

Abstract

This article synthesizes the peer-reviewed literature about injury prevalence in Brazilian Jiu-Jitsu (BJJ) and strategies to mitigate injuries. It is critical to implement injury prevention initiatives necessary to reduce injury rates among BJJ students since injuries are barriers to continued training and learning. A reduction in injuries may ultimately lead to improved intrinsic and extrinsic benefits and increased student longevity. This literature review analyzes BJJ's history and its significance to combat sports and as a fighting system, along with how it shapes the lives of those who study BJJ. In addition, injury prevalence in BJJ and types of injuries are discussed in detail, including risk reduction and mitigation strategies, whether curriculum might play a role in reducing risk and a possible nexus between how adult students learn, how instructors teach, and student injuries.

Injury Prevalence in Brazilian Jiu-Jitsu and Mitigation Strategies for Brazilian Jiu-Jitsu

Practitioners and Instructors: A Literature Review

Overview

The purpose of this literature review is to share knowledge collected from the literature with the Brazilian Jiu-Jitsu (BJJ) community concerning the problem of injuries and possible mitigation strategies. BJJ practitioners sustain injuries while training and this literature review aims to analyze the literature related to injury prevalence and mitigation strategies. This literature review will discuss BJJ's history and its significance to combat sports and as a fighting system, along with how it shapes the lives of those who study BJJ. In addition, injury prevalence in BJJ and types of injuries are examined in detail, including risk reduction and mitigation strategies, whether curriculum might play a role in reducing risk and a possible nexus between how students learn, how instructors teach, and student injuries

Narrative Review

Historical Perspective

BJJ is a popular combat sport and efficient martial arts system because of its practical use of techniques and conservative energy use. It focuses on a ground fighting system that incorporates various takedowns, chokes, and joint locks. Essentially, BJJ is the offspring of Japanese Jiu-Jitsu, a combat style designed to take an opponent to the ground and dominate them using leverage, tension, and pressure. According to Pedreira (2014), the Brazilian government knew about Jiu-Jitsu as early as before the Russo-Japanese War of 1904-1905. Brazilian officials discovered that Japan's military leaders championed Jiu-Jitsu as a manner of physical training, as a recruitment aid, and as a means to keep soldiers and state police productive when not performing their duties.

According to Helio Gracie (2020), Jiu-Jitsu roots date back 2500 years in the Indian mountains. These roots stretched from China, finally settling in Japan approximately 400 years ago, where Jiu-Jitsu masters developed the fighting system widely practiced today. Mitsuyo Maeda, a Japanese Judo master, and prizefighter would later commercially introduce Jiu-Jitsu to Brazil in the early 20th century.

At the turn of the 19th century, George Gracie left Scotland and settled in Brazil (H. Gracie, 2020). He aimed to find adventure and opportunity, not knowing that one day his descendants would claim historical significance as developing one of the most effective ground fighting systems the martial arts community has ever seen. Two of these descendants, Carlos and Helio Gracie, are today's faces in BJJ. However, according to Drysdale (2020), it was when Maeda met Carlos Gracie in 1916, BJJ was born.

Helio Gracie (2020) attests that Maeda came to Brazil to settle a Japanese immigration colony in northern Brazil. He also competed in no-rules fights, endeavoring to demonstrate the effectiveness of Jiu-Jitsu as a fighting system (Drysdale, 2020). During this time, Carlos and Helio Gracie's father met Maeda and eventually helped Maeda establish a colony for his countrymen. As thanks, Maeda agreed to teach 14-year-old Carlos Gracie the fundamentals of Japanese Jiu-Jitsu. According to Helio Gracie (2020), Carlos Gracie became enamored with Japanese Jiu-Jitsu and immersed himself in the martial art.

Five years later, Carlos Gracie moved to Rio de Janeiro, where he taught local law enforcement officials until 1925 when he moved to the outskirts of Rio de Janeiro to open his first public BJJ school. He essentially taught the same philosophies and concepts Maeda taught him that profoundly impacted his life (Gracie Barra Brazilian Jiu-Jitsu, n.d.). Carlos Gracie shared his knowledge with Helio Gracie, who eventually opened his schools throughout Brazil

(Gracie, R., & Maguire, 2021). Rickson Gracie and Maguire (2021) suggest that Carlos Gracie is credited for advancing BJJ as a sport in the BJJ community, while Helio Gracie is credited for promoting its self-defense application.

Today, Carlos Gracie's life work is memorialized in the Gracie Barra culture and curriculum, taught in over 800 schools across six continents. Like all the other Gracie Barra schools, most BJJ schools follow a standardized curriculum to train philosophies and concepts through structured tiers. Each training tier is a foundation of the next tier, which teaches advanced judo-style takedowns and ground fighting concepts and techniques. Notably, even when trained under careful supervision, BJJ techniques are quick and violent movements that can cause injury.

Significance of BJJ On and Off the Mats

According to Li and Nabors (2020), BJJ has emerged from an obscure regional sport into extremely commercialized global events. In large part, BJJ's significance is the role it has played in the globalization of martial arts and combat sports through big-ticket events like the Ultimate Fight Championship (UFC) and Bellator MMA. These types of events underscore the importance of BJJ to an athlete's toolkit once the fight is on the ground. BJJ focuses on takedowns, chokes, and joint locks, but its specialty is ground fighting (Williams et al., 2019). Furthermore, Williams et al., (2019) assert with open tournaments worldwide, BJJ has attracted and opened the door for everyday practitioners to compete in front of fans while piquing new interest in the art.

Most fighting systems, to some degree, rely on strength to overcome an opponent. However, BJJ's significance lies with its efficient use of techniques and economical use of energy (Williams et al., 2019). Furthermore, Williams et al. (2019) state that BJJ allows practitioners to apply a number of different takedowns, pins, joint locks, and choke techniques

that rely on leverage and body positioning to overwhelm their opponent and walk away with a victorious outcome.

Equally significant is how BJJ teaches students lessons applicable outside of self-defense, competition, and fighting. Chinkov and Holt (2016) examined BJJ as a vehicle for life skills acquisition, and their research conclusion showed that participants believed their lives changed because of BJJ. According to Chinkov's and Holt's (2016) data, notable changes among participants included respect for others, perseverance, self-confidence, and healthy habits, which, among other things, promoted physical health improvements and reduced physical injuries.

Finally, perhaps BJJ's central significance is its facilitation of social identity and personal connection. Rodrigues et al. (2019) investigated how a BJJ school's peer interaction structure was possibly correlated with group classification within that setting and aimed to predict its attachment to school activities. According to their findings, Rodrigues et al. (2019) concluded that the BJJ students in their study who were in the middle of their peer network proclaimed stronger opinions of social identity and personal connections and were more likely than not to persist in their BJJ training and education. The findings demonstrate how formative centrality between peers might compare to ideas about the group and member behavior (Rodrigues et al., 2019). Worth noting from the aforementioned is the need to reinforce BJJ students' peer integration within their schools.

Injury Prevalence in BJJ

There are 1522 registered BJJ academies worldwide (*2021 Registered Academies*, n.d.) and 6006 certified black belts (*Certified Black Belts*, n.d.). Renner Gracie, head instructor at Gracie University, asserts that 10% of students will earn their blue belts, and only 1% of all students will progress through the rank system and earn their black belt (MMA Guru, 2021).

There are approximately 6,006,000 white belts in BJJ schools globally; however, it is challenging to triangulate a solid number of actual students because of low retention rates.

BJJ is not only a martial art but also a combat sport, and research is abundant in sports injury prevalence and incidences, physiological and psychological factors, energy consumption, and athlete profiles. According to McDonald et al. (2017), BJJ practitioners are likely to experience distal and proximal injuries to their upper and lower extremities when training. For example, one research on injury prevalence concluded that nine out of ten BJJ students suffered injuries while training (Petrisor et al., 2019). The research included a survey of 70 BJJ students, and 91% of the respondents claimed to have sustained injuries to their fingers, upper extremities, and neck. Simply put, injury prevalence among BJJ students appears relatively high.

Yet, despite the high probability of injury, BJJ remains extremely popular. As previously mentioned, BJJ's popularity has aligned with the popularity of combat sporting events because of its effectiveness when competitors find themselves fighting on the ground. As a result, BJJ schools have benefited from this popularity, seeing an increase in globalization and commercialization (Mataruna-Dos-Santos et al., 2020). Therefore, understanding injury prevalence could be critical to BJJ instructors if they want to learn how pervasive injuries are, if at all, in their programs.

Types of BJJ Injuries

According to Petrisor et al. (2019), students decide whether or not to quit BJJ based on injury types, characteristics, and severity. Their epidemiological study of BJJ training injuries indicated high incidences of sprains and strains to the upper and lower extremities and the neck. This study is consistent with McDonald et al.'s (2017) and Silva Júnior et al.'s (2018) research

on injury prevalence in BJJ, which concluded that students were likely to sustain injuries to their distal extremities.

Although the three studies were relatively similar in approach, using an epidemiological study design, and reported comparatively the same limitation (respondent sampling), the variance between the Petrisor et al. (2019) versus McDonald et al.'s (2017) and Silva Júnior et al.'s (2018) studies lies in injury types and characteristics (Petrisor et al., 2019) versus injury pervasiveness McDonald et al.'s (2017) and (Silva Júnior et al., 2018). Thus, even though each work separately exhibits research rigor and their conclusions supported by evidence, these studies combined appear to paint a more holistic picture of BJJ injuries that might be useful for the leadership at BJJ schools to develop an injury prevention framework.

Types of injuries students sustain while studying BJJ affect their ability to learn and practice continually. According to the literature, BJJ students report two types of injuries - self-reported and medically diagnosed (Koutures & Demorest, 2018; Lemoyne et al., 2017; McDonald et al., 2017; Moriarty et al., 2019; Petrisor et al., 2019; Silva Júnior et al., 2018). Self-reported injuries related to grappling and submissions, like BJJ, typically range from minor rashes to moderate joint pain. However, the more severe injuries include concussions, head injuries, and joint dislocations.

Silva Júnior et al. (2018) affirm that students with light injuries typically lose no training time, light to moderate injuries lose a day or two, moderate injuries lose two weeks, moderate to severe injuries lose two to four weeks. In addition, students who sustain severe injuries will lose more than four weeks of training time or, according to Petrisor et al. (2019), will quit training altogether. Consequently, it might be necessary for the leadership at BJJ schools to understand the relationship between injuries and recovery time. Doing so could help them mitigate injuries

and avoid negative consequences associated with injured students, such as learning barriers and student retention issues, for example.

Mitigating Injuries

Coaches, across all sports, try to implement different injury mitigation strategies among their programs. After all, injuries are bad for business, so to speak. For example, non-scholarship student-athletes with a significant enough injury might quit their team and suspend their tuition or quit their school and sport altogether. In BJJ, new students are likely more prone to sustain an injury because instructors sometimes overestimate a student's ability to learn specific techniques to protect themselves (Moriarty et al., 2019). In the same vein, instructors can underestimate a student's ground fighting education, potentially exposing lesser trained students to injury. Spano et al. (2019) claim that although BJJ research is scarce, its uniqueness drives the research in the area. Most BJJ studies appear to be related to or associated with physiology and injuries among practitioners.

There are different components to injury mitigation and students play a vital role in reducing the risk of injury. To illustrate, Chinkov and Holt (2016) suggest a correlation between students who learn and practice healthy habits through BJJ and success on and off the mats. They submit that students who acquire healthy habits, which include things like being proactive in their BJJ training and proper nutrition, are mentally and physically healthier and better prepared to meet the physiological and physical challenges of BJJ. As reported by Malm et al. (2019), there is a direct relationship between living a healthy lifestyle and reducing the risk of physical injury and mental illness.

Coaches and instructors play an equally important role in mitigating injuries. Specifically, a coach's or instructor's conversance and perspective concerning injury mitigation

and prevention, along with their ability to allocate resources and support, are critical to adopting risk reduction policies, procedures, and programs (Talpey & Siesmaa, 2017). There is a high expectation of injury among athletes or others who train in sport, self-defense, or competition.

However, when those charged with coaching or teaching take a strategic approach to addressing potential risks, they may have a greater chance of mitigating injuries. These strategies often include reviewing, analyzing, and synthesizing training quality, training strategy, functional fitness, low-intensity training, and sports psychology (Butler, 2020; Emery & Pasanen, 2019; Mekhdieva & Zakharova, 2017; Neelis et al., 2020; Schmit et al., 2018). Accordingly, the literature and the relevant data could be helpful to the leadership at BJJ schools if their aim is to promote a reduction in student injuries at their schools.

Training Quality

There is much research on the relationship between training quality and injury mitigation. In particular, Gabbett (2016) suggests interconnectivity between training load, injury, fitness, and performance, all key elements in sports medicine/physiotherapy and sport science research. In BJJ, training is often high-intensity and, depending on training partners, can also be high-load. Although BJJ's fundamental philosophy is to use technique over strength, framing against heavier opponents to reduce pressure, so one can breathe requires strength and energy exertion.

Understanding that training by or in itself is not the problem but rather improper training methods or poor training quality can help BJJ instructors, and their students mitigate the risk of injury. As stated in Gabbett's (2016) thesis, a training-injury prevention paradox exists and there appears to be a link between extreme and unreasonably accelerated advances in training loads and non-contact, soft-tissue injuries. Conversely, physically demanding yet proper specific training in terms of load, intensity, and quality protects against injuries.

Specific physical training plays a critical role in making a determining contribution to an athlete's training quality (Satyanarayana et al., 2020). BJJ instructors distill training into two separate parts. The first is specific training in which students drill specific concepts repetitively and the second is “rolling,” which applies learned concepts and techniques through sparring between two opponents (Gracie Barra, 2015). When approached holistically, coaches and instructors can influence injury mitigation and increase prevention awareness among their athletes and students by promoting training quality and specificity over rushed and inappropriate training methodologies.

Strategic Approach to Training

Analyzing training needs, identifying skill gaps, prioritization, and training preparation and delivery are all critical components in a strategic approach to training. In sport, researchers examine case-control, cohort, and comparative effectiveness studies and quasi-experimental designs to investigate injury mitigation strategies (Emery & Pasanen, 2019). The leadership at BJJ schools and their students might find utility in taking a strategic approach to training by thinking about the previously mentioned components and integrating these components into a personal training plan for the individual student or even a curriculum change for classes as a whole.

The leadership at BJJ schools can also review the literature to support any strategic training initiatives they want to implement for their schools. In consonance with Lemoyne et al. (2017), university-level coaches and athletic directors use data collection to understand injury prevalence, patterns, and risk factors, so they might take a strategic training approach to better protect their athletes from injury. They do this because they embrace the idea that training smart is critical to a successful program.

One area the sports training literature seems to discuss frequently is being mindful of training loads and overtraining. A comprehensive periodization strategy, defined as the systematic planning of athletic or physical training, is effective in managing an athlete's training load while combining movements to reduce the effect of learning multiple skills while mitigating the propensity of overtraining, which will frequently lead to injury (James, 2014). From a BJJ practitioner's and instructor's perspective analyzing their training load to manage the likelihood of overtraining can be the basis of an evidence-based and strategic approach to BJJ training.

Perhaps another strategic approach to BJJ training is to rely solely on BJJ-type movements without students supplementing their training with other forms of exercise. According to Ovretveit's (2018) experimental approach to studying BJJ practitioners' anthropometric and physiological characteristics, athletes who included extra strength and conditioning training to increase aerobic and anaerobic quality produced the same results as athletes who exclusively trained BJJ. Reasonably, functional training in lieu of supplementary training might be an avenue worth exploring as a viable training strategy that decreases injury potential.

BJJ and Functional Fitness Utility

BJJ requires explosive and unconventional movements that require the use of a wide range of muscle groups. In this context, there is a strong argument that BJJ in and of itself is functional fitness by definition and requires little to no supplemental training. One utility of functional fitness in BJJ is that it offers agile and versatile exercise modalities that aim to employ practical, multi-joint actions designed to evoke greater muscle engagement (Feito et al., 2018). For example, when BJJ practitioners drill specific techniques or spar with each other, they use large muscle groups to push and pull each other into positions of advantage. According to

Dexheimer (2019), these compound movements engage large muscle groups that put an athlete in a state of “High-Intensity Functional Training.”

Another utility of functional fitness is in its rehabilitative potentialities. As an illustration, isokinetic tests used to measure muscle imbalances and the functional use of antagonistic muscles can serve as an avenue for rehabilitation (Andreato et al., 2017). Likewise, in discussing physiotherapy, Bergfeld et al. (2019) attest that diagnosis, overload indications, cause-effect chain, core strength, and communication between patients and rehabilitators are key elements in an athlete's recovery. Relevantly, injured BJJ students attempting to return to training after an injury, or instructors who strive to get their students back on the mats because of an injury, might find functional training concepts and their application to recovery beneficial.

According to Bergfeld et al. (2019), medical professionals charged with rehabilitating an injured athlete should first define a physiotherapy protocol appropriate for the injury type while monitoring indications of progressive overtraining. Physical therapists should then pay close attention to the patient's reactions and how the rest of their body compensates for the injured body part. Next is for patients and physical therapists to focus on core stability and functional training as these are proven pathways to recovery. Finally, continuous communication between the patient and the entire care team, including coaches, is vital to rehabilitation because it facilitates information sharing and ensures care compliance.

Flowing (Low-Intensity Training) Versus Imposing (High-Intensity Training)

There is much debate on high versus low-intensity training related to athletes learning a specific skill or as a means of injury prevention or a rehabilitation modality. For example, research on the health benefits of physical activity and sports shows that although high-intensity training is an effective aerobic exercise, it does not prevent the loss of functional units of muscle

contraction (Malm et al., 2019). On the other hand, Ramez et al.'s (2020) study on cardiovascular disease concluded that high-intensity training causes an increase in plasma and myocardial levels, contributing to the reduction of tissue damage when blood supply goes back to tissue after oxygen loss. In simple terms, both studies show the value, utility, and benefits of high-intensity training; however, it is not without its limitations.

The literature suggests that low-intensity training might be safer for a broader population to promote health because its movements aim for an output of approximately half of high-intensity exercise in terms of exertion. For instance, Figueroa et al.'s (2018) review on the effects of different resistant training intensities on arterial stiffness and blood pressure showed that low-intensity resistant training significantly increases the ease of blood flow through circulation at a given pressure variance. Meaning, low-intensity resistant training potentially decreases arterial issues by reducing the narrowing of blood vessels through the nervous system that regulates heart rate, blood vessel constriction, and blood pressure. Likewise, low-intensity training with progressive increases in workload and exercise variation leads to enhanced training adaptations and lower injury rates (Kyröläinen et al., 2018). This part of the literature might be applicable to the leadership at BJJ schools and their students because it shows the potential benefit of low-intensity training in a high-intensity sport.

BJJ is a form of physical chess in which combatants employ moves and countermoves, guile, and deception. As previously mentioned, in BJJ, students apply the concepts and techniques they learn by rolling with an opponent. Rolling is a (typically) five-minute, high-intensity, and dynamic sparring session between two practitioners or practitioner versus instructor. However, there also exists another form of rolling that is low-intensity and less vigorous, called flowing. Pope (2019) stated that flowing allows BJJ practitioners to execute

their strategy against an opponent, going through various scenarios, escapes, counters, and attempted submissions safely and methodically. Flowing might also produce an enhanced training experience and greater training quality in which physical activity is critical to learning and development (Kohoutkova et al., 2018). Low-intensity training, such as flowing, is an essential problem-solving vehicle that also allows students to control the emotional and psychological aspects of the sport.

Psychology and Mood

Psychological well-being and mood are critical components of holistic injury mitigation. Mental and emotional status are key markers in an athlete's general health, and trainers, coaches, and instructors should observe their athletes/students for transformations in psychological and social characteristics (Piedade et al., 2019). The aforementioned is especially true for elite competitors because they perform under high physical and psychological pressure due to their competition level, potential earnings, and greater ramifications should they become injured.

As an illustration, Malm et al. (2019) assert that professional athletes and high levels of competition can lead to physical damage, overtraining, progressive psychological stress, and decreased motivation to train. Consequently, BJJ teachers and learners must understand the importance of the psychological aspect in any injury mitigation initiative and how the mental part of the sport plays a vital role in risk reduction and prevention. Doing so might promote learning through confidence that instructors have a student's psychological and physical well-being in mind when teaching.

Like psychological well-being, mood and mood states play an influential role in an athlete's overall general health. In fact, according to Brandt et al. (2017), sports psychologists and sports researchers consider mood states as one of the essential sports performance and pre-

competition predictive determinants. They believe certain mood states enhance athletic performance before and during competition through thought, feeling, and behavior management. Similarly, in BJJ, mood states affect an athlete's training and competitive spirit.

For example, Andrade et al. (2019) attempted to verify mood state changes among BJJ athletes in training and competition. Using questionnaires that characterized participants and employing the Brunel Mood Scale, a scale of 24 mood descriptors using a standard response timeframe (Parsons-Smith et al., 2017). To measure two pre-competition points, post-weighing and post-competition benchmarks, they concluded BJJ athletes exhibited high levels of toughness against depression, anger, fatigue, and confusion. There is a direct relationship between mental health physical injury (Reardon et al., 2019), and the leadership at BJJ schools and their adult students might find the literature in this area helpful in mitigating injury in training and competition.

BJJ Students

Rickson Gracie, one of the most famous Jiu-Jitsu practitioners in modern history, submits that today's BJJ students and teachers seem to distance themselves from BJJ's core of teaching the fundamentals and that BJJ schools should employ a comprehensive curriculum to close that distance (Young, 2018). BJJ schools and academies are similar to traditional educational institutions. For example, both have a student population, set schedules for learning, the ability to get extra help/tutoring, and the opportunity to interact with social and academic systems. However, unlike traditional learning environments, it is more common than not for BJJ schools to teach random techniques because they lack a standardized curriculum (*Gracie University*, n.d.). Schools, whether traditional or alternative that use a standardized curriculum ensure student success.

According to Dhanapala (2021), curriculum is a field of study which identifies important disciplines in “teaching, learning, and assessment.” In education, teachers use their school’s curriculum as a guide to achieving learning goals and student development and as a way to support learning. Adults seem to consume information better when teaching follows a plan of instruction and is not randomized (Knowles, 1988). Therefore, curriculum is especially important in adult learning and curriculum designers should understand adult learning theories when constructing effective adult education curricula that could influence education policy.

Although no hard data exists that captures the number of adult BJJ students in the United States, the International Brazilian Jiu-Jitsu Federation (IBJJF) shows 33139 nationally ranked adult competitors (*2020-2021 Ranking: IBJJF*, 2021) among 1522 registered BJJ academies worldwide (*2021 Registered Academies*, n.d.). These competitors hold ranks from white belt to black belt across different age categories, amateur and professional. Reasonably, based on the IBJJF sample, it might be safe to logically conclude that BJJ schools/academies in the United States have many adult students enrolled. The leadership at BJJ schools might find utility in the IBJJF data and learning literature. They can analyze and synthesize different learning models, while addressing potential curriculum gaps to enhance their adult training programs and possibly identify a pathway to reduce injuries.

The Role of Curricula, Theory Application, and Feedback in Adult Learning

As educational spaces evolve, so should curricula, and the avenue for this evolution is through learning trajectory processes. Wijngaards-de Meij and Merx (2018) conceptualize a learning trajectory as a logical arrangement of teaching and learning that works harmoniously across various subject areas to achieve educational goals. Therefore, identifying educational objectives and analyzing student learning trajectories is the basis of sound curriculum

development or improvement. For example, in the BJJ space, instructors must present essential concepts like pressure, fulcrums and leverage, framing, timing, tactics, control, and breathing in a comprehensive format that adheres to a logical instruction flow (Young, 2018). In other words, when teaching BJJ, having a curriculum is essential.

The primary objectives of a curriculum are to advance student learning, ameliorate their educational experience, identify appropriate syllabi, improve learning outcomes through effective teaching, and evaluate those outcomes (Dhanapala, 2021). In sports, curriculum sometimes translates to the industry-specific verbiage “training plan” or “training strategy.” Coaches and trainers follow a specific curriculum or training plan or strategy for their teams or individual athletes to achieve particular goals, such as improving team performance or reducing an athlete's risk of injury. For example, according to Emery and Pasanen (2019), training strategies target elastic athlete-centric risk factors through strategic training interventions. Moreover, the literature on epidemiological studies of injury prevention efficacy supports the implementation of evidence-based training strategies.

A curriculum, or training plan, is an effective way for BJJ instructors to meet student needs and achieve learning objectives. For the leadership at BJJ schools, addressing how to reduce adult injury rates through curriculum development or improvement might include reviewing, analyzing, and synthesizing several relevant areas. These areas include adult education theories, learning approaches, curriculum frameworks, curriculum development and improvement in sports, curriculum alignment, and learning through feedback.

Theory to Application in Adult Education

Whether in a traditional or a non-traditional learning environment, teaching adults requires that a teacher's actions and learning conditions support, enhance, and promote adult

education. Knowles (1988) theorized that pedagogy and andragogy are fundamentally different in terms of learning concepts, the role of the learner's experience, readiness to learn, and orientation to learning. Learning BJJ is not just about gaining fighting or self-defense knowledge. In fact, the literature discusses the many complexities of BJJ and its learning takeaways. For example, Kotarska et al. (2019) conducted a qualitative and quantitative study on the health behaviors of combat sports participants. They concluded that learning arts like Judo and Jiu-Jitsu positively shaped the lives of their practitioners. In another example, Chinkov's and Holt's (2016) study on implicitly transferring lessons learned from BJJ to everyday life showed that practitioners' lives positively changed in several areas.

The aforementioned examples are important to this section because it underscores the difference between pedagogy and andragogy. According to Mansfield and Stacy (2016), the teacher is the expert in a pedagogical environment, and therefore shaping a child through education is more manageable. However, they also say that in andragogical learning, teachers must use their expertise along with student knowledge and prior experiences to interface with established curricula. Therefore, managing learning with adult students might not be as straightforward as compared to managing it with children.

John Dewey, an educator, philosopher, psychologist, and reformist, and Eduard Lindeman, an educator and philosopher, influenced North American adult education theory (Gouthro, 2018). Today there is an assortment of adult education theories that shape the understanding of how adults consume information and learn, advancing curricular design strategies for adult educators to leverage. For example, Ashall (2018) asserts that theory can help build sound teaching practices that support various research educators conduct in their respective fields. Contemporaneously, adult education theories continue to evolve as today's technological

advances, and societal challenges drive this evolution. As an illustration, adult educators who teach distance learning through platforms like Canvas and employ applications Zoom or Microsoft Teams for student collaboration or integration likely practice a distinct set of teaching methods and follow different curricula as they would in a traditional classroom environment.

In discussing curriculum design, Wang (2017) affirmed the utility of modern education theories for adult learners. Specifically, curriculum designers should analyze and understand adult learning characteristics, learning ability, and student motivation because these components are the basis of modern adult education theories. As previously discussed, in adult education, a student's knowledge and prior experiences are part of the learning process and work in tandem with the course curriculum. According to Gardner (2011), a person's intelligence varies, with each intelligence component independent of one another. It is likely for this reason that including an adult student's knowledge and prior experience in adult education is a critical component to their learning.

Adult education development theories have improved, aligning with the times (Wang, 2017). However, the research shows that problems exist in adult education curriculum development, institutions of higher learning, and other spaces that teach adults. Therefore, administrators of adult education should promote an efficient instructional methodology that addresses the real needs of adult students. Moreover, the curriculum should enhance the adult education instructional quality and advance adult learning growth.

Adult Students and Learning Components

As mentioned earlier, conditions that support actions and learning promote adult education irrespective of the learning environment. The avenues for success in adult education have many turns, and how adult educators and students approach learning has just as many

components. One such component is student persistence. According to Tinto (1975), lack of integration in the academic and social domains leads to low commitment and increases the likelihood of student departure. As adult students do not fall under any compulsory education statute, they have the option to stay or leave any school as they see fit. For those who choose to quench their thirst for knowledge, they will face many challenges, such as academic and social integration, which according to the literature, can affect their ability or desire to remain in school or continue learning. However, Tinto (2015) suggests that acknowledging such challenges exist and having a plan to overcome them, which includes goal setting, motivation, and persistence strategies, is one way to achieve success.

Another learning approach component in adult education is engaging the non-traditional student. According to Holton (2017), non-traditional students are 25 years or older. Their significance in the education space drives school leaders and policymakers to develop and deploy strategies and policies that meet their needs. One way to meet their needs is through engagement. Active student involvement or engagement is a reliable way to forecast learning gains (Tinto, 1997). For example, educational institutions that champion learning communities on campus appear to keep students engaged. In fact, Wyatt (2011) asserts that institutions should develop learning communities at the institution, program area, and classroom levels. Student engagement is critical to the learning process because it reduces the potential of student departure while promoting a sense of institutional belonging and personal investment.

Promoting active learning is perhaps the most critical component in adult education. Active learning is any teaching methodology, apart from a lecture, that includes students in the learning process and stresses the teacher's part in the classroom (Hyun et al., 2017; Prince, 2004). In addition, learning space is an essential part of active learning because spaces conducive

to learning promote student participation. For example, some BJJ schools have open mat sessions allowing students to train freely and roll with other practitioners. However, according to de Queiroz et al. (2016), some schools lack adequate supervision or foster an environment that promotes bullying the lesser skilled. Furthermore, a motivating environment encourages consistent training, health improvement, and persistence. Instructors who support a contributory learning space encourage an active learning environment.

Curriculum Framework

A curriculum is at the center of all learning. Widely accepted as a sequence of learning activities, curriculum endeavors to achieve learning outcome goals for individual subjects. Dhanapala (2021) stated that a curriculum's primary objectives are to enhance learning outcomes by enriching the student learning experience and improving outcome goals by promoting teaching excellence and proper syllabi and appraising results.

Curriculum designers acknowledge the importance of developing a framework as a broader cornerstone of a functional syllabus. Of the many curriculum frameworks discussed in the literature, Dhanapala's (2021) "Triangular Framework for Curriculum Development" appears to align nicely with constructing a BJJ curriculum. Teaching, learning, and assessment are the basis of the framework just mentioned, with the syllabus as the main component for each of the three areas that should work harmoniously together. As a matter of fact, Radmehr and Drake (2018) suggest that teaching intersects with learning, assessment, and content. In addition, Bloom's Taxonomy aligns with the fundamental tenets of adult education because it is agile enough for application in a variety of content types, themes, and subjects (Williams, 2017). The leadership at BJJ schools might find this part of the literature especially helpful when considering the development or improving a current training curriculum.

The “Learning Environment, Learning Processes, and Learning Outcomes” (LEPO) framework is another one BJJ curriculum designers might find useful. As a process of employing teaching as an activity, LEPO reworks learning and suggests that most learning happens outside structured lectures (Wong et al., 2021; Phillips et al., 2019). This curriculum framework supports active learning concepts and methodologies because it fundamentally operates under the same presupposition: learning occurs outside of lectures. For the BJJ student, a bulk of their learning occurs on the mats, and they too might find utility in the LEPO framework.

According to Phillips et al. (2010), LEPO has three critical learning components: an environment that facilitates learning; learning activities; and knowledge, behavior, skills, understanding of lessons learned. The LEPO framework and its components are valuable to both teacher and learner because they detail the interconnectedness of students with their learning environment, processes, and outcomes. Part of outcomes includes assessment and evaluation. This data might prove valuable to curriculum experts aiming to reform certain aspects of curricula to enhance student experiences and achieve educational goals.

Sports and Curriculum

The literature is consistent in curricula's role in learning. Typically, a curriculum is associated with traditional classroom learning; however, the literature shows it is portable across different learning environments. For example, as previously discussed, sports coaches and trainers use training plans or strategies to achieve team or individual goals, akin to classroom teachers using their curriculum to achieve the same goals. Language aside, a sports coach and teacher aims to facilitate an environment so their athletes or students can learn while enhancing the athlete or student experience and championing their achievement. To illustrate, Hong and Coffee (2017) conceptualized developing and evaluating a psycho-educational curriculum in

sports. They hypothesized that four competencies (transition management, skill transfer, social support, and career planning are these four competencies) exist in a sports curriculum.

According to Reardon et al. (2019), there is a mental and physical health axis. Moreover, they are inseparable, as evidenced in the medical literature, which shows mental health indications increase the likelihood of physical injury and delayed rehabilitation. In sports, rest is one of the most critical components of success and sleep is the single best promoter of rest. Lack of sleep impacts physical and mental performance and mental health (Charest & Grandner, 2020). This information is relevant to curricula's role in sports because, as Reardon et al. (2020) suggests, encouraging healthy sleep and scheduling training around sleep underscores the importance of rest and encourages it to be part of the overall training plan.

Training systems should incorporate a plan designed to avoid mental and physical overload (de Moraes et al., 2019). Coaches and trainers acknowledge that athletes who are not mentally and physically stressed think creatively and critically in training and competition (Molly & Weight, 2019, p. 25). At the same time, they challenge their athletes to understand and incorporate the underlying physical and mental science, diet, leadership, and communication components of sports. These things are all synergistic components of an overall training system.

Molly and Weight (2019, p. 18) submit that athletics can pair nicely with structured curricula and classroom instruction that includes a sports participation lab. They say doing so promotes a collaborative approach to experiential learning. This part of the literature fits well with BJJ schools that promote a curriculum as part of learning. Specifically, it shows the alignment between the literature discussion and the current practice of curriculum-based teaching (i.e., teaching from a structured curriculum in an instructor-led platform then applying lessons learned under supervision).

Aligning Curriculum

The research on curricula's importance is abundant, and few, if any, oppose the essentialness of a curriculum in an educational space. However, there still needs to be synergy between curricula and learning. For example, Wijngaards-de Meij and Merx (2018) opine that an asymmetrical curriculum design, together with students' inability to recognize the benefit of a curriculum, negatively affects education. In other words, there is a solid correlation between curriculum alignment and student achievement.

Curriculum alignment is a continuous process for educators to understand student growth and development better. It provides data showing that students consume information through observation and assessment strategies at current development levels (Ali, 2018). Furthermore, it analyzes a student's interests and needs, enabling educators to create or modify learning objectives.

For instructors who teach adult students, the literature is evident on the importance of curriculum alignment in adult education. For instance, according to Sanger and Pavlova (2016), alignment along with the content's relevancy to life and experience, its emotional connection to the learner, and self-directed learning are all part of the principles of andragogy when discussing curricula. Another supporting argument on the value of aligning curriculum is that it adds to curriculum conversation efficacy (Shaltry, 2020). So often, staff discussing curriculum overlaps and gaps limit themselves to broad topics.

Curriculum alignment allows for commonality, frequency, and depth between conversing staff. For example, instructors at the BJJ schools collaborate to enhance their school's current training curriculum to address a topic, say injuries, as well as content and message delivery. When addressing topics related to curriculum alignment, like curriculum transparency or

assessments, for example, it is critical to discuss the traps and best approaches of introducing new learning materials and methodologies.

Wijngaards-de Meij and Merx (2018) contend that transparency encourages thinking and potentially enhances student learning processes. They also assert that program-level congruency between teaching, learning, and assessment is vital to quality teaching. Therefore, a staff meeting on curriculum alignment discussing curriculum transparency or assessments should consider the boon and bane of including and implementing fresh teaching content and ways of delivery.

Feedback and Learning

Arguably, feedback is one of the most vital parts of any educational setting. Above all, it is probably more important when it comes to teaching adult students. Effective feedback represents a significant role in assisting adult students to reach their highest potential and achieve their learning goals (Brown et al., 2016). Feedback can also help with self-confidence, self-awareness, and eagerness to learn. For example, self-confidence might encourage students to take risks and express themselves more in the classroom. Furthermore, students with self-awareness might have better perspicacity into who they are as students, their response mechanism, and a pathway for self-improvement. Finally, feedback can promote a student's eagerness to learn, the opportunity to gain knowledge, and to develop new skills.

Few areas are in agreement with each other than goal-setting and feedback. According to Sandford et al. (2020), productive feedback drives the achievement of personal goals. Thus, feedback can show progress even though sometimes students might not be aware that they are making progress. Although the sports literature indicates more research is needed, athletes who continuously receive feedback, whether from their coach or other stimuli, appear to develop their skills sets at a much faster rate than those athletes who receive little to no feedback (Moles et al.,

2017). So, educators need to know that feedback is indeed important to the learning process, but providing the proper feedback at the appropriate time will do so much more for their students in the long run.

Summary

The purpose of this study was to provide recommendations to the leadership at BJJ schools with possible solutions to the problem of student injuries. The problem is that students who practice BJJ sustain injuries while training. This dissertation in practice chapter analyzed literature related to the research problem.

Injury prevalence in combat sports, like BJJ, as well as injury prevention strategies and curricula's impact on training and education, are well discussed in the literature. In BJJ, injuries happen because of its ground fighting focus and use of the body's biomechanics to take an opponent to the ground, choke them, or lock their joints into submission. When Mitsuyo Maeda introduced Japanese Jiu-Jitsu to Brazil, it was the beginning of a globalization process to ensure that BJJ became a household name. One such household name and one of the largest BJJ teams in the world is Gracie Barra. With hundreds of schools globally, it has championed Maeda's first student's (Carlos Gracie) philosophical approach to BJJ training, including a methodical approach to learning BJJ through a structured curriculum.

Its commercial popularity and life skills transfer evidence BJJ's impact on and off the mats. When fans watch big-ticket mixed martial arts events, they witness BJJ's effectiveness firsthand when the combatants find themselves on the ground. However, the average practitioner might experience a different type of effectiveness, one that translates a BJJ training session to lessons learned about life. Such lessons include respecting others, having perseverance and self-confidence, and practicing healthy habits.

Sustaining an injury in any sport, including BJJ, is more likely to happen than not (Kotarska et al., 2019). The research on injury prevalence and incidences, physiological and psychological factors, athlete profiles among BJJ practitioners is plentiful. However, the research is limited to only these areas. The literature in these areas discusses types of injuries that BJJ practitioners are likely to sustain, injury mitigation and prevention strategies, and injury rehabilitation. However, sports and medical journals offer relevant information on reducing BJJ-related injuries. The criticalness of training quality, training strategy, functional training efficacy, employing various levels of training intensity, and the relationship between mental health and physical injuries are all areas in the sports and medical journals that the leadership at BJJ schools might find helpful when attempting to address injuries at their schools.

According to the literature, one way to reduce sports-related injuries is to include risk mitigation and injury prevention strategies as part of the overall training plan. In addition, these training plans often aim to advance the athlete and enhance their experience using a methodical process that improves learning and performance through evaluation and coaching. Thus, by definition, a training plan is indeed a curriculum. Teaching, learning, and assessment are all curriculum bedrocks. These bedrocks are essential components in any learning environment, irrespective of student type. Most BJJ schools subscribe to a strict training curriculum. However, instructors who do not curriculum-based education but endeavor to reduce injury rates at their schools might find utility in curricula's role in education, the application of learning theories, and feedback in education spaces, and consider using data from the literature to support a curriculum.

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