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Secondary mathematics educators and coaches' role in providing motivation

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SECONDARY MATHEMATICS EDUCATORS AND COACHES' ROLE IN PROVIDING MOTIVATION

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Purpose

My dad is a high school football coach and has been for my entire life. When I was younger, I always thought that motivation was all about having a great "rah rah" speech like you see in the movies. However, as I got older I realized that motivation could not come from a great speech every day. In order to be a good athlete, you have to work hard almost every day. I always thought that my dad was a good motivator of his players; he had a knack for getting the most out of all of his players and knowing what to say to get them going. It led me to wonder exactly how much influence he had on motivating his players.

Once I graduated high school, I started to spend time with my dad and some of the other coaches and heard some of the ways he tried to motivate athletes such as tearing them down only to build them back up. Soon after this, I had my first field experience at Waterloo West, as part of my major program of study. I started to have worries that I would be teaching students who did not want to learn, especially mathematics. I wondered how I could get secondary students with different backgrounds to want to learn about math. I started to see some similarities in some of the readings I did for classes on motivation and things I experienced when observing my dad at work. This led me to want to learn more about how similar the methods math teachers and coaches use to motivate the adolescents with whom they work.

When we were in a team meeting for football earlier this year, our head coach, Mark Farley (2017), was talking about new hires on the coaching staff. He said he wanted to hire great teachers (M. Farley, personal communication, February 2017). This got me thinking. I wondered if one of these great teachers of football could inspire their

athletes to compete in the athletic arena, and then walk into a secondary math classroom and be able to motivate adolescents to study mathematics despite being in a different setting. I became curious if the key features of motivation for teaching math students could be the same as coaching athletes. This led me to form these three questions as I conduct my research, they follow.

1. What does research indicate are the best ways teachers can use to motivate secondary students to increase their learning in mathematics classes?
2. What does research indicate are the best ways coaches can use to motivate athletes to increase their performance?
3. What do the motivation techniques found in research for secondary math teaching and coaching have in common?

After I graduate, I plan to teach secondary mathematics and also coach. I am also considering getting into coaching at the college football level. Regardless of what field I enter, I will need to motivate the people that I am teaching or coaching. This research will help me to understand the best ways.

Methodology

I performed a meta-analysis by reading and analyzing research in the two areas addressed in my study. I found various research articles and books that examined how students are best motivated to learn mathematics. I focused on research about motivating high school students since those are the grades that I most want to teach. However, I did not discredit research done in other grades if I felt that it could be reasonably applied to high school students. For the mathematics education studies on motivation, I used

resources Dr. Catherine Miller gave me to get started, and mined these to find more studies to use in my research.

In the coaching area, I looked at research on motivating athletes. Again, I wanted to find the research on high school athletes. To begin, I got a reading list used in courses for UNI's coaching minor addressing how coaches motivate their athletes. I also met with another expert, Dr. Mickey Mack of the sports psychology department, to talk about some of the initial findings uncovered in the coaching research. He was also able to give me some key ideas to look for and consider as I was doing my research. By doing these things, I felt that I had was able to get a thorough understanding of motivation in both areas to use in forming my conclusions to the first two research questions.

After identifying the themes that emerge across studies in each set of research, I highlighted key words and similar concepts found in each set of studies. Once I found a new theme, I revisited studies already read to see if it appeared there as well. I used tables to document themes and where they appeared in each set of studies.

As previously stated, I am currently a secondary mathematics education major while also being a student athlete here at UNI. Therefore, I am currently an active member of both communities. I have begun to form my opinions on both of these areas so I am not without bias. I will make sure to clearly document my findings and uncover my biases within the reviews of research in both so the readers of my thesis understand my perspective and how it might influence my findings and conclusions.

Literature Review

Motivation in Teaching Secondary Mathematics

There was a decent amount of research in this area. I was looking specifically for research in regards to secondary students. However, a lot of the research was found on mathematics students in general, without any specific age. Nevertheless, uncovering research-based strategies to use to motivate students in secondary mathematics classes is evident in this body of research.

Self-efficacy as motivation.

Self-efficacy is a major factor in motivating students to want to do mathematics. It is not the same as knowing how to do something. Instead, it involves a person's belief that he or she is *able* to do something. In this case, it involves students' beliefs that they are able to do mathematics. Students' beliefs about their abilities and skills lead into their beliefs about what actions they believe they can perform (Schunk and Pajares, 2009). Students who have high self-efficacy are more willing to participate in class to learn mathematics. They are also more likely to show greater effort when performing these tasks and persist longer when the tasks are difficult (Schunk and Pajares, 2009). It is important for students to be persistent in their learning. If students give up any time that they run into trouble, then they will not be able to reach their full potential.

Students end up finding information about their self-efficacy from their performances and from the performances of others. When students do well on a performance, such as a test, they may start to believe that they are able to do mathematics. They can also increase self-efficacy when they observe their peers doing well on performances because they believe that if others can learn how to do math then

they can too (Brahier and Speer, 2011). Hearing positive encouragement from teachers like, "Keep trying, I know you can do it" can also raise self-efficacy as long as students are able to see themselves do well on later performances (Brahier & Speer, 2011).

Setting goals for motivation.

Having students set their own personal goals can also help raise self-efficacy. Short-term goals help students to see the progress they are making by seeing evidence that they are getting better. This increases their beliefs that their efforts and persistence is helping to grow their skills and abilities to do math. In order for these goals to be effective, the students must be committed to attaining these goals. Simply setting the goals is not good enough (Locke & Latham 2002).

It has also been found that students' personal goals need to include a specific performance standard. These are better for self-evaluations, as opposed to general goals like doing your best or working hard. This means that… "Specific goals better describe the amount of effort that success requires and promote self-efficacy because evaluating progress toward a specific goal is straightforward" (Brahier & Speer, 2011, pg. 17).

It is also important that goals set reasonably high expectations for students. If goals are too easy, then students are more likely to procrastinate in their attempts to reach the goal. Similarly, if the goals are too difficult, students are less likely to work toward them because they feel they are unachievable. (Locke & Latham, 2002). This is important for teachers to know. It shows that not every student should have the same personal goals. What is challenging and difficult for one student may be too easy for another. Teachers need to be aware of this when they are nurturing students' personal goals.

Examining the types of goals that students have is important for understanding their motivation. These goals are different from the goals previously discussed because students would not write these goals down and may not even know that they have these goals. These can be broken down into two groups, learning goals and performance goals. These goals affect how students approach doing mathematics.

Performance goals motivate students so they can get good grades or even garner teacher attention. Students with performance goals see success as having supremacy over others (Brahier & Speer, 2011). They may take advanced math classes because of what it would allow them to do in their future careers or future classes, but are in these mathematics classes because they need to take them, to achieve their goals and not because they are generally interested in learning about mathematics. They also believe that being good at mathematics is due to innate ability as opposed to effort and hard work (Brahier & Speer, 2011).

When students have learning goals, they look to study mathematics so they can improve their overall skills and knowledge (Brahier & Speer, 2011). They like mathematics because it allows them solve puzzles and complete challenges. Students who have learning goals typically do better in mathematics compared to students with performance goals because they do not get as discouraged when they do poorly on an assessment. They understand that learning takes time and is part of a bigger process (Brahier & Speer, 2011).

Motivation embedded in instruction.

The ways in which teachers set up their classrooms and teach plays a big part in whether their students have learning or performance goals (Middleton & Spanias 1999).

Two types of instruction seen in today's secondary schools are the more traditional teacher-centered classroom and the student-centered classroom. "Teacher-centered mathematics instruction consists of teachers demonstrating procedures to the class, after which students replicate and practice those procedures on individual exercises" (Brahier & Speer, 2011, p. 100). This type of instruction typically focuses on the procedures used to find one correct solution to a math problem. It also serves to deemphasize conceptual knowledge, which is the ability to understand and interpret the relationship between ideas. When students have conceptual knowledge, they are able to connect one idea to another as opposed to memorizing a multitude of procedures. It can also cause students to believe that memorization is the best way to understand mathematics and that mathematics is all about determining correct answers (Brahier & Speer, 2011). Teachers need to be able to help students see the connection so they can see how valuable all of mathematics is. Building off of previous knowledge is a critical part of learning mathematics. Students are able to see and understand the connections when they have conceptual knowledge and expand their potential for learning. They are interested in the process of learning and not as focused on the outcome. If students are solely focused on the procedures and rote memorization then they will start to develop performance goals.

In student-centered instruction, teachers help to guide students in their discussions and explorations of math content as a whole class and within groups. It helps to promote a deeper understanding of mathematics for students since they have to give reasoning when explaining their ideas and justify their solutions (Brahier & Speer, 2011). This allows the students to build up their conceptual knowledge. If teachers are able to create a classroom environment centered on inquiry, then students are more likely to have an

understanding of mathematical concepts as a whole (Cobb, Wood, Yackel, & Perlwitz, 1992). This type of instruction helps students express themselves more creatively and personalize their meanings of mathematical concepts. Students are able to "… focus on process and explanations of problem solving rather than emphasizing quick responses to single-answer exercises" (Brahier & Speer, 2011, p. 109). This personalization of the mathematical content motivates students to want to do better. It encourages the students to begin setting learning goals. They begin to become motivated to enjoy the process required to learn mathematics and not get caught up solely on the results. Middleton and Spanias (1999) described the connection between what students do in the classroom and how it effects their goals:

> Students who view mathematics as a fixed body of knowledge tend to develop goals of memorization of facts and procedures. These students also tend to develop goals of memorization of facts and procedures. These students also tend to emphasize determining correct answers as the primary goal of mathematics learning. Students who view mathematics as a process, guided by their own search for knowledge, tend to value constructing relational understanding of concepts, and consequently they are motivated intrinsically because the knowledge they develop is their own (p. 73).

Motivation in Coaching Sports

The research base on motivation for coaching sports is less broad, compared to what is found in mathematics education literature. However, there are three general behaviors that indicate whether or not an athlete is motivated. The first is in the choices

athletes make. This includes their choices to attend workouts, play the sport in general, and whether they set challenging goals (Burton & Raedeke, 2008). The effort athletes give in practice, during workouts, and while competing with others also displays their level of motivation. The last behavior is persistence. Persistence can be seen in how long athletes are willing to persevere when faced with adversity and failure (Burton & Raedeke, 2008).

The reason most athletes begin to play sports is simple; they play because they can have fun (Ewing & Seefeldt, 1990). This means that oftentimes when athletes are not motivated to compete it is because they are not having fun. Athletes can get burned out or just start to find other activities more interesting. To be motivated to continue in a sport, athletes need to find their participation exciting and stimulating, without it being too easy (Burton & Raedeke, 2008). If athletes do not feel challenged then they will often become bored.

It is also important for coaches not to ask for their athletes to do activities that are too daunting (Ewing & Seefeldt, 1990). If the activities or drills that athletes do in practice are too challenging, then athletes may become stressed out and have greater anxiety. The main reason athletes do drills or activities in practice so they can improve their athletic skills in their sport. It is important for coaches to find a way for athletes to improve their skills while also making it fun and enjoyable (Burton & Raedeke, 2008).

Self-efficacy.

Oftentimes, coaches want to make sure their players are not overconfident in their abilities so they do not take their opponent lightly. However, discouraging confidence in athletes can have a negative effect. Athletes are more likely to participate when they feel

like they have a better chance of being successful (Bandura, 1997). They need to feel like their efforts have a chance of being successful. It has been shown that, "motivationally, athletes with higher self-efficacy tend to try harder, persist longer, choose greater challenges, experience effort more positively, and feel less anxious" (Murphy, p. 8). Athletes' belief in their own personal competence has great effect on whether or not they will be motivated to do a task. Bandura (1977) stressed this:

> Expectations of personal mastery affect both the initiation and persistence of coping behavior. The strength of people's convictions in their own effectiveness is likely to affect whether they will even try to cope with given situations… Not only can perceived self-efficacy have directive influence on choice of activities and settings, but, through expectations of eventual success, it can affect coping efforts once they are initiated. Efficacy expectation determines how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences. The stronger the perceived self-efficacy, the more active the efforts (ps 193-194).

Mastery-oriented and outcome-oriented motivation.

A key part of motivating athletes is understanding whether they are outcome-oriented or mastery-oriented. Not surprisingly, outcome-oriented athletes believe their success as an athlete is measured purely on the outcome. They enjoy winning but also enjoy the recognition that comes with winning. Due to this, they enjoy the extrinsic rewards that come with winning, in part, because it validates their talents. As a result of

this, these athletes are prone to sacrifice learning opportunities if they feel the chance of committing mistakes is high (Burton & Raedeke, 2008).

The qualities of outcome-oriented athletes do not mean that these athletes are not motivated. They are motivated to achieve great things because they thoroughly enjoy the effects that success brings. However, these athletes are less likely to improve during times like the offseason. This is because they do not feel that abilities need to be developed when not being recognized for winning or accomplishment like it would be during the season. Conversely, these athletes consider others, who have to work hard to achieve a task, must do so because they are less talented (Burton & Raedeke, 2008).

Mastery-oriented athletes are able to be motivated by their coaches regardless of the outcome. They do not define success as simply winning versus losing. They measure their own successes based on elements they can control, such as improvement and effort. This means that they are likely to work hard regardless of the outcomes of their competitions. They enjoy the process of learning and perfecting their crafts. Even if they do not see results right away, they will continue to persist and develop strategies that will help them succeed (Burton & Raedeke, 2008).

Unlike outcome-oriented athletes, mastery-oriented athletes enjoy challenges because they view them as great opportunities to further develop their skills. In times of failure, they are likely to attribute their lack of success to a lack of effort as opposed to a lack of ability. They are motivated in these times because they know that their skills are not stagnant and can still be developed (Burton & Raedeke, 2008). They are also more likely to want to practice and get more out of their practice because they know that it is a great time for them to develop their skills.

Intrinsic and extrinsic motivation.

When athletes participate in sports because they enjoy the challenges, excitement, and learning opportunities that sports presents, they are intrinsically motivated. When they participate because of external factors, like scholarships, trophies, awards, and pleasing others they are externally motivated. Intrinsic and extrinsic rewards can both help to increase motivation. They can also have an effect on each other (Vallerand, 1997).

Athletes can be intrinsically motivated and have that intrinsic motivation ruined by external rewards (Vallerand, 1997). Athletes, who previously felt like they were playing for the love of the game, will start to feel like their reasons for playing are external to themselves. For example, a college football player trying to gain weight may be told that he needs to wake up in the middle of the night to eat or drink a protein shake. He may really enjoy the process of putting on weight and getting bigger. However it is fair to ask, is he controlling himself when he is doing this? Does he really want to wake up in the middle of the night to eat? (Mack, 2017, personal communication) When athletes feel like they are losing control of why they are doing something their intrinsic motivation will decrease. When athletes feel like they are controlling why they are doing something, they will have a greater sense of autonomy and an increase in intrinsic motivation.

Findings

I analyzed the research, identifying themes that address my research questions, then I compared the two sets of themes to address the third question. Recall that my research questions were the following:

1. What does research indicate are the best ways teachers can use to motivate secondary students to increase their learning in mathematics classes?
2. What does research indicate are the best ways coaches can use to motivate athletes to increase their performance?
3. What do the motivation techniques found in research for secondary math teaching and coaching have in common?

In the following sections, I will address each research question in the order they appear above. For the third research question, I will identify the themes common to both sets of research I reviewed.

Mathematics Teaching Themes

Self-efficacy.

The motivation for students in a mathematics classroom can be attributed to a number of factors. Students' belief in themselves is one of the major factors. For students to begin to engage in the mathematics being done in a classroom, they must first believe that they are capable of doing the mathematics. This is referred to as self-efficacy. If students believe that they are able to do mathematics, then they are more willing to stick with a challenging task. Students are able to see their capabilities in forms of assessment, such as a test. When students see themselves do well on these types of assessment, they gain confidence in their ability to do mathematics (Ewing & Seefeldt, 1990).

Goals.

When examining students' motivation for taking mathematics, it is important to look at their innate goals. These types of goals are not necessarily written down or thought about, but it is how a student will look to approach their participation in

mathematics. One of these types of goals is learning goals. This is where students look to study mathematics because they enjoy solving problems and understanding new ideas. Teachers can foster learning goals by creating student-centered instruction. This instruction is done by guiding students in their discussions about mathematical content and letting them discover the meaning behind mathematical ideas. The other type of goal is performance goals. When students have performance goals, they are more worried about getting good grades and doing well on tests. They also may enjoy the attention from their teachers and peers that comes from getting good grades. They view mathematical ability as something that is a talent and not able to be changed.

Coaching Themes

Self-efficacy.

Athletes need to believe that they are capable of performing whatever sport they are playing. They are more likely to participate when they feel that they have a high chance of being successful at whatever task is being asked of them. When athletes participate in sports, it is often because they want to have fun. The tasks or drills that they do in practice can have a direct reflection on their motivation as a whole. When they are they asked to do an extremely challenging task, they may find it too daunting. This could lead to anxiety and stress about their abilities and could even cause them to not attempt to do the task. Similarly, if a task is too easy, athletes can become bored and uninterested (Ewing & Seefeldt, 1990).

Mastery-oriented.

It is important for coaches to know whether their athletes are mastery-oriented or outcome-oriented. This allows coaches to have a better understanding of athletes' actions. Athletes who are mastery-oriented do not believe that their success as an athlete is solely measured by wins and losses (Burton & Raedeke, 2008). They focus on things that are within their control. They believe that it is important to improve their skills every day, and they look to give great effort in practice and workouts (Burton & Raedeke, 2008).

Mastery-oriented athletes embrace the process of getting better and perfecting their craft. They also enjoy the challenges that come with being an athlete. They do not view these challenges as a defining moment. Instead, they look at them as another opportunity for them to develop their abilities (Burton & Raedeke, 2008). When mastery-oriented athletes fail, they are more likely to believe that their failure was a result of lack of effort instead of lack of skill. This ends up encouraging them to try harder so they'll be ready the next time they are in a similar situation (Burton & Raedeke, 2008).

Outcome-oriented.

Outcome-oriented athletes think results are the only things that define their success as an athlete. They enjoy winning. However, this is mainly done because they think winning validates them as being successful. These athletes can still be considered motivated even though the driving force in their motivation are the things that come from being successful. This type of motivation does not benefit athletes in the long run. Outcome-oriented athletes are less likely to work hard in the offseason because they think talent is static and cannot really be improved (Burton & Raedeke, 2008).

Intrinsic and extrinsic motivation.

When athletes are motivated, they are either intrinsically motivated or extrinsically motivated. Intrinsically motivated athletes play sports because they enjoy the challenges that sports present. They also enjoy the overall fun and enjoyment that come from sports. This is often why children first want to play sports in the backyard when they are young (Murphy, 2005).

At some point, external rewards can have an effect on the intrinsic motivation of athletes. Their original reasoning for wanting to play a sport, like having fun, will be replaced with other motives. These motives could be things like trying to please a parent or maintain a scholarship (Vallerand, 1997). When athletes feel like they are losing control of why they are doing something, their intrinsic motivation will decrease. When athletes feel like they are controlling why they are doing something, they will have a greater sense of autonomy and an increase in intrinsic motivation (Vallerand, 1997).

Conclusions

After conducting an analysis of the research in the secondary mathematics and coaching fields regarding motivation, it is possible to draw some conclusions to the research questions posed earlier. The first two research questions will be discussed, first. They are seen below.

1. What does research indicate are the best ways teachers can use to motivate secondary students to increase their learning in mathematics classes?

Theme	**Source(s)**
Self-efficacy	Schunk and Pajares, 2009 ; Brahier and Speer, 2011
Difficulty of Tasks	Schunk and Pajares, 2009

Setting specific goals	Locke and Latham, 2002 ; Brahier and Speer, 2011
Learning and Performance Goals	Brahier and Speer, 2011 ; Middleton and Spanias, 1999
Student-centered and Teacher-centered classrooms	Brahier and Speer, 2011 ; Middleton and Spanias, 1999 ; Cobb, Wood, Yackel, and Perlwitz, 1992

Table 1: Themes and Citations for Motivation in Secondary Mathematics Teaching

2. What does research indicate are the best ways coaches can use to motivate athletes to increase their performance?

Motivation in Secondary Mathematics Teaching

The research reviewed for this study indicated that there are a number of ways to increase secondary students' motivation to learn mathematics. One of the key ways is increasing each student's sense of self-efficacy. In order for students to first want to try to do mathematics, they need to be believe that they are capable of doing mathematics. In a sense, students need to feel that pursuing mathematics is worth their time. If students see that the work that they are putting in to get better at mathematics is not leading to any real improvement, then they are unlikely to continue working at it. As a teacher, it will be important for me to remember this idea. Students need to feel that they are good at math (Schunk & Pajares, 2009). One way of doing this is by creating in class activities that are challenging yet achievable. When students see that they are capable of working through difficult concepts, they are more likely to want to do it in the future. They are able to develop self-confidence. It is vital to create tasks that allow students to feel competent

while not making them too easy (Locke & Latham, 2002). Teachers also need to give positive encouragement, such as "I know you can do this," to students when they are performing these challenging tasks so they understand that their teacher believes in them.

If teachers consistently want motivated students, it is important that they set up their instruction in the proper manner. How teachers set up their instruction greatly affects whether their students have learning or performance goals. If their classroom is teacher-centered, then it is likely to consist of a demonstration of procedures that students then repeat on individual exercises (Middleton & Spanias 1999). Students start to believe that understanding mathematics requires a memorization of rote procedures. Students develop performance goals because all they are worried about is finding the solution to a problem. This will decrease their overall motivation over time (Middleton & Spanias 1999).

Teachers should look to have a classroom environment that is student-centered if they want to have more motivated students. In these environments, teachers will help students explore mathematical content as whole class. This exploration will allow students to develop a conceptual knowledge of mathematical content (Middleton & Spanias 1999). It will also allow them to connect new mathematical ideas to previous ones. Students will develop learning goals and become more interested in the process of learning new mathematical ideas as opposed to the procedures used to find correct answers (Middleton & Spanias 1999).

Motivation in Coaching

Coaches need their athletes to be confident in their abilities and have a high self-efficacy. Athletes need to believe that they are capable of executing at a high level in

order for them to be motivated to put in the work required to do that (Bandura, 1997). Athletes' expectations of themselves will determine how long and how much they are willing to work through difficult times. Coaches need to give athletes activities and drills that are not too daunting so they can have the confidence that they can get the job done (Ewing & Seefeldt, 1990).

Coaches who wish to have motivated athletes should encourage them to be mastery-oriented. Mastery-oriented athletes judge their success as an athlete based on the things in their lives they can control, like improvement and effort (Burton & Raedeke, 2008). They enjoy the process that goes along with perfecting their craft and getting better. They do not measure success by trophies or wins and losses. They are also able to stay motivated in troubling times because they realize their skills are not stagnant. (Burton & Raedeke, 2008). Coaches can help to encourage mastery-oriented athletes by praising things that athletes can control like their effort and attitude. If coaches only praise athletes because they have had a great game or won an award, then they are encouraging them to be outcome-oriented athletes. This would show to the athletes that their coach is only focused on the outcome and not the work that is done prior to the outcome being determined (Burton & Raedeke, 2008). A summary of these findings can be seen below, in Table 2.

Theme	**Source(s)**
Self-efficacy	Bandura, 1997, 1977 ; Murphy, 2005
Difficulty of Tasks	Ewing and Seefeldt, 1990 ; Burton and Raedeke, 2008
Setting specific goals	Bunker, Linda K. 1985 ; Murphy, 2005
Mastery-orientation and outcome-orientation	Burton and Raedeke, 2008

Intrinsic and Extrinsic Motivation	Vallerand, 1997

Table 2: Themes and Citations for Motivation in Coaching

Comparing the use of Motivation in Teaching Secondary Mathematics and Coaching

For the third, and final research question we will compare what was found in the two areas of research to uncover how motivating mathematics students and athletes have in common. In Table 3, you will see a summary of what was found. Each of these ideas is explored in more detail to conclude this report.

Research indicates that the motivation techniques for secondary math students and athletes have a lot in common. Both are reliant upon students and athletes having high self-efficacy. In order for them to feel motivated to engage in the task that is being asked of them, whether it is in the classroom or in the athletic arena, they must feel that they have a good chance of being successful in the task. The tasks, cognitive or physical, presented to them must be challenging enough that they feel like they can get something out of them. The tasks also must not be too challenging otherwise the student or athlete may not give forth their best effort if they know it is for a fruitless cause (Locke & Latham, 2002) , (Ewing & Seefeldt, 1990).

Even though the terms may be different, the way in which students and athletes go about their business are very similar. Mathematics students who have performance goals are similar to athletes that are outcome-oriented. Similarly, students who have learning goals are like athletes that are mastery-oriented. Students and athletes need to be focused on the process of getting better and improving. If they get too caught up in the results, whether it is a poor grade or loss on the field, they will become unmotivated

during times of struggle. Teachers and coaches need to praise their kids for things they can control like their effort attitude.

One of the ways in which these two environments differ is that a secondary mathematics classroom can be set up so motivation is embedded in instruction. Having a student-centered classroom, as discussed previously, can do this. These student-centered classrooms allow students to take pride in their work because they are the ones forming the arguments (Middleton & Spanias 1999). It encourages students to have learning goals because they are the ones coming up with the mathematical reasoning. Conversely, it would be difficult to promote mastery-oriented athletes by creating an athlete-centered team. While it can be a positive to give athletes control over some aspects of their daily rituals, it would be difficult to guide the athletes as they control what the team does. Coaches would have a better control over what plays to run or workouts to do since they are generally more experienced and have more knowledge.

While both fields have a sufficient amount of research, there have never been any studies that have examined the connection of the motivating factors in each. This was why I completed this work. However, I feel like a lot of the research done in the books and articles I looked at are more psychology based. I do not feel like I necessarily have a great background with psychology. When I say this, I mean that I may not have necessarily interpreted the key ideas that previous authors were trying to emphasize when they wrote their research. Please see the Table 3 below, which compares the similar themes found throughout the two fields.

Secondary Math	**Coaching**
Self-efficacy	Self-efficacy
Difficulty of Tasks	Difficulty of Tasks

Learning and Performance Goals	Mastery and Outcome Orientation
Setting Specific Goals	Setting Specific Goals
Student-centered and teacher-centered classrooms	Intrinsic and Extrinsic Motivation

Table 3: Comparison of Themes Between Secondary Mathematics and Coaching

As stated earlier, I have had experience in both of these fields and therefore cannot be entirely neutral. That said, the findings make sense based on my previous experiences. I believe that the personality characteristics typical of adolescents in a classroom can be the same characteristics as what is shown on the field or court. Therefore, it makes sense that the same things could motivate them. For example, students who like getting good grades because of the recognition it gives them would like scoring goals because it would allow them to be seen on the field.

The compatibility between learning goals for students and mastery-oriented athletes makes sense based on my experience in both fields. I have often heard from coaches that it is important to "embrace the process" or "trust the process." This same idea can be applied to a mathematics secondary classroom by praising effort and embracing the struggle that comes along with having a conceptual understanding of mathematics. As a future educator and coach, it is exciting, and to be honest somewhat scary, to know that I can a great effect on what my students believe they are able to achieve. After conducting this study, I feel like I met my initial goal of seeing the connection between motivating my future math students and athletes, and how I can go about doing it.

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