom implications.** The researcher’s problem of practice is that students’ archery achievement appears to be negatively impacted and they are not able to reach their full potential due to the difficult nature of archery combined with a quick response
to failure of giving up. Ultimately, the researcher wants all students to experience success and enjoyment in archery, which has many benefits. The results of this study indicate that students significantly increased their archery ability, and although moving more toward a growth mindset was not statistically related to an increase in archery ability, the data showed that having a growth mindset appears to play a significant role in the increased archery achievement. Therefore, there are significant classroom implications. Qualitative data indicated that students who employed a growth mindset were willing to give more effort and not give up as easily compared to students with a fixed mindset. This is supported by much of the literature on growth mindset. Teaching students how to have a growth mindset may lead to benefits and increased achievement in other units that the researcher teaches such as working more collaboratively during a team-building unit on the low ropes course or not giving up as quickly when unable to complete a route in the rock climbing unit. It may also improve students’ performance and ability to find control points during an orienteering unit when the students are unable to find them.

**Social justice implications.** There are many social justice implications as a result of this study that not only apply to the researcher’s outdoor adventure class, but also to the world outside of the class. Although there has been recent progress toward a more just and democratic society, this progress has been slow and a large disparity gap remains. The greatest achievement gap still lies between white, middle-class students and minorities predominantly from low SES backgrounds (Lalas & Morgan, 2006). Noguera (2005) asserts that these achievement gaps are a manifestation of *social inequality* rather than the *lack of technical ability*. The social inequality often results in stereotypes. Previous research suggests that negative stereotypes that question Black students’
intellectual abilities play a role in their lack of achievement (Aronson, Fried, Good, 2002). Being aware of these stereotypes can threaten African American students psychologically, which is known as “stereotype threat” (Froehlich, Martiny, Deaux, Goetz, & Mok, 2016). This phenomenon can create responses that can impair both psychological engagement and academic performance. Studies have found that if African American students see intelligence, which is often stereotyped in African Americans, as malleable rather than fixed, these students will be less susceptible to stereotype threat and more likely to remain psychologically engaged in academics, which in turn increases achievement. Growth mindset interventions have found to be just as effective on Latino students (Broda, Yun, Schneider, Yeager, Walton, Diemer, 2018). Stereotype threat is not limited to minority students; it also applies to females. There is much research that shows the effectiveness of fostering a growth mindset in females and its impact on math, science, STEM, and computing achievement and enjoyment (Coleman & Hong, 2008; Degol, Wang, Zhang, & Allerton, 2017; Hoyt & Burnette, Hoyt, Forsyth, Burnette, 2018; Rogers, Primeau, Hennessey, Baygents, 2016; Stout & Blaney, 2017). These studies found that females with a growth mindset had higher expectancy beliefs and increases in achievement. Furthermore, the growth mindset alleviated the effects of stereotype threat. Growth mindset may also mitigate the effects of gender inequality. Females who hold the belief that gender is a biological construct are more likely to hold a fixed mindset; thus, they are more likely to endorse negative feminine traits and fail to quickly deny stereotypic feminine traits compared to females with a growth mindset, who believe that gender is socially constructed (Coleman & Hong, 2008). Having a fixed mindset can lead to the maintenance of gender inequality, which suggests that it is crucial to foster a
growth mindset in minority students and females. Hoyt and Burnette (2013) found that growth mindset in males can be just as impactful in reducing stereotype threat and gender bias toward females. As a result of stereotype threat and gender roles, males with a fixed mindset often judge females as less competent leaders. This, in turn leads to discrimination against females. However, males who have a growth mindset are more likely to reject traditional gender roles and show more favor towards females. This suggests the power of the growth mindset in reducing gender bias.

Growth mindset may also have positive implications in the researcher’s outdoor adventure class as well as the other outdoor adventure education classes taught by other teachers. Outdoor education has struggled with issues of social justice (Warren, 2005). For example, the field consists of mostly white, male instructors; this is mostly “due to entrenched constraining factors, such as hiring and training discrimination, pay and advancement inequities, and lifestyle barriers” (Warren, 2005, p. 89). According to Dawson (2000), just going outdoors is based on the privileged concept of leisure. Fortunately, there are many ways to address social justice issues in outdoor adventure education. The researcher believes that fostering a growth mindset in students will serve as a powerful alleviation to some of the social justice issues present at his school and in his classes. Although this study measured the impact of a growth mindset curriculum, Brainology, on psychomotor skill achievement, the ability to foster a growth mindset in general has the potential to enhance social justice. Not only may it help encourage more minority and female students to take the researcher’s class in the future as a result of decreased stereotype threat found in many adventure activities, but it may also reduce gender bias and foster leadership potential in these students.
Since the hallmark of adventure education methods is to cultivate a climate of safety and comfort, for people’s feelings to be heard and respected, to choose supported challenges, and for individual differences to be valued, they offer an excellent methodological fit with learning about social justice (Warren, 2005, p. 95). The major elements of social justice education, such as balancing emotional and cognitive components, supporting personal experience, attending to social and group relations, utilizing reflection and student-centered learning, and valuing awareness, personal growth, and change as learning outcomes (Adams et al., 1997) are a direct mirror of experiential education methodology (Warren, 2005). Adding a growth mindset to this formula may have profound social justice implications.

**Implications for future research.** Growth mindset is a well-documented psychological construct (Blackwell et al., 2007), which has shown to increase student achievement in academic areas such as science (Bedford, 2017), math (Aditomo, 2015; Blackwell et al., 2007), reading (Andersen & Nielsen, 2016), music (Davis, 2017), computer gaming (Lee, Heeter, Magerko, & Medler, 2012), and STEM (Degol, Wang, Zhang, & Allerton, 2018). Relatively few studies show the impact of a growth mindset intervention on psychomotor achievement. O’Brien and Lomas (2017) conducted a study which examined the impact a growth mindset intervention created by the researchers had on self-efficacy and resiliency in an outdoor adventure program. To the researcher’s knowledge, this is the first study that has examined the impact of Brainology on psychomotor achievement, specifically in archery. This study was not able to distinguish if employing a growth mindset or increased practice time had a greater effect on archery achievement. Therefore a future study should investigate the difference that growth
mindset versus mere practice has on archery achievement. It would be beneficial for future studies to examine the impact that using a growth mindset intervention such as Brainology has on psychomotor achievement in physical education or outdoor adventure education classes. For example, it may be beneficial to study the impact of a growth mindset intervention tailored specifically to the psychomotor domain or an outdoor adventure content area such as rock climbing, archery, or orienteering. Although this study did not examine the social justice impacts due to the lack of overall diversity in the sample, more research should be conducted to see the social justice impacts in physical education or outdoor adventure education from a growth mindset intervention. For example, it would be beneficial to see what impact teaching students growth mindset had on female and minority participation in adventure activities, both in the researcher’s class and outside of school. Finally, There is much research on mindset theory, and mindset scales have been thoroughly tested and validated. However, it is unclear if this has been applied to specific skills such as archery. Although the MAP (Archery) scale has not yet been validated, a validation study may provide useful information about the utility of this measure.

Limitations

This action research study has many limitations that may have affected the results of this study and the ability to generalize the results outside of the researcher’s classroom. It should be noted that the results of this study were merely suggestive, not probative.

The first limitation is the nature of action research itself. Action research is less focused on producing results generalizable to other settings like traditional research, and more focused on a problem of practice related to a certain setting. Although this is a
limitation to generalizing results outside of the researcher’s particular setting, unlike traditional research, “action research produces knowledge grounded in local realities that is also useful to local participants” (Herr and Anderson, 2005, p. 98).

A second limitation is the sample size and sampling method. The sample consisted of 50 purposefully selected sixth grade students in the researcher’s outdoor adventure education class. A larger sample, or a sample from a different class may have yielded different results.

A third limitation is the intervention that was used to teach growth mindset, which also included the MAP assessment. There are many ways to teach the growth mindset. The researcher chose to use Brainology, specifically the summer school curriculum, based on other studies and its appropriateness for sixth grade students. Students may have responded differently to a different growth mindset intervention or to a different Brainology curriculum. Furthermore, the MAP only asks a few questions based on other, more detailed, surveys. The use of a different curriculum or survey may have produced different findings.

A fourth limitation is the timeframe of the study. This study was relatively short, lasting 34 days, of which 15 were the intervention. A longer study may have yielded different results.

A fifth limitation of this study is the unknown validity of the MAP (Archery) assessment. Although the MAP (Intelligence) is a valid assessment, the unknown validity of the MAP (Archery) may have affected the results of this study.
Summary

The use of a growth mindset intervention to increase psychomotor achievement is promising. Although much research has shown the positive impact of such intervention in academic areas and areas of social justice, the research is lacking concerning its effect on improving psychomotor achievement. Adventure outdoor activities involve major opportunities for setbacks and failure, in the face of which students must learn how to cope in order to increase learning and achievement (Duckworth, 2015). The results of this action research study indicate that having a growth mindset may increase psychomotor achievement, specifically archery ability. As a result of this study, an action plan has been created that will lead to more in-depth study of the impact that growth mindset has in the outdoor adventure education classes at the researcher’s school.
REFERENCES


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Routledge.


*Sport History Review, 35*(1), 20-31.

Do perceived autonomy-supportive and controlling teaching relate to physical
education students’ motivational experiences through unique pathways?
Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise, 16*, 26-36.


### APPENDIX A: OFFICIAL NASP SCORECARD

#### Official Score Card

**10 Meter Round**

<table>
<thead>
<tr>
<th>End 1</th>
<th>End 2</th>
<th>End 3</th>
<th>End 4</th>
<th>End 5</th>
<th>End 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**15 Meter Round**

<table>
<thead>
<tr>
<th>End 7</th>
<th>End 8</th>
<th>End 9</th>
<th>End 10</th>
<th>End 11</th>
<th>End 12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Shooter Name:**

**Archer’s Signature:**

**Witness Signature:**
APPENDIX B: MINDSET ASSESSMENT PROFILE (INTELLIGENCE)

This is NOT a test! It is an opinion survey about beliefs and goals regarding ability and performance. It is very important that you give your honest opinion, not what you believe someone else would think best. Read each statement, decide how much you agree or disagree with the statement, and circle your answer.

<table>
<thead>
<tr>
<th>Do you Agree or Disagree?</th>
<th>Disagree A Lot</th>
<th>Disagree A Little</th>
<th>Agree A Little</th>
<th>Agree A Lot</th>
<th>Profile Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No matter how much intelligence you have, you can always change it a good deal.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. You can learn new things, but you cannot really change your basic level of intelligence.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I like my work best when it makes me think hard.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I like my work best when I can do it really well without too much trouble.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I like work that I’ll learn from even if I make a lot of mistakes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I like my work best when I can do it perfectly without any mistakes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. When something is hard, it just makes me want to work more on it, not less.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. To tell the truth, when I work hard, it makes me feel as though I'm not very smart.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

MINDSET ASSESSMENT PROFILE NUMBER
APPENDIX C: MINDSET ASSESSMENT PROFILE (ARCHERY)

**Mindset Works® EducatorKit - Module 1 Toolkit**

**MINDSET ASSESSMENT PROFILE (ARCHERY)**

This is NOT a test! It is an opinion survey about beliefs and goals regarding ability and performance. It is very important that you give your honest opinion, not what you believe someone else would think best. Read each statement, decide how much you agree or disagree with the statement, and circle your answer.

<table>
<thead>
<tr>
<th>Do you Agree or Disagree?</th>
<th>Disagree A Lot</th>
<th>Disagree A Little</th>
<th>Agree A Little</th>
<th>Agree A Lot</th>
<th>Profile Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No matter how much archery ability you have, you can always change it a good deal.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. You can learn new things, but you cannot really change your basic level of archery ability.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I like archery best when it makes me work hard.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I like archery best when I can do it really well without too much trouble.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I like archery that I'll learn from even if I make a lot of mistakes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I like archery best when I can do it perfectly without any mistakes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. When archery is hard, it just makes me want to work more on it, not less.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. To tell the truth, when I work hard, it makes me feel as though I'm not good at archery.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**MINDSET ASSESSMENT PROFILE NUMBER**

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APPENDIX D: NASP ARCHERY EQUIPMENT SPECIFICATIONS

3. Equipment -- Only equipment specified for use in NASP® may be used in the tournament.

*NASP® equipment has been selected to be as universal-fit as possible to make administration of the program most suitable for in-school teaching. The program would be too complicated if multiple bows, arrows, and accessories were allowed. Tournaments follow in-school program design as closely as practical.*

3.1. If after the 10-meter practice end begins an archer is found to be using disallowed equipment, the archer is subject to disqualification.

3.2. **Bows:** Only the stock (original) unmodified GenesisTM bow approved for NASP® may be used.

3.2.1. All bows must be on bow racks for range official inspection before shooting begins. Once inspected, the bow must remain on the range unless a repair is needed and approved by a lane official.

3.2.2. The Genesis Mini, Pro, and GenX are not allowed for use in NASP®.

3.2.3. The bow’s axle-to-axle length, measured from the center of each axle must be within ¼” of the manufacturer axle-to-axle specification of 35.5”.

3.2.4. The bow’s grip must be in place and unmodified. Changing the shape by removing material or adding material, including tape would be a disallowed modification.

3.2.5. Only tied on or heat shrink nock locators may be used.

3.2.5.1. There may be up to one nock locator above and below the arrow nock.
3.2.5.2. If using two nock locators the gap between them must be \( \leq 1-1.5 \) nock widths.

3.2.5.3. Brass nock locators are prohibited for safety reasons.

3.2.5.4. Instructions for tying on a nock locator are available @ www.naspschools.org

3.2.6. The bow must be sight and sight-mark free.

3.2.6.1. Tape or paint to cover sight marks will be applied to the face of the sight window at a point starting at the top of the bow’s grip and running at least 6” up the face of the sight window towards the top limb.

3.2.6.2. Camouflage bows may be used, but the face of the sight window must be covered to prevent camouflage lines serving as sight marks.

3.2.6.3. The face and inside of the sight window must be kept free of any marks and raised edges, such as tape and bubble logos. If an NWTF bubble logo it must be removed or placed elsewhere on the bow.

3.2.6.4. Tape or paint used to cover sight marks must remain throughout the competition.

3.2.6.4.1. Archers and coaches should comply with this rule before their flight time.

3.2.6.4.2. If sight marks are discovered the archer or coach will be asked to cover them.

3.2.7. The bow must be free of draw stops or stabilizers.

3.2.8. The bowstring and cables may be ‘after-market’ but of the same approximate length.

3.2.9. The standard cable guard, grip, slide (black only), wheel, cam, bearings, riser, and limbs must be original and unmodified. Axle to axle length as specified in 3.2.3 must be met.
3.2.10. A bow may be personalized by painting, stickers, et cetera, but without sight-marks.

3.2.11. The arrow rest must be original and unmodified. The rest arm sleeve may be original, absent, or replaced with heat shrink tubing similar to the original rest arm sleeve.

3.2.12. The bow’s draw weight must remain unchanged throughout the flight after the 1st scored arrow is shot at 10 meters.

3.2.13. Except for malfunction, bows must remain downrange of the waiting line once shooting begins.

3.2.14. Except for major malfunction the same bow must be used throughout the competition.

3.2.15. A non-compliant bow must be removed from the competition by the head coach until it is restored to a compliant condition before competition begins or resumes.

3.3. **Arrows:** Only the original unmodified Easton aluminum 1820 arrows approved for NASP® may be used.

3.3.1. Tournament officials will provide 5 NASP® arrows in each archer’s floor quiver.

3.3.1.1. These provided arrows are loaners and remain the property of NASP® after the student’s use.

3.3.1.2. Arrows provided may have been shot in prior flights.

3.3.1.3. **IMPORTANT: BEGINNING WITH 2017 WORLDS, ARCHERS MAY BE REQUIRED TO PROVIDE**

THEIR OWN ARROWS WITH NONE PROVIDED AT THE TOURNAMENT.

3.3.2. If the archer provides personal arrows they must be official, unmodified NASP® arrows.

3.3.3. If personal arrows are used, a readily accessible supply of replacements must be on hand.
3.3.4. Arrow nocks may be the NASP® glue-on or push-in nock or both.

3.3.5. Arrow points must be the NASP® standard; glue-in, cone shaped and weighing 60 grains.

3.3.6. Arrow vanes must be 3 soft plastic, 2.5-3.0” long and no more than .4-.6” in height and attached to the shaft with a straight off set of approximately 1.5 degrees. Vanes may be of any brand or shape but must be within the listed dimensions.

3.3.6.1. New Archery Products (NAP), the maker of the Genesis bow arrow rest, has developed a replacement vane system for NASP®. This system will be permitted in NASP® schools and tournaments. It meets our dimension specifications outlined in 2.2.5 above. It is called “NASP® SPEEDFLETCH” (patents: 7,955,2901 & 6,142,896). This vane system will have the NASP® logo marking the index vane.

3.3.7. Personal arrows must have vanes marked for identification. The arrow shaft may be marked, crested, or taped above the mid-point (towards the nock) for identification.

3.4. Accessories: Very few accessories are allowed in NASP®

3.4.1. Archers may wear finger tabs, tape, or gloves to protect draw-hand fingers.

3.4.2. Finger protection devices similar to the “No Glove” and devices made by other manufactures may be placed on the bowstring but these must be without locator buttons (also known as kisser buttons), discs, or aiming aids.

3.4.3. Heat shrink tubing may be placed on the bowstring to reduce finger strain but the tubing must cover the entire center serving above and below the nock locator(s).

3.4.4. Archers may wear arm guards and chest protectors.

3.4.5. Archers may wear eye patches, glasses, or tape on glasses.

3.4.6. Finger or wrist slings are allowed. Wrist slings may be attached using the bolt that comes with the strap. The bolt must be made of steel or plastic and must only protrude one inch or less beyond the bow’s accessory hole.
3.4.7. Mechanical release aids are prohibited.

3.4.8. The bow must remain free of any devices designed to dampen vibration.

3.4.9. Potential special allowances for physically challenged archers are evaluated on a case-by-case basis. While participation by the challenged archer is important, other competitors must not be negatively impacted.

Commonly approved allowances include:

3.4.9.1. Wheel chairs are permitted if needed.

3.4.9.2. In the case of hearing or visually impaired archers, a coach or parent may provide assistance at the shooting line. A lane official must be alerted before shooting begins.

3.4.9.3. Mouth tabs are permitted for archers whose physical challenges make drawing the bowstring impossible.

3.4.9.4. Archers who use crutches may shoot from a chair or have coach assistance to stand.

3.5. At official discretion, any bow, arrow, or accessory may be subjected to inspection, including dismantling and weighing. Anyone found using disallowed equipment or modifications will forfeit awards and be disqualified. Disqualification may affect their team’s rank.
APPENDIX F: FOCUS GROUP INTERVIEW GUIDING QUESTIONS

(1) Looking at your post-test MAP group, how does this description compare to the way you think and feel about your archery ability? Which parts are true for you and which are not?

(2) Looking at your archery pre- and post-test shooting scores, why do you think it changed (or didn’t change); what made it change?
APPENDIX G: NASP ARCHERY SHOOTING RULES

4. Competitive Format

NASP® competitions are designed to be extensions of the in-school curriculum. Tournaments emphasize safety, sportsmanship, and indoor application.

4.1. Range Set-Up

4.1.1. Target butts will be placed directly on the floor similar to the height of school butts. Target faces will be placed 4-6 inches above the range floor IF the target butt is large enough to allow this much space.

4.1.2. Targets faces (paper) will be NASP® 80 cm FITA face with 10 scoring rings.

4.1.3. The target line will be approximately 2 yards or meters from the target butts.

4.1.4. There will be 10 meter (32’ 10”) and 15 meter (49’ 2”) shooting lines.

4.1.5. The waiting line will be at least 4-5 yards or meters beyond the 15-meter shooting line.

4.1.6. A ‘Coach’s Alley’ will be delineated between the waiting line and spectators.

4.1.6.1. Only three coaches from each team may be in the coach’s alley.

4.1.6.2. We encourage alley coaches to be seated as much as possible to prevent blocking the view of spectators in the audience.

4.1.6.3. Coaches in the alley must wear credentials provided at registration (wrist strap, etc.)

4.1.6.4. For teams, at least one coach must be immediately available and located with his or her team while the team is shooting in case issues
must be resolved. Coaches must display positive sportsmanship while in this alley.

4.1.7. Spectator seating will be placed as close as possible behind the waiting line.

4.1.8. Shooting lines will support 5 foot wide shooting lanes accommodating 2 archers per lane.

4.1.8.1. The shooter’s label will indicate with “Left” or “Right” which half of the 5’ wide shooting lane each archer is assigned.

4.1.8.1.1. Crowding across the middle of the lane is considered unsportsmanlike conduct.

4.1.8.2. Shooters occupying a lane will be from different schools where possible.

4.1.8.3. Solo shooters will be combined where possible to promote integrity.

4.2. **Whistle Signals: NASP® whistle commands will be used to operate the range.**

4.2.1. 5+ whistles for an emergency

4.2.2. 2 whistles to ‘get bow’

4.2.3. 1 whistle to ‘shoot’

4.2.4. 3 whistles to ‘go get arrows’

4.3. **Arrow Handling and Movement About the Range: NASP® safety rules must be followed.** 4.3.1. Archers must walk when moving about the range.

4.3.2. Archers must have one foot on each side of the shooting line with ‘bows on toes’ before shooting begins.

4.3.3. The tournament-provided arrow quiver must be placed ON the shooting line in FRONT of the archer.

4.3.4. Shooter and quiver must remain in their half of the assigned lane when on the shooting line.
4.3.5. While both archers may approach the target when scoring, only one archer may remain at the targets when arrows are pulled. The other archer must be safely behind the target line while arrows are being pulled from the target.

4.3.6. Archers must remain standing on their feet and off their knees when pulling arrows.

4.3.7. Arrow points must be covered with one hand and shafts grasped below the vanes with the other hand when walking with arrows.

4.4. **Order of Shooting**

4.4.1. The archer must nock, pre-draw, draw and aim in a manner keeping the arrow pointed safely towards the target, below the top of the backstop curtain, and away from the floor at all times.

4.4.2. Archers will shoot one practice end of 5 arrows and 3 scoring ends of 5 arrows at 10 meters.

4.4.3. Archers will shoot one practice end of 5 arrows and 3 scoring ends of 5 arrows at 15 meters.

4.4.4. Archers will have 2 minutes to shoot each 5-arrow end.

4.4.5. Dropped arrows will be left on the floor and replaced by a range official.

4.4.6. An arrow that bounces off the target may be shot again as instructed by range officials.

4.4.7. An arrow that reaches the target line without hitting the target is considered a shot rather than a dropped or bounced-out arrow and will be scored zero points.

4.4.8. If an archer is unable to safely use the equipment and follow range protocols that archer may be removed from the competition.

4.4.9. If the archer’s draw weight and draw length aren’t sufficient to perform on par with other archers in the tournament the archer may be removed. Shot arrows that fail to reach or stick in the target butts are symptomatic of insufficient performance.
4.4.10. After shooting the last arrow the archer must immediately leave the shooting line, rack the bow, and return behind the waiting line. This is NASP®-specific range management protocol.
APPENDIX H: NASP SCORING RULES

5. **Scoring:**

5.1. Only archers and tournament officials will be allowed downrange of the waiting line.

5.2. All arrows should be scored before any arrow or the target’s face is touched. 5.2.1. Moving the target face to affect an arrow’s score is a violation of 5.2.

5.2.2. Moving or pushing an arrow into the target face to affect an arrow’s score violates 5.2. 5.3. Beginning in the center of the target, scoring rings are 10, 9, 8, 7, 6, 5, 4, 3, 2, & 1.

5.3.1. An arrow **shaft** touching a scoring ring line is awarded the higher point value.

5.3.2. An arrow outside all scoring rings is awarded ‘0’ points.

5.3.3. The ‘X’ ring in the center of the 10 is simply scored as a 10.

5.3.4. An arrow that ‘robin-hoods’ another arrow receives the value of the arrow in the target.

5.3.5. An arrow that skips off the floor and imbeds in the target is scored where it sticks.

5.3.6. An arrow that skips off the floor and bounces off the target is treated as a bounce out.

5.3.7. An arrow that sticks in the target but falls completely out as shooting continues is treated as follows: 5.3.7.1. If BOTH archers agree what the arrow’s score was BEFORE it fell out, the arrow can receive that value.
5.3.7.2. If BOTH archers are uncertain what the arrow’s score was BEFORE it fell out, the arrow is treated as a bounce-out and a replacement arrow may be shot.

5.4. Each lane should have two archers, one in the left half of the lane and the other in the right half of the lane.

5.5. Scannable (bubble-type) scorecards will be used. Archers should practice with this type of scorecard before coming to the tournament.

5.6. Both archers’ scorecards will be on the same score board.

5.7. Both archers will walk to the target in their lane to record arrow scores.

5.7.1. One or both archers may approach the target face to score arrows.

5.7.2. NEW PROTOCOL: One archer will CALL and BUBBLE the other archer’s arrow.

5.7.2.1. The scorecard will be modified to have a “Check-Box” to the right of each 5-arrow end.

5.7.2.1.1. The archer should check this box indicating he or she has examined each 5-arrow end to make sure the score has been correctly entered.

5.7.2.1.2. Also check to assure that NO ARROW VALUE LINES are left blank.

5.7.3. Then the archers will reverse roles.

5.7.4. If archers cannot agree on an arrow’s score, a range official must be asked for the final decision.

5.7.5. Only range officials may have erasers on the range. If the archer needs a score erased, the official will perform the task. The lane official will document such action on the back of the scorecard.

5.7.6. After both archers are satisfied that arrow values have been accurately recorded, scores are considered final.
5.7.7. One archer will move safely behind the Target Line while the other archer pulls his own arrows.

5.7.8. Then the archers will reverse positions, one behind the Target Line while the other pulls his or her own arrows.

5.7.9. At the conclusion of the flight both archers must sign the scorecard.
   
5.7.9.1. If an archer fails to sign his or her scorecard, the scorecard will be considered approved and final.

5.7.9.2. The archer represented by the unsigned scorecard will not be disqualified for neglecting to sign.

5.8. Scorecard deficiencies may be found in the scoring room:

5.8.1. Scorecard has more than one value on a scoring line. The higher value will be erased.

5.8.2. Scorecard has more than one value on a scoring line but there is a blank line among the 5 scoring lines. One of the double values will be moved to the blank line.

5.8.3. A scoring line is blank. Except in 5.8.2 above, the blank line will be scored zero.

5.9. An archer’s score may only be counted for a single team. The score will also be used to determine the archer’s individual placement.

5.10. Range officials will gather signed scorecards after each flight at the target.

5.11. Disqualification may occur if an archer takes the scorecard up-range of the 10-meter shooting line or to the coach or other unofficial person(s).

5.12. If an archer observes another recording a false score a range official must be alerted.

5.13. Summation of the team’s highest 12 individual scores, with at least 4 of both genders, will comprise the team score.
APPENDIX I: MAP CHART (INTELLIGENCE)

<table>
<thead>
<tr>
<th>If your profile number falls into this range:</th>
<th>Then your MAP (Mindset Assessment Profile) group is:</th>
<th>People in this MAP group usually believe the following things:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-12</td>
<td>F5</td>
<td>You strongly believe that your intelligence is fixed—it doesn’t change much. If you can’t perform perfectly you would rather not do something. You think smart people don’t have to work hard.</td>
</tr>
<tr>
<td>13-16</td>
<td>F4</td>
<td>You lean toward thinking that your intelligence doesn’t change much. You prefer not to make mistakes if you can help it and you also don’t really like to put in a lot of work. You may think that learning should be easy.</td>
</tr>
<tr>
<td>17-20</td>
<td>F3</td>
<td>You are unsure about whether you can change your intelligence. You care about your performance and you also want to learn, but you don’t really want to have to work too hard for it.</td>
</tr>
<tr>
<td>21-24</td>
<td>F2</td>
<td>You believe that your intelligence is something that you can increase. You care about learning and you’re willing to work hard. You do want to do well, but you think it’s more important to learn than to always perform well.</td>
</tr>
<tr>
<td>25-28</td>
<td>F1</td>
<td>You really feel sure that you can increase your intelligence by learning and you like a challenge. You believe that the best way to learn is to work hard, and you don’t mind making mistakes while you do it.</td>
</tr>
<tr>
<td>29-32</td>
<td>G1</td>
<td></td>
</tr>
<tr>
<td>33-36</td>
<td>G2</td>
<td></td>
</tr>
<tr>
<td>37-40</td>
<td>G3</td>
<td></td>
</tr>
<tr>
<td>41-44</td>
<td>G4</td>
<td></td>
</tr>
<tr>
<td>45-48</td>
<td>G5</td>
<td></td>
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### APPENDIX J: MAP CHART (ARCHERY)

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<th>People in this MAP group usually believe the following things:</th>
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</thead>
<tbody>
<tr>
<td>8-12</td>
<td>F5</td>
<td>You strongly believe that your archery ability fixed—it doesn’t change much. If you can’t perform perfectly you would rather not do something. You think good archers don’t have to work hard.</td>
</tr>
<tr>
<td>13-16</td>
<td>F4</td>
<td>You lean toward thinking that your archery ability doesn’t change much. You prefer not to make mistakes if you can help it and you also don’t really like to put in a lot of work. You may think that archery should be easy.</td>
</tr>
<tr>
<td>17-20</td>
<td>F3</td>
<td>You are unsure about whether you can change your archery ability. You care about your performance and you want to shoot well, but you don’t really want to have to work too hard for it.</td>
</tr>
<tr>
<td>21-24</td>
<td>F2</td>
<td>You believe that your archery ability is something that you can increase. You care about archery and you’re willing to work hard. You do want to do well, but you think it’s more important to learn than to always shoot well.</td>
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<td>25-28</td>
<td>F1</td>
<td>You really feel sure that you can increase your archery ability by learning and you like a challenge. You believe that the best way to learn is to work hard, and you don’t mind making mistakes while you do it.</td>
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