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USING SPORTS TO DEVELOP COMMUNITY IN THE MATHEMATICS CLASSROOM

BENJAMIN T. LAWSON

HONORS PROJECT

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Using Sports to Build Community in the Mathematics Classroom

I have been playing sports since I was old enough to run. I grew up playing sports year-round. I have played on dozens of teams with varying levels of success. Yet when I reflect on the teams that I find the most memorable, they are not always the teams that won the most games. They are also not necessarily the teams where I played the best and received the most accolades. They are the teams that had the best relationships, trust, and respect between teammates and coaches alike. These teams had brotherhood, camaraderie, and a community of like-minded individuals who were working towards a common goal, willing to do whatever it took to complete our objective. Chavis and colleagues (1986) defined a sense of community as “a feeling that members have of belonging and being important to each other, and a shared faith that members’ needs will be met by their commitment to be together” (p. 11). These community-driven teams are the ones that have lasted the longest in my memory and the relationships that I revere the most to this day.

Similarly, I have been a student as many years as I have been a teammate. Being in dozens of mathematics classrooms throughout my sixteen-year academic journey, I have encountered numerous teaching styles and pedagogies. Some have even inspired me to pursue a career in mathematics education. Within these experiences, not all would be considered a successful classroom experience. I would determine a mathematics classroom experience successful if one experienced substantial growth in content knowledge, critical thinking, engagement, and application. However, when looking back at the classrooms that I find the most successful and impactful to me, they all have one thing in common. That one thing was not a classroom that was the easiest to get an ‘A’. Having experienced academic success, a classroom that requires little intellectual challenge can be very mundane and lacks depth. Successful

classrooms are also not necessarily the classes with the nicest teachers who never raised their voice or disciplined their students. Kindness and love have a place in the classroom, but they are not the determining factor of a successful classroom. Brilliant teachers who could answer any questions thrown their way are also not the key factor. Expertise does not dictate educational success and knowing is not teaching. The classes that are held in my fondest memories are the classrooms where the students and the teacher had a healthy relationship with mutual respect and trust. A classroom where learning was enjoyable, but not without challenge. Students felt safe in the space to experiment with ideas and stand up for their claims even if they might be wrong. Classrooms that consisted of a community of individuals working together to achieve a common goal.

A sense of community and its connection to successful classrooms has been a topic explored in research. Multiple studies have emphasized the importance of community in their findings, suggesting that a sense of community can be linked to increased academic performance (Battistich & Hom, 1997; Chavis & Wandersman, 1990; McCarthy et al., 1990, as cited in Warner et. al., 2012). These classrooms had teachers and students who were both willing to put in the work for one another, and it paid off.

When I reflect on these two major components of my life, sports and education, I cannot help but notice underlying similarities in the success stories of both. Both highlights involved the prominence of community in their respective activity. The unfortunate reality is that in my experience, athletic teams achieved this community far more often than in the classroom. What is happening in sports that we can bring into the mathematics classroom? How can we achieve this sense of community more often in the classroom? According to the High School Athletics Participation Survey (2018-19), over half of high school students participate in school sports. If

this many students are participating in sports, it could be a path to bridge the gap in the development of community. By building rapport, minimizing anxiety, and normalizing failure we can build community in a mathematics classroom using a sports lens.

How are Sports and Education Connected?

In my experience as a teammate and a learner, there are many similarities between sports and a mathematics classroom. First, the students and players can both be thought of as a team. Though teamwork is more apparent in a sports atmosphere, collaboration is still a very important role in the classroom. Collaboration and sharing ideas with one another are key components of math education and is featured in the third Standard for Mathematical Practice (CCSSI, 2010). The third standard is to “construct viable arguments and critique the reasoning of others” (pg. 6). This can be achieved in the classroom by working together and utilizing teamwork. Just as teammates work together, students can use one another to construct knowledge and share ideas to deepen understanding. Next, we can look at the roles of coaches and teachers. Both are trying to help the individuals on their respective teams to learn or master skills that will be assessed in the future. Each team goes through extensive practice before being assessed on their skills. In a math classroom, students will perform a variety of tasks to practice their skills on certain concepts for a series of time. They then will be assessed in the form of a unit test or exam to see if they have mastered the content. In many sports, players practice a variety of skills for weeks, which will then be tested against other teams in the form of games or matches. Their skills are assessed by their ability to best other teams. Sports teams, who do not practice well, tend to not play well in games. Classrooms that are not productive or do not utilize effective learning methods in their practice will not be as likely have high levels of understanding from their students; hence they may struggle on tests. Assessment offers a valuable lesson that sports teams

can teach the field of education. Consider the following scenario on a basketball, or any sport, team.

A coach has been conducting drills to improve their players skills and abilities for several weeks. Most players seem to be making a lot of growth as the team approaches their first game, but the coach is not really paying attention to the players individual performance. Instead, the coach is focused on finding drills the players will enjoy and that seem effective in theory. After a couple more weeks, the first game has arrived. When conducting the starting lineup, the coach decided to randomly select his lineup to be fair to his players. As it turns out, some of the players they selected were still lacking in multiple skills and were not ready for this level of competition and hindered team success. The coach was shocked to see that the players were all over the place in terms of game readiness. Despite doing various drills for weeks, the players did not seem to know what to do. The coach tried to use this new information to adjust for the second half, but the team was already so behind and could not comeback. They lost their first game to their opponent.

To anyone with experience on a sports team, this should be an alarmingly silly scenario. No coach in their right mind would wait until the first game to try and see how their players are doing and which ones are ready. The fact of the matter is, a coach should be able gauge their teams' skills every single day at practice. They can assess their players skills day in and day out to determine which players are struggling and which are thriving. This information is invaluable to the coach as they decide which areas to focus on and which ones do not need as much practice. A coach would also use this information of his players to figure out which squad works best together to represent the team in the starting lineup. A coach does not have to wait until the game to discover which players are struggling and which ones are thriving. The same should be

said for teachers. We are able to assess our students every day. If we get to the test and are shocked to see some of our students were not ready, we have failed them, not the other way around. We should be assessing them every single day to see where they need practice and how we can help. Compared to coaches, teachers even have the luxury of deciding when the 'game' will be. We can move the date back if many of our students are not ready or move it up if they are flourishing. By waiting until the assessment to gauge our students, we are only setting them up to be left behind in the inevitable case that some may not be as prepared as others. Coaches have a responsibility of knowing their players strengths and weaknesses to know what to work on. They can even use this knowledge in practice to put players in groups based on their skills so they can help one another. The same idea can be applied to education. A teacher can use their knowledge of students' readiness to put them in groups that can scaffold one another and enhance learning.

One may argue that in classrooms students are not being assessed as a team like in sports. Admittedly, most assessments in the classroom are individual assessments, not situations where team success is the most important. Even though students are often assessed individually, one student's success is not reliant on another student's failure. In other words, they can be thought of as all on the same team. For example, if all students learn and understand the material to the fullest, they are able to all receive 'A's on that assessment. One student's success does not rely on another student's failure. This can contribute to viewing the classroom as a team and a team success when all students do well in the 'game'.

While the main goal for a teacher or coach is to help students or players learn the most they can about their respective content, they will also be teaching them lessons that they can apply to their lives. In my experience, the best coaches and teachers have taught me lessons

about general life skills. These lessons include responsibility, respect, self-efficacy, confidence, and hope, among others. When developing authentic connections between the instructor and their learners, the learning transcends the bounds of the content.

There are also several factors that will hinder a classroom and a team. First, a few bad apples can spoil the bunch. A few students who constantly disrupt the classroom and are more worried about getting attention can make it much harder for all students to learn. This adds more stress to the teacher and makes it harder for students to focus and stay on task. Similarly, if a team has a couple players who do not have the team's best interest in mind, they can really impede the success of the team. In basketball for example, if a player is more worried about scoring points (personal goal) than winning a game (team goal), it may lower their chances for team success. This idea of putting the team first is very important in coaching philosophy to instill in its players. Tony Fryer is a basketball coach and trainer with over thirty years of coaching experience. He has been a coach for three NCAA Division-I teams and has learned and been trained by seventeen players in the National Basketball Association Hall of Fame. In an article he wrote for the USA Basketball organization addressed five keys to being a great basketball coach. One of these keys he identified was teamwork which he implores coaches to incorporate, "Teach your players that "we over me" is what most often leads to "us over them," in team sports competition. Encourage your players to be selfless and supportive teammates in both losing and winning efforts." This mentality can be applied to the classroom to ensure students know that no one's opinion is more important than another's. Each student is critical in the growth of the classroom and when all students are involved, everyone benefits.

A final shared component revolves around the relationships between the authority figures and their teams. On sports teams there is a phrase associated with the process of gaining mutual

respect between players and coaches. This is referred to as getting the players to “buy-in”. This means the coach wants the players to buy-in to his philosophies and ideals and to trust his process to success. This relationship and rapport are first steps towards a successful team. If the players do not buy in, the lack of trust will be just another roadblock towards success. I believe a similar situation could be said about a classroom. A classroom where the students have not bought in to the way the teacher is teaching, it will make the learning so much harder. The teacher must put in an effort to establish rapport to begin kindling this connection for students to buy-in.

Getting to Know Your Team

The biggest common denominator between successful classrooms and successful teams in my experience is rapport. Rapport is defined by the Oxford Dictionary as “a close or harmonious relationship in which the people or groups concerned understand each other’s feelings or ideas and communicate them well”. It is this empathetic, mutual understanding that provides a sense of connectedness, whether it be on a field or in the classroom. Rapport is not just important in the classroom. Rapport in athletics can be a strong component of a successful team. Joseph Baker’s study of 228 athletes across 13 different sports found that a negative rapport was the strongest corollary linked to negative performance, including athlete anxiety (Baker, 2000, p. 116). When these coaches did not have a sturdy relationship with their athletes, there was a lack of trust which led to a feeling of anxiety among players. Anxiety among players can reduce performance and hinder the success of the team. Intentional development of rapport is crucial among all players. Developing the connections on your team will allow the players to be more comfortable with one another and promote team connectedness.

Researchers are not the only ones identifying this important relationship between coaches and their players. Urban Meyer is one of the most successful football coaches in recent history. He has coached college football for seventeen years and has a career .854 win percentage. He has won two national championships and been awarded five different coach of the year awards. Thanks to his success, he was recently hired as a coach in professional football for the Jacksonville Jaguars. Meyer knows the importance of developing a community and its impact on success. In July of 2020, he was asked to rank the top five coaches in college football. He explained five criteria that define a great coach. While predictable answers such as strategy and leadership were on his list, his single most important criterion was culture (Meyer, 2020, 01:40). While culture is not the same as community, its meaning is close in this application. Both refer to the relationships present in the group setting and overall feel of the group. Though Meyer does not explicitly define culture in this video, he does talk about what is important to his program in another video that can shine light on his idea of connections between coaches and players. At a 2012 Ohio High School Football Coaches Association clinic, Meyer said the following, “What is our program? Our program is very similar to what I had at [location of previous school], a head coach and a group of assistants that care deeply about their players. They’re going to grind them, they’re going to push them, but they’re going to know everything about them” (Meyer, 2016, 0:06:08). This quote aids in the explanation of his view on the importance of connecting with his players. I believe it is these connections which he is referencing when discussing culture in his criteria. This quote shows that even though the players may have to grind through tough work, the have made efforts to connect with their players and establish relationships. Great coaches know the importance of establishing rapport.

Rapport is also the foundation of developing community in the classroom. The importance of developing rapport cannot be overstated. In a 2020 study of over 200 college kids and their view on relationships in education, Frisby et. al. (2020) summarized the following, “students viewed rapport as an essential component of an effective teacher in order to foster substantial interpersonal relationships and classroom connectedness” (pg. 292). The development of this rapport and classroom connectedness invigorates classroom discussion and involvement. Stronger rapport leads to more comfort in communication which increases the likelihood students speak out when confused, challenge the teacher when they disagree, and share ideas with the rest of the class. The same study says, “In other words, while rapport with an instructor and communication satisfaction with interactions with the instructor may be important, the relationships peers build with one another and, presumably, the social support that results from these relationships is critical” (Frisby et. al., 2020, pg. 297). It is from the foundation of rapport that the classroom can reach its full potential through its connectedness and community.

If rapport can be seen as the foundation of community, then respect is the cornerstone of rapport. Respect is not something that is given, it must be acquired. In American society, teachers are not granted innate respect simply by their profession. It must be earned and established by cultivating authentic relationships with one another (Benn, 2018). This means the instructors must make an active effort to get to know their students to earn their respect. I think this starts by the instructor modeling a respectful behavior and showing the students they care about them. You must show them you care before they will bother to listen to you. A quote that I feel summarizes this idea is as follows, “they don’t care how much you know, until they know how much you care”. While this quote’s original author is uncertain, I feel its message is quite the opposite. Its implications in education are spot on. I have been in many classrooms where the

students do not feel respected or appreciated because the teacher did not make an effort to connect with them. This dilemma is especially important when considering the development of rapport with your students. You must make an effort with your students for the entire betterment of the class so they may give you the effort you desire in return. Just as a good coach focuses on striving to connect with their players and develop a strong culture, a teacher should do the same in their classroom.

Maximizing Performance by Minimizing Anxiety

A common dilemma for athletes in sports is trying to succeed while combatting anxiety. Hitting shots in crunch time or scoring points in the clutch is often associated with performing under pressure. It is an idea that many authors have sought to solve and is constantly in conversation. Athletes are consistently trying to perform under pressure. Fear of failure, fear of societal consequences, and worry about not living up to expectations of adults, can all contribute to sport anxiety. This anxiety can restrict motor movements, blood flow, and overall performance (Baker, 2000, pg. 110-111). Many offer solutions of coping with this anxiety to perform optimal in the toughest positions. One such solution could be reframing, suggested in the book, *Crunchtime*. Co-author Rick Peterson, former pitching coach for the Oakland A's during the Moneyball era, has coached numerous Hall of Famers, All Stars, and Cy Young Award Winners (pitching award given to the two best pitchers in Major League Baseball). Fellow co-author Judd Hoekstra is a leadership and human performance expert, sales executive, bestselling author, and speaker. Rick is very familiar with elite athletes and has even worked with Michael Jordan himself. In the book, Judd and Rick describe reframing as way for elite athletes to succeed when it matters most. They defined reframing as “the skill of consciously thinking about a situation in a new or different way to change how you interpret the situation, the actions you take, and the

results you achieve” (Peterson & Hoekstra, 2017 pg.7). This ability allows athletes to shift their perspective from a daunting difficult task to view it as one they have been practicing for years. One of my favorite examples of reframing is the commonly used bridge example. It goes as follows: Let us say you are given two tasks. The first task asks you to walk across a 50-yard bridge. The bridge is as wide as a sidewalk but has no rails and is 5 feet off the ground. Immediately, this task does not seem too difficult. The second task again asks you to walk across that same bridge (width of sidewalk, no guard rails) but this time the bridge is 1,000 feet in the air, and you are to do it with a stadium of people watching you from below. The physical requirements of both tasks are the same, yet one seems far more daunting than the other (Peterson & Hoekstra, 2017, pg. 14). The book uses reframing to make situations like Task 2, seem more like task 1. Both tasks require the exact same physical requirements to walk across the sidewalk. Yet the context of the situation influences your thinking that one scenario is much more difficult. This is a powerful way to shift perspective and view anxiety inducing scenarios in another light. Peterson and Hoekstra even mention in their book that these strategies are not limited to sports but can be used in daily life. Anxiety addressing strategies are common in the sports world. Why not in education? Students perform better when they are not anxious just like athletes perform better when they are not anxious. Instructors need to help our students reframe our perspective in the math classroom. Time in the classroom should be viewed as safe space to answer questions, make mistakes, and grow. Each mistake should be viewed as a learning opportunity, not a disappointment. The instructor should take it upon themselves to help form a safe space for their students, just as a coach would want to help their players stay composed under pressure.

One deterrent from achieving community in the classroom can be an unwelcoming classroom environment. This lack of a safe space can invite student anxiety. Student anxiety in the classroom can greatly hinder a students' chance at success. Xin Ma, assistant professor for the Centre for Research in Applied Measurement and Evaluation at the University of Alberta, conducted a meta-analysis of twenty-six studies on the relationship between anxiety toward mathematics and achievement. The study resulted in a statistically significant correlation between those factors (Ma, 1999). When we allow anxiety to infiltrate the classroom, we are allowing students to struggle. One way to ease student anxiety is to develop a sense of community. This community will provoke a sense of comfort, familiarity, and safety in the classroom. When students are not comfortable in the classroom, there will be different forms of anxiety that reduce engagement and involvement. Dr. Daniel Brahier mentions this idea in his book, *Teaching Secondary and Middle School Mathematics*. He discusses how the mathematics teacher must be successful at establishing a positive classroom environment to encourage participation by all students (Brahier 2020, pg. 38). Establishing a safe space for students to share ideas and be involved will help promote a sense of community. When students feel part of a community, they are more likely to speak out and engage in their learning (Starcher, 2011). Without the comfort and security, students will not want to answer questions or participate in activities. Students may also have anxiety associated with sharing answers in front of the class. In sports they are often supported by fans, friends, and family. They have a community of people cheering them on. In the classroom, students are often only representing themselves. If we can develop a sense of community in the classroom that supports one another, maybe students will not feel alone when they fail or succeed, but supported by the class.

Normalize Failure as Growth

In sports, practice is often a safer space for failure than practice in the classroom. Missing shots or performing sub-optimally is accepted in practice. Coaches understand that they do not need to be perfect in practice, but they need to improve leading up the game. When it comes time to assess their skills against another opponent, that is when the best foot must be put forward. In education, performance is often expected to be optimal even with little practice. Students feel pressures to answer questions right minutes after hearing how to complete a task. Teachers should make an effort to normalize failure as growth, encourage risk taking, and embrace the process of productive struggle. After completing his Ph.D. in algebraic geometry at the University of Washington, Dr. Dan Finkel founded Math for Love, a Seattle-based organization devoted to transforming how math is taught and learned. He mentions in his TED Talk, *The Five Principles of Extraordinary Math Teaching*, that “It’s not uncommon for students to graduate from high school thinking if they don’t know the answer in 30 seconds or less, they aren’t a math person.” (TEDx Talks, 2016, 05:08). This concept is immensely problematic, especially in mathematics education. Perseverance and persistence are foundational characteristics of proficient math students. The very first Standard of Mathematical Practice reads, “Make sense of problems and persevere in solving them” (CCSSI, 2010). Students need to understand that they are not expected to fully understand a concept when it is first introduced, or that they must solve it as fast as possible. Students cannot give up and must be willing to try their best and put in the effort. Student who self-categorize themselves as ‘not math people’ are leaving the door open to quitting before giving themselves a chance.

Another common fear that I have noticed in math classrooms throughout my experiences is the fear of being wrong in math, or even worse knowing you are wrong. This fear has plagued so many math classrooms in my experience. When students are too worried about being right or

wrong, they are missing out on chances to share their ideas with one another and are limiting their learning. This hinders collaboration and the engagement of the class. In sports, this fear is often associated with a lack of confidence. When players are not confident enough in themselves, they are destined for failure. This is where the famous quote, “you miss 100% of the shots you don’t take” applies directly. We need students to feel confident enough in themselves that they are willing to take the shot. Even if they miss, they need to know it will be worth it, and that they are not going to be ridiculed for it. Without taking the shot, the students will never be able to grow from their mistakes, or successes.

Jack Matson, an award-winning professor at the University of Michigan, explored the idea of rewarding failure in his college classroom. He taught an entrepreneurship course where his students were required to fail multiple times before reaching their final goal. He noticed that students had built up a wall to failure from years of error-free learning. He quickly realized the students needed failure to get where they wanted to be. He says, “They found they needed failures to define the boundaries of success” (Matson, 1991, p.84), and “Rewarding failure is, on the face of it, counterintuitive. However, it provides a useful mechanism to spring creative behavior from normally risk adverse students” (p.81). Matson saw the importance of letting students fail and learn from their mistakes. This type of thinking can be applied to mathematics education. Perhaps an instructor can encourage students to explore common mistakes that they make on a problem. They could also encourage students to review work they have done that is incorrect instead of just erasing it. Either way, it is important to note how valuable mistakes can be in the classroom. This idea discerns a notable difference in sport and educational philosophy. In sports, it is often preached to leave failures in the past and look to the next opportunity. Sports are fast paced and often racing against the clock in a game. There is no time to dwell on mistakes

and feel apathic when there are other tasks at hand. Most times these mistakes must be viewed after the play, game, or match is over, unless they occur in practice. Contrarily, in education I think failures are more relevant in the present and provide learning opportunities students can build on now. The classroom is not quite as fast paced as the court and there is valuable time to be spent learning from a mistake as opposed to trying to forget about them.

Another way to help students normalize failure is through productive struggle. Productive struggle refers to the process a student takes to get an answer. This process should be challenging but not out of reach for a student. The idea is rooted in Granberg's (2016) study on mathematics problem solving in secondary school education: the students used prior knowledge in unguided problem solving and use that to create new knowledge. Two instructors used this information to mold their class around the idea. They compared a traditional flipped classroom with one based on productive struggle. In a traditional flipped classroom, instruction occurs out of class (videos to watch at home), while time in class is reserved to actively engage in practice and problem solving. On the other hand, in the productive failure flipped classroom, students explore, discuss, and solve problems related to new concepts in class first, even though they might come across failures, then they use videos at home to support the concepts and associated procedures. The study had the following results, "The research findings show that students from the productive failure condition significantly outperformed their counterparts from the lecture and practice condition in the post test on procedural knowledge, and conceptual understanding and problem-solving skills." (Song & Kapur, 2017, pg. 294). This format gave students opportunities to explore and provide solutions first. If the students make a mistake, or answer the question incorrectly, they then can check their work with the teacher's facilitation or guidance. Overall, it just scratches the surface to show the power of productive struggle. The National Council of

Teachers of Mathematics (NCTM) published an article echoing similar beliefs. Their article focused on the power of productive struggle for deeper understanding. Productive struggle gives students opportunities to develop a deeper understanding of mathematical concepts and relationships instead of memorizing procedures to get answers (Baker, 2020, p.361). This concept not only deepens their learning, but also encourages students to embrace failures and not shy away from the possibility of being wrong. Dr. Finkel (2016) went as far as to say that “Thinking only happens when we have time to struggle” (5:01) and then later “Struggling with a genuine question, students deepen their curiosity and powers of observation. They also develop the ability to take a risk” (6:08). When we feed answers to students without giving them a chance to fully grasp it, we are stealing that sense of discovery and satisfaction that breeds an enjoyment in math. Everyone is familiar with the feeling of something being spoiled, whether it is a movie, a riddle, a joke, a puzzle, or in this case a math problem. As educators we should strive to let our students experience that satisfaction of solving the problem and that ‘aha’ moment. While sports have been used to encourage these ideas, this concept seems somewhat unique to the field of mathematics education.

Help Your Team Succeed

This investigation of existing research has only enhanced my drive to connect sports and mathematics education. Several lessons can be drawn from the field of sports and their applications of establishing community. Several of the sources emphasized that building a community and establishing classroom connectedness is a necessity in a successful classroom. Frisby (2020) said, “Practically, this research provides a stronger rationale for why instructors should strive to build positive classroom climate and community in their courses” (pg. 299). Frisby went on to state that this community should be achieved in every classroom regardless of

content, “In an era of declining resilience and alarming levels of student dropouts (e.g., Gray, 2015), building classroom connectedness may be a pedagogical tool that all instructors should employ for the success of their students.” (Frisby, 2020, pg. 300). Homrich-Knieling (2019) suggests, “We need to reject the notion of building relationships as an item we can check off our beginning-of-the-year to-do list and instead ask ourselves how to meaningfully center relationships in our classrooms, in our pedagogy, and in our practices, not as a classroom management technique but as a way to foster empathetic, democratic, and supportive community” (pg. 58). This analysis is intended to share a differing perspective on the way we approach successful classrooms and perhaps to borrow ideas from a field that seems to achieve community more often. Warner describes the success sports have in establishing community in their findings, “This research is a step towards better understanding the participants’ experience, and how sport can serve as a tool to enhance a sense of community among individuals” (Warner et. al., 2012 pg. 1000). Sports and education are indefinitely their own respective fields and not all ideas are transferrable. In fact, it is their different perspectives that offer valuable insight on ideas in ways perhaps not previously explored. As a large portion of our students will have experienced sport in some way, this may offer a new way to establish community with our students by building rapport, minimizing anxiety, and normalizing failure.

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