Technical Analysis and Development of Single Bamboo Floating from the Perspective of Education and Psychology

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Abstract

It is quite remarkable how solo bamboo drifting (originated from indigenous boating in southwestern China) has transformed into a captivating and innovative sport when compared to more conventional forms of competition. This study focuses on the competitive element of solo drifting on bamboo, which involves direct contact with the terrain. Instead, the focus is on studying a variety of oar-rowing strategies and understanding how successful athletes achieve victory in competitions. The primary objective of the research is to offer training advice that is supported by empirical evidence for the participants/athletes involved in the sport. The investigation involves five athletes who were selected for the case studies based on their performance in the 60-metre straight track event. In this context, the study tools used include literature analysis, observation, video playback, and statistical mathematics. The Dartfish sports technique video analysis system, a specialised app, enables you to scrutinise movements closely and compare them to your athletes to evaluate their pole-rowing techniques. The results suggest that the athletes' technique plays a vital role in determining the competitive outcomes in solo bamboo drifting. Factors such as their position on the bamboo, the angle at which the pole enters the water, the management of rowing power and speed, and the control of the bamboo's direction all contribute to the overall performance. By maintaining proper posture and employing effective pole-rowing techniques, you can greatly reduce water resistance and increase the speed of the bamboo's forward movement. Efficiently managing the force applied during rowing is crucial for maintaining the stability of the bamboo and maximising the overall effectiveness of the rowing process. Furthermore, the competitors' yawing phenomena during the competition have a negative impact on rowing efficiency, disrupting the rhythm and stability of the rowing motions. This study employs comparative analysis to investigate the pole-rowing tactics of three athletes, emphasising differences in their movement intricacies and effectiveness during the rowing cycle. The results of this study provide a solid basis for future training efforts. This paper provides a comprehensive set of training suggestions derived from the research findings. These recommendations involve incorporating cutting-edge technology for technical monitoring and analysis, improving physical training to optimise rowing efficiency, and honing direction control in different competition conditions. The purpose of these guidelines is to help athletes enhance their pole-rowing techniques and elevate their performance in competitions. This research not only provides theoretical justification for the technical training of solo bamboo drifting but also offers practical instructions for the scientific advancement and widespread adoption of the sport.

Keywords: Solo Bamboo Drifting, Pole-Rowing Technique, Technical Analysis.

Introduction

The serene experience of bamboo raft riding, known as the "dude bamboo boat" or "drawing bamboo poles," used to be a popular activity in the Chishui River basin area. This type of folk craft in northern Guizhou is highly valued and unique, showcasing its rich cultural heritage and longstanding tradition (Gong et al., 2023; Lan, Liang, & Lu, 2019; Wei & Lan, 2011). Initially, it was solely used for harnessing the river waters during the navigation of treacherous rivers. However, over time, it evolved into a beloved pastime and source of entertainment. Several bamboo dias, with their unique angles and uneven surfaces, present a delightful challenge for athletes to maintain balance. Additionally, these structures serve as a beautiful reminder of how intelligent living can harmonise with the wonders of nature. Single bamboo drifting has historically been a popular pastime among locals. Furthermore, this activity is rapidly gaining popularity as a thrilling sport.

In the realm of contemporary sports, one fascinating example is the bamboo sweep style, which has evolved significantly over time. This historical period of human activity encompasses a wide range of elements, including the incorporation of contemporary aspects such as rule standardization and the integration of scientific technology in these sports or games. Recently, we have made some exciting

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enhancements to the single bamboo drifting activity, making it even more competitive and entertaining. As a result, there has been a significant increase in the number of participants and spectators in this sport. Undoubtedly, the bamboo-based floating movement has had a profound impact on the local and international cultural scene, leading to its recognition as "China's Intangible Cultural Heritage Floating". At a domestic level, the bamboo Piao has gained recognition as an important sport in the National Ethnic Traditional Sports Games. It serves as a vehicle to showcase national culture and sportsmanship. The international organisation of bamboo drifting on single bamboo, a traditional Chinese tournament with a distinctive Chinese flavour, has been gaining increasing attention from the international sports community who are fascinated by this unique sport.

Despite some progress in the competitive aspect of single bamboo drifting, there remains a need for more comprehensive scientific research in this field. This study focuses primarily on the historical and cultural aspects of sports, the development of competitive regulations, and the teaching of fundamental practices. However, there is a noticeable absence of a thorough analysis of athletes' technical movements, training techniques, and competitive tactics. In terms of the fundamental feature of stroke technique, there is a clear lack of structured research to offer athletes guidance in their training and improve their performance in competitions (Adomavičienė et al., 2019; Chi et al., 2020; Morris et al., 2013; Steele, Papazian, & Feldner, 2020).

The objective is to examine the stroke techniques of outstanding single bamboo drifting athletes to explore the key factors that impact their success in racing. Furthermore, this study aims to provide scientifically grounded training recommendations. The study enrolled three national champion athletes and used the Dartfish technical analysis system to carefully observe and conduct quantitative statistical analysis on their stroke mechanics. This study seeks to offer theoretical support and practical recommendations for improving the technical training and competitive performance of single bamboo drifting.

Technical Analysis: Study Prevailing Technique: Initially, aspire to excel in the latest SBF technique utilized in Martial Arts, which has its roots in disciplines such as Tai Chi and Wushu.

Breakdown of Movements: Evaluate every aspect of the SBF technique, such as the way you handle a school bag, maintain balance, posture, hand position, and footwork.

Understanding Physics: Understanding the principles of physics that govern the balance and movement of a single pole bamboo, such as center of gravity, momentum, and equilibrium, is crucial.

Trial and Error: Experiment with various iterations and fine-tune specific aspects to enhance customer reliability and efficiency.

Observation: Observe the experts in action and take note of their exceptional ability to delve into the intricacies of the technique.

Educational Perspective

Breaking Down Complexities: Break down the technical concepts into more manageable steps that are easier for learners to understand and apply.

Progressive Learning: An effective approach should be developed, starting with the most basic concepts and gradually progressing to more advanced topics. This will help students understand and build a strong foundation, allowing them to improve their skills before tackling more complex material.

Visual Aids: Through the use of visualization diagrams, videos, or animations, you can effectively visualize the important aspects, such as proper form and execution.

Hands-On Practice: Promote student engagement in practical application, providing ample feedback and correction to help them master the necessary skills.

Peer Learning: Implementing teambuilding activities and partner quizzes can foster collaboration and networking among individuals.

Safety Precautions: Begin by prioritising safety as the top concern, ensuring that beginners are taught proper techniques for falling and are provided with adequate padding.

Cultural Context: By engaging in this activity, assist individuals in gaining a deeper understanding of the historical and cultural significance behind this particular form of combat within the realm of martial arts traditions.

Incorporating Philosophy: Integrate concepts such as mindfulness, consistent training, and deep respect for instructors into the learning experience, thereby enhancing the comprehensive nature of martial arts education.

Development Process

Iterative Approach: Encourage the collaborative development of the method by involving experienced practitioners and learners of all levels to identify areas that can be improved.

Adaptation: Apply the technique to the audience and tailor it to the specific needs and capabilities of individuals, taking into account factors such as different ages, physical condition, and experience.

Research-Based Practices: Use the research in motor learning and skill acquisition to develop instructional methods and apply them effectively to the learning process.

Continuous Improvement: Regularly update and incorporate fresh educational materials and teaching methods based on past experience and observation.

STEM Education Integration

This project may be especially enlightening for high school students who are exploring potential career paths and college majors. There is a lack of awareness regarding the wide range of career opportunities available in engineering and the applied sciences. This project provides students with the opportunity to manipulate the boat in order to achieve optimal outcomes. This project offers numerous possibilities for research and exploration. This may be of interest to those who are passionate about learning, and ambitious students will be excited to compare their abilities with their classmates.

Students will acquire the ability to measure important properties of both liquid and solid materials, as well as to observe and record experimental data. These skills are emphasized in state and federal science and math academic standards. The bamboo boat project's minimalist nature aligns with state and national efforts to enhance technology and engineering education. Engaging students in the process of imagining, planning, and building a boat with limited resources and without prior instruction serves as a valuable starting point for teaching technological design and problem-solving. Acquiring this skill set is crucial for the next generation of innovators and inventors. The proposed bamboo floating project targets high school students, who are at a crucial juncture in their lives in terms of both environmental awareness and academic development. Hence, the project is not merely an addition but rather a crucial component of their educational journey. The project primarily focuses on supporting science and maths education. By studying the environmental factors that impact the buoyancy of the bamboo boat, students can gain practical knowledge of how mathematics is applied in real-world scenarios (volume displacement of water and geometric shape to determine the area of the waterline and hull drag).

The analysis and development of single bamboo floating, from an educational perspective, focuses on studying the potential of bamboo structured technology and its applications in architecture. This study examines the expertise in architectural design studio, specifically focusing on architectural design technology. It was conducted during the 6th semester of study. The main focus of this study is the potential of bamboo structured technology and its applications in architecture. The objective is to conduct a comprehensive analysis of this technology. The studio focuses on addressing community problems and challenges through architectural design, specifically by examining real cases in rural communities across different regions in Indonesia. The aim of this study is to investigate how an architectural design methodology can result in a building with high architectural value and low cost, considering local community issues and cases. This includes the construction and maintenance processes.

Curriculum Integration

It is widely recognized that the floating raft used for fishing in rivers has been a subject of interest for children who are fascinated by it asking the question "Why does it float?". Using a single bamboo float can be a great way to introduce students to hands-on learning in science and technology. The teacher can elucidate the historical uses of this float and draw comparisons with contemporary floats and toys. This could potentially result in an engaging hands-on activity where students create different rafts using materials readily available in the classroom. They can then test their creations by taking them to a nearby river or running water facility. This activity is best suited for upper primary school students.

Science

In primary education in Brunei, the emphasis is on acquiring essential knowledge, understanding concepts, and developing investigation skills in the field of science. In order to effectively navigate the future, it is crucial for this generation to possess a strong foundation of scientific knowledge, cultivate a favourable mindset towards science, and develop proficiency in the realm of technology. This is widely accepted because a strong understanding of science is crucial for navigating and addressing future challenges. However, the approach could use some refinement. When it comes to learning at a young age, the most effective approach is through hands-on experience. As time goes on, knowledge and understanding naturally develop. The objective is simply to provide a foundation for reaching the stage of future management.

Mathematics

Our education modules are designed to familiarise students with the vast potential of bamboo as a sustainable building material and ignite their enthusiasm for incorporating it into their project work. Most students don't typically prioritise maths when it comes to using bamboo, but it plays a crucial role in the design process. We aim to demonstrate that the challenges faced in this context are frequently distinct from those encountered in other fields.

We will present a range of challenges throughout the design and construction phases that will prompt students to apply and enhance their existing mathematical abilities with a specific goal in mind. This is different from the typical math's instruction in schools and might help uncover some of the misunderstandings students have about their abilities in the subject. The practical applications of these problems can help to inspire individuals who find abstract mathematics unappealing. In real-world design situations, making decisions is crucial, but it's an area where students often lack sufficient practice. We will create decision-based tasks that provide students with the opportunity to observe the outcomes of their choices. This could potentially be expanded into a computer-based simulation, although it is not within the focus of our current project. All challenges will be approached with a competitive mindset to encourage the active involvement of every member of the team.

Engineering

A bamboo floating bridge is a prime example of ingenuity and originality. The construction of a bamboo floating bridge aims to foster teamwork and engagement through interactive activities, providing valuable learning opportunities in engineering. Regarding the implementation in the teaching and learning process, the construction of a bamboo floating bridge can be used as an assessment for both groups and individuals. This also involves the preparation of building a bamboo floating bridge. It is important to foster students' creative and critical thinking skills prior to their construction of the bamboo floating bridge. One way to assess students' skills is by assigning them a task to design a bamboo floating bridge within a specific time frame. After the test is finished, the design created by the students will be evaluated and analysed. This session may involve a presentation where students are expected to provide a comprehensive explanation of their design in front of their peers and instructor. After completing this preparation and planning session, students will proceed to the next step of building their bamboo floating bridge. This activity is crucial as it will form the core of the students' learning process in comprehending the engineering principle. Throughout the process of building the bamboo floating bridge, students will need to document their progress and articulate the rationale and concepts behind their work. This is important because encountering mistakes or failures during the process can serve as a valuable learning opportunity for students. It helps them develop skills in problem identification and solution finding. After the bamboo floating bridge is finished, students will have the opportunity to participate in a testing session to determine its buoyancy and weight-bearing capacity. This is a thrilling activity for students as they have the opportunity to engage in friendly competition with their peers, testing the strength of their bridges by determining which one can withstand the heaviest load. By the conclusion of this activity, a thorough analysis and evaluation will be conducted on the students' work in testing the bridge, as well as the overall outcome of the construction process.

Art and Design

When examining the objective of the design method in contrast to the concept design of the Single Bamboo Floating Joint, there is a distinct shift in the approach to product design. The concept design of the Single Bamboo Floating Joint aims to modernise and enhance the traditional fisherman's tool, replacing the outdated bamboo floating with a more efficient and contemporary alternative. The concept design of the bamboo floating is an innovative iteration of the previous tool, while still retaining its inherent strength and traditional roots. Typically, fishermen are reluctant to part with their traditional tools due to their unique functionality. These old tools often outperform modern ones in terms of efficiency and durability if crafted properly. The innovative concept design utilises cutting-edge technology, allowing for 3D product modelling and FEA simulation. The primary objective of this design method is to identify superior alternatives to existing products. Another option at this stage involves a solitary bamboo raft designed to catch fish using bamboo tools. After conducting observations with 10 fishermen, it was found that the product, known as bamboo floating, received positive feedback and can be embraced by contemporary society. By utilising meticulous technical analysis and employing effective learning strategies, you can create a comprehensive and easily understandable instructional course. This course will equip students with the necessary knowledge to master the single bamboo floating technique in their martial arts practice.

The Effect of Psychology on Development of Single Bamboo Floating

The development of Single Bamboo Floating (SBF) is undeniably shaped by psychological factors, both on an individual and collective scale. Here's how psychology might play a role:

Motivation and Vision: Psychology explores the reasons behind people's behaviours. When it comes to SBF, the founders or developers may have been driven by a vision of sustainability, innovation, or cultural preservation. Gaining an understanding of these motivations can offer valuable insights into the reasons behind the pursuit of SBF and the way it was conceptualised.

Creativity and Innovation: Studying the psychological aspects of creativity and innovation can provide valuable insights into the processes behind the development of a concept like SBF. Originality, analytical abilities, and the capacity to approach challenges from unconventional angles are all psychological factors that foster innovation in diverse domains, such as architecture and engineering.

Perception and Aesthetics: The consideration of beauty, aesthetics, and functionality holds great importance in the field of architecture and design. Research in psychology can provide valuable insights into the visual attractiveness of SBF structures, helping to ensure that they are both functional and visually appealing.

Social Influence and Collaboration: The development of SBF likely required the collaboration of various professionals, including architects, engineers, environmentalists, and other stakeholders. Gaining insight into social dynamics, communication patterns, and group decision-making processes can shed light on how these collaborations influenced the development of SBF.

Environmental Psychology: SBF, as a sustainable architecture concept, is strongly connected to environmental psychology. This field of psychology investigates the ways in which individuals engage with their constructed and natural surroundings. Gaining insights into individuals' attitudes, behaviours, and perceptions regarding sustainability can provide valuable guidance for the development and execution of SBF projects.

User Experience and Human-Centered Design: Psychology plays a vital part in the design process as it emphasises the importance of understanding and meeting the needs, preferences, and experiences of the end-users. Human-centered design principles prioritise the consideration of users' needs, comfort, and cultural appropriateness when designing SBF structures, in addition to their environmental friendliness.

Risk Perception and Decision-Making: Developing SBF structures requires careful evaluation of potential risks and making informed decisions in situations of uncertainty. Psychology provides valuable insights into how individuals perceive and evaluate risks, as well as how they make decisions in uncertain situations. These insights can provide valuable information for risk management strategies during the planning and implementation phases of SBF projects.

Role of nervous system on Development of Single Bamboo Floating

The nervous system may not appear to have a direct connection to the development of Single Bamboo Floating (SBF), but it actually plays a crucial role in various aspects:

Sensory Perception: The nervous system is responsible for processing sensory information, which includes inputs from the senses such as vision, hearing, touch, and body position. Architects and designers engaged in SBF development heavily depend on sensory perception to comprehend the surroundings in which these structures will be constructed. When designing SBF projects, factors such as wind patterns, water currents, and sunlight exposure are carefully considered.

Motor Control and Coordination: Having a strong grasp on motor control is essential for successfully constructing and assembling SBF structures. This skill requires precise coordination of muscles and movement. Engineers and builders require accurate motor control to effectively manipulate bamboo and other materials, guaranteeing structural integrity and stability.

Cognitive Function: During the planning and design phases of SBF development, cognitive processes like attention, memory, and problem-solving play a crucial role. Professionals in the field of architecture and engineering rely on their cognitive abilities to imagine, conceptualise, and solve problems related to a wide range of projects, including structural design and sustainability factors.

Emotional Responses: The nervous system plays a crucial role in regulating emotions and affective responses, which in turn can have a significant impact on decision-making and design choices in SBF development. For instance, designers can strive to elicit particular emotional reactions, like serenity or wonder, by utilising the aesthetic and spatial characteristics of SBF structures.

Stress Response: The development of SBF projects can present various challenges and stressors, including financial limitations, technical obstacles, and regulatory complexities. Individuals involved in SBF development must navigate the challenges, manage stress, and stay focused on project goals, which triggers the stress response mechanisms of the nervous system.

Safety and Risk Management: The nervous system is involved in evaluating and reacting to potential risks linked to SBF construction and usage. When designing SBF structures, engineers and safety experts take into account various factors related to human behaviour, such as perception, reaction times, and attentional capacity. This is done to prioritise user safety and minimise potential risks.

Environmental Adaptation: The nervous system allows organisms to respond to environmental changes by processing sensory information, acquiring knowledge, and making behavioural modifications. Similarly, SBF structures may need to adapt to environmental factors such as water level fluctuations, erosion, or changing weather conditions, necessitating continuous monitoring and adjustment mechanisms.

The role of the nervous system in the development of SBF may not be immediately obvious, but its influence is widespread. It affects how individuals perceive, interact with, and respond to the challenges and opportunities of sustainable architectural innovation.

The primary objective of this research is to examine the unique technical aspects and developmental path of bamboo floating techniques from a psychological perspective. The jing duan da bo, a fundamental skill derived from traditional martial arts, embodies the intricate balance of physical strength, mental focus, and emotional control. This study employs principles from cognitive psychology, behavioural analysis, and mindfulness as its theoretical foundation. It delves into the intricate connection between cognitive perception and body movements while performing the single bamboo floating techniques. This study investigates the cognitive processes, emotional states, and psychological factors through qualitative interviews, psychometric assessments, and empirical observation. Advances in research enhance our understanding of psychological processes in sports training and provide practical recommendations for optimising performance and maintaining personal well-being.

Material and Methods

We chose five outstanding athletes from our college's single bamboo Drifting Team, recognising their impressive paddling skills and their success in winning championships at the National Democracy Games. We conducted a thorough analysis on the talents by using their participation in the 60-meter straight racing event of the single bamboo Drifting Trials of our College as a case study.

Table 1

Details of Candidates

Candidate	The 11th National Democracy Games
1	Men's 60m, 100m and 200m straight racing champion
2	Women's 100m and 200m straight racing champion
3	Women's 60m straight racing championship
4	Men's 60m, 100m and 200m straight racing champion
5	Women's 100m and 200m straight racing champion

Methodology

Information that is written or recorded to provide details or instructions about a specific subject or process. We collect academic literature and resources related to the single bamboo Drifting Movement through the National Knowledge Infrastructure (cnki) database, Google Scholar, and other sources. Refine the academic literature on stroke technology by carefully choosing trustworthy and pertinent sources. Carefully analyse the selected material and structure the descriptions, analyses, and discussions on stroke technology to establish a strong foundation for further in-depth study. Key principles.

Method of Observation

We had the opportunity to visit the Drifting Training Base of our College and observe the athletes' training first-hand. Our main focus was on studying the stroke motions, strength, coordination, and other factors that contribute to their performance. Examine differences in stroke technique among different athletes.

Method for Analysing Videos

In order to balance the demands of athlete training and research, we made use of the Dartfish sports video analysis system to thoroughly examine the technical movements of highly skilled single-bamboo rafting athletes. We conducted a thorough analysis of the body posture of athletes while floating, along with the precise angle at which the pole enters the water. In addition, we examined how technical factors, such as the depth of water entry and the distance of the draw, affect the speed of single bamboo floating. In order to assess the technical indicators of athletes' strokes, we utilised pertinent theories from the field of sports biomechanics.

Such research application incorporates a mixed method removing both qualitative and quantitative analysis to comprehend the psychosocial part of the single massive moving technique. Qualitative information comes from such resources as tutorials for the experienced trainers, observation of personnel during the sessions and analysis of some texts and instructional materials from the past history. Quantitative measures are as diverse and advanced as psychological tests demonstrating the cognitive faculty in addition to the emotional intelligence levels and mindfulness features in the participant. Data triangulation and theme (/ the text / / thematic) analysis tools are used for this purpose to find prevalent features, themes, and relationships that run through- dataset.

Statistics

Utilising the spssau online data analysis system, we conducted a comprehensive examination and research of the data collected during the video analysis process. I examined the water entry angle, water exit angle, and forward movement of the body during various stroke cycles. We conducted a thorough analysis of these measurements, examining both the left and right sides of the same athlete, as well as different athletes performing the same stroke on the same side. A thorough analysis was conducted to compare various data points, leading to the discovery of several significant insights and suggestions.

Results and Analysis

After careful calculation, it has been found that a single bamboo float can support a weight of up to 120 kilogrammes for an athlete. Typically, athletes with a lighter build experience less resistance when moving forward on the bamboo float. Nevertheless, possessing a lower body weight may result in a lack of muscular strength to effectively propel the single bamboo Drift forward. Nevertheless, individuals who are overweight may experience challenges when using the single bamboo Drift due to the added weight, which can impede their progress and make it harder to achieve quick results. Therefore, it is essential for athletes to coordinate their entire body to generate force and execute stroke techniques.

The positioning of the athlete on the float affects their performance of sports skills and is a significant factor in determining the forward resistance of the float in the water. In order to minimise the water resistance of the bamboo float, athletes should position themselves behind the frosted surface of its central section. As a result, approximately two-thirds of the float head's cross-section will be positioned above the water surface. Adopt a stance with your feet positioned in both forward and backward directions, aligning the arches of your feet tightly with your torso for stability. The recommended distance between the feet is approximately 1.5 times the width of the shoulders, with the toes pointing inward. The front foot and rear foot angles with the bamboo float are approximately 30 degrees and 45 degrees, respectively (Li, 2020).

Key Attributes of Stroke Methods Shown by Top Athletes

Elite athletes demonstrate several common traits during the stroke process to optimise efficiency. These include maintaining a stable and buoyant body posture, coordinating stroke motions, and accurately controlling stroke force and velocity. The exceptional accomplishments are primarily attributed to the competitors' strong physical condition and, most significantly, their proficient paddling abilities. Developing proficient stroke technique enables players to achieve rapid and consistent progress in the game, resulting in exceptional outcomes. The stroke method can be divided into four stages: water entry, paddling, water departure, and aerial pole movement, as illustrated in Figure 1.

Figure 1: Illustration Depicting the Sequential Stages of a Single Stroke Cycle Performed by an Individual Bamboo Rafting Athlete.

Plunge Into the Water

The athlete grips the pole with his hands positioned parallel to each other, approximately twice the width of his shoulders apart. Athletes should assume a forward-leaning posture, extend their hands forward, and move their lower limbs in a forward and backward motion to prepare for paddling when entering the water. The torque and power generated during a stroke are affected by the angle at which the stroke enters the water, as determined by the principles of motion mechanics. In order to optimise the efficiency of the single bamboo float action, it is crucial for athletes and coaches to accurately adjust and modify the angle at which the stroke is made into the water. When observing the paddle from the front, a larger water entry angle (Figure 2) causes the water entry point to be closer to the bamboo drift. This phenomenon also results in a greater relative water entry depth of the paddle, leading to increased torque generation and improved paddling efficiency. In addition, a higher speed is attained. The bamboo drift may experience yawing due to inconsistent water entry angles on both sides. In addition, if the water entry point is near the bamboo float, it will increase the resistance to the float's forward movement. When the paddle moves in the opposite direction, it generates a force that displaces the water, leading to a decrease in pressure in that area. The water surrounding it is drawn towards the low-pressure area, resulting in a reverse flow. The retrograde water flow counteracts the buoyant object, hindering its forward movement. If the point of water entry during the stroke is too close to the centreline of the body, the athlete's feet will align in a straight line, which weakens support at the third point. Consequently, this will reduce the body's stability and negatively affect its efficiency during the stroke.

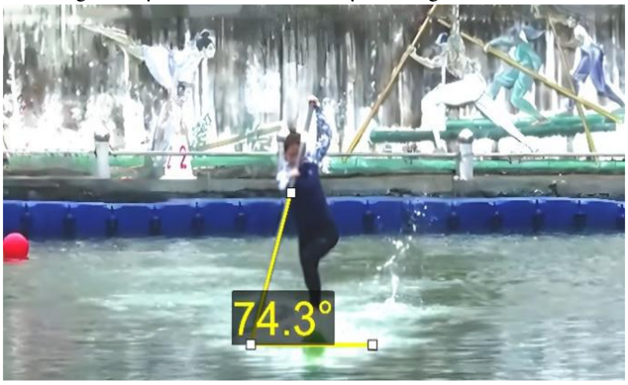

Figure 2: Athletes Are Propelling Themselves Forward by Using a Paddle to Push Through the Water at a Certain Angle Known as the Stroke Angle.

When the angle of the front stroke is less than 60 degrees, the wading depth of the stroke decreases, leading to reduced resistance during the stroke. This phenomenon also results in a longer moment arm and reduced stroke efficiency when the athlete exerts the same amount of effort (Chen, 2019). As the angle of water entrance increases, the water entry point moves closer to the body. The stroke distance is negatively affected, resulting in reduced efficiency and increased physical exertion due to the need for frequent pole adjustments.

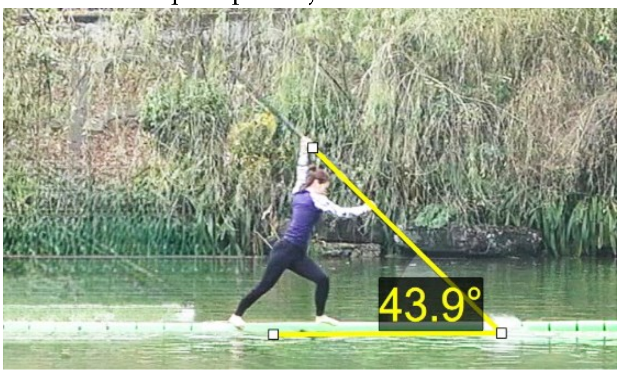

Figure 3: The Angle at Which the Athlete's Side Stroke Enters the Water.

Inadequate side angle of water entry leads to water emerging at the front end of the stroke, resulting in a significant splash upon entering the water. Athletes exert excessive physical energy to counteract the upward force experienced during the initial phase of the stroke. Consequently, this impedes the athlete's stroke rate and rhythm, leading to a decline in stroke efficiency. Non-uniform angles of water entry on both sides lead to variations in the stroke distance. Significant differences in angles can cause bamboo to drift in yaw. Therefore, athletes should adjust the extent of their forward reach on the paddle according to the specific circumstances in order to maximise paddling efficiency.

Stroke and Stroke

Stroking is a crucial technical aspect in the sport of single bamboo floating. Athletes should maintain a consistent and fluid motion during the paddling procedure. The key factors that contribute to an effective stroke, as per the principles of sports biomechanics, are strength, speed, coordination, and balance. The efficacy of paddling is strongly associated with the velocity of the bamboo float. The speed at which the bamboo float moves forward is directly correlated with increased paddling efficiency.

An athlete with advanced skills enters the water at an optimal angle while gripping the rowing oar. The athlete assumes a forward-arching and back-pedalling stance while firmly grasping the oar with both hands. The upper hand provides support while the lower hand propels the oar backwards. Concurrently, the foot pedals apply force to the bamboo, resulting in the body's centre moving in a backward direction. The front leg is extended while the rear leg is flexed, executed in a continuous motion, with the goal of maximising the distance travelled in a single stroke. Moreover, a longer distance for each stroke can also affect the frequency of strokes in the game.

The process of paddling requires the maintenance of a dynamic equilibrium. Having a high level of physical fitness and mastering the paddling technique are crucial for staying balanced and making quick progress in the ever-changing environment, whether you're using a paddle pole, participating as an athlete, or rafting. During the paddling process, athletes need to maintain a steady reliance on the rowing rod to ensure proper balance and make necessary adjustments to their body's centre of gravity caused by the intense paddling movements. Nevertheless, if the stability is compromised during paddling, it can result in errors in movement and greatly reduce the efficiency of each stroke. The imbalanced force and secondary stroke impact can cause the bamboo drift to veer off course, ultimately impacting the players' performance and strategic abilities in the later stages of the game. At the same time, it's important to pull the paddle backward in line with the bamboo float as much as possible while paddling. This helps to conserve physical energy during the outward stroke of the paddle and avoid any unwanted sideways movement.

The objective is to reduce hydrodynamic and aerodynamic drag during paddling. When determining an athlete's weight, it is appropriate for them to position themselves on the bamboo float so that approximately two-thirds of the cross-section of the float head is submerged in water. Positioning the float head at a greater distance reduces strain on its cross-section, but also increases the weight of the float body. The drag experienced by the rear end in the water does not outweigh the benefits. When the wind force is at level 0 and an athlete is paddling at a velocity of 3 meters/second, the wind resistance experienced by the side of the body is lower than that experienced by the front. Hence, it is advisable to rotate the body in order to reduce the time during which the front of the body is exposed to the wind.

Swim Stroke

The recovery phase of the paddling motion is essential for initiating the next cycle of paddling. There is a correlation between the angle of water exit from the paddle and the height. As the height increases, the angle of water ejection from the paddle also increases. As the height decreases, the angle of water ejection also decreases.

The stroke process is influenced by the angle of the stroke when viewed from the side. A narrower angle leads to increased pressure on the end of the stroke as it exits the water. The increased pressure upon exiting the water results in a larger splash, thereby consuming a portion of the athlete's physical energy. Moreover, the transfer of downward force from the rowing rod to the bamboo float through the human body causes the submersion of the end of the bamboo float. Increased water resistance on the float body is a factor that affects the speed of the single bamboo float. However, reducing the height results in an increase in the length of the stroke that enters the water. When combined with the athlete's power and balance, this stroke will generate a stronger push.

Aerial Manipulation

The mid-air pole shift represents the final phase of a single stroke cycle. Athletes are required to perform the stroke transition while in mid-air to prepare themselves for the following set of strokes. Individual bamboo floaters can effectively maintain balance and stability while manoeuvring the pole in mid-air, enabling smooth and rapid stroke transitions. This enhances the consistency and speed of the stroke.

Upon lifting the pole from the water, its motion commences. During the act of propelling oneself out of the water, the athlete raises both hands slightly. The lower hand is thrust diagonally forward, fully extending the arms, while simultaneously transitioning the upper hand to the lower hand, effectively coordinating the movements. Prior to immersing the oar in the water and subsequently retracting it during the stroke.

Analysing the Impact of Stroke Styles Used by Professional Athletes

The D artfish technical analysis programme was utilised to collect data on the stroke angles of the three participants during their involvement in the 60-meter straight race. All five athletes are right-handed. Huang adopts a stance with his right foot positioned in front (Table 2 and Figure 4). An optimal athletic stance involves positioning the left foot in front. The initial 2-shot in the game was performed by positioning the front foot on the corresponding side. The participants believed that synchronising their body movements by entering the water on the same side after receiving initial instructions would increase efficiency.

Table 2

The Stroke Entrance Angles of 5 Highly Skilled Athletes Participating in the 60-Meter Competitive Unit: Academic Qualification

Athlete	Height	Weight	Front		Side		P Value
	C M	K G	Right	Left Side	Right	Left Side	
1	174	63	70.87±2.43	71.89±2.58	44.54±2.34	43.21±2.32	0.02
2	164	61	69.98±2.48	68.03±2.47	40.21±3.37	37.79±2.22	
3	156	50	69.42±2.64	68.12±2.43	40.53±2.21	35.43±1.84	
4	166	62	70.57±2.88	69.03±2.82	41.12±2.58	42.76±1.77	
5	165	64	70.75±1.98	68.69±2.69	41.06±1.57	38.65±1.32	

A thorough examination was conducted on the water entry angles of both sides of the paddle, as well as the water entry angles of the three athletes on each side. There is no noticeable variation in the water entry angles between the different sides of the athlete. The data shows statistical significance with a p-value of 0.02, as indicated in Table 3 and Figure 5. There is no noticeable difference in the water entrance angles between the athletes on the left and right sides of the front. There is a lack of variation in the angles at which water enters on the right side of the object. There is no significant difference in the angles at which water enters on the left side of the object. Athletes exhibit a minimal discernible disparity. Huang and Wei are exclusively positioned on the left side. The water entrance angle of the side rowing rod exhibits a significant difference (P = 0.017), as indicated in Table 3.

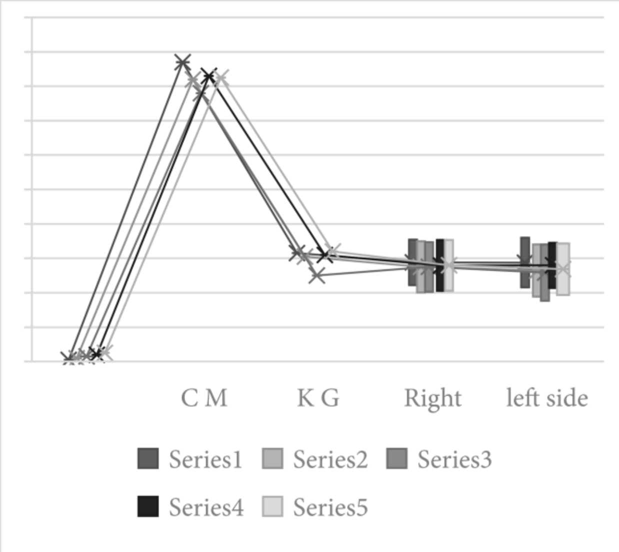

Figure 4: The Stroke Entrance Angles of 5 Highly Skilled Athletes Participating in the 60-Meter Competitive Unit: Academic Qualification.

Table 3

First Athlete Side Stroke Angle T Test Analysis Results

	Both sides		*t*	*p*
	Right side (n =12)	Left side (n =12)		
Water Entry Angle	40.01±1.32	35.04±1.35	4.58	0.02

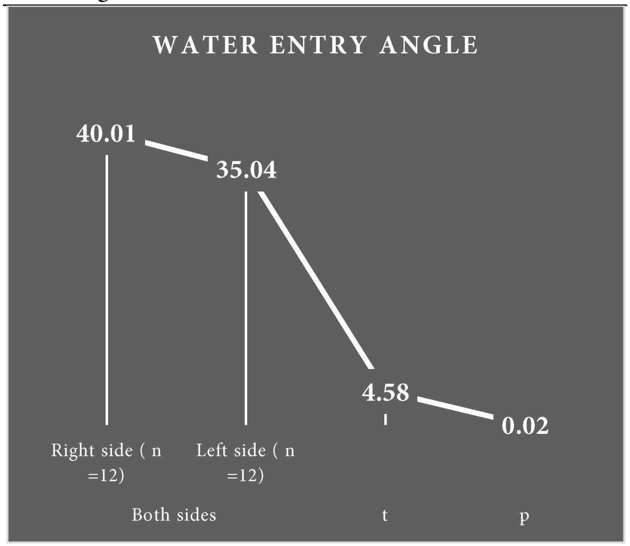

Figure 5: First Athlete Side Stroke Angle t Test Analysis Results.

Table 4

The t-test Analysis Findings for The Side Water Entrance Angle of The Paddle for the 2nd To 5th Athletes, Comparing the Entry Angle on The Left Side of Two Individuals Entering the Water

	2nd (n =12)	3rd (n=12)	4th(n=12)	5th (n=12)	t	P
Water Entry Angle	43.13±2.32	42.79±1.58	35.09±1.98	43.54±1.47	6.48	0.017

Analysis of Frontal Angles

Although the heights of the three athletes differ, there is no significant difference in the water entry angles of the two sides when viewed from the front. There is no correlation between the angles at which water enters the two sides of the front and the height of the athletes. However, a larger average difference and standard deviation of water entry angles on both sides suggests inadequate stability of the athlete's body posture while paddling. When faced with such situations, athletes must depend on the paddling pole for support to stabilise their body's centre and sustain force exertion on the pole. The entrance angles of the athletes on both sides of the water are non-uniform, resulting in uneven depths at which their strokes enter the water. The trajectory of the bamboo float tends to be biased towards the side with a small angle, resulting in a gradual descent into the water. In order to stabilise the bamboo float and prevent it from swaying, the other side simply needs to decrease the angle of entry. The force applied during the stroke directly affects the stroke's effectiveness and the velocity of the bamboo float. The statistical analysis of water entrance angles in the front strokes of the 5 athletes indicates that the first athlete had a slightly greater water entry angle on the left side, while the water entry angles of the 2nd to 5th athletes were somewhat larger on the right side. Moreover, the angles exhibit a relatively high standard deviation. This primarily refers to the position or viewpoint of the bamboo raft. The initial athlete places their right foot in front, using the left side as the inner stroke. In contrast, athletes two to five adopt a left foot forward position, using the right side as the inside stroke. Moreover, it relates to the flexibility and mobility of their shoulder and hip joints, as well as the flexibility and stability of their core muscles in the waist region. The lateral draw results in a decrease in the angle at which water enters. The water entry angle of the inner stroke is slightly larger than that of the outer stroke. Failure to consider other elements can result in yaw during the competition, as demonstrated by research. The third athlete's failure to paddle on the left side resulted in his exclusion from the top three positions in this competition (Table 4 and Figure 6).

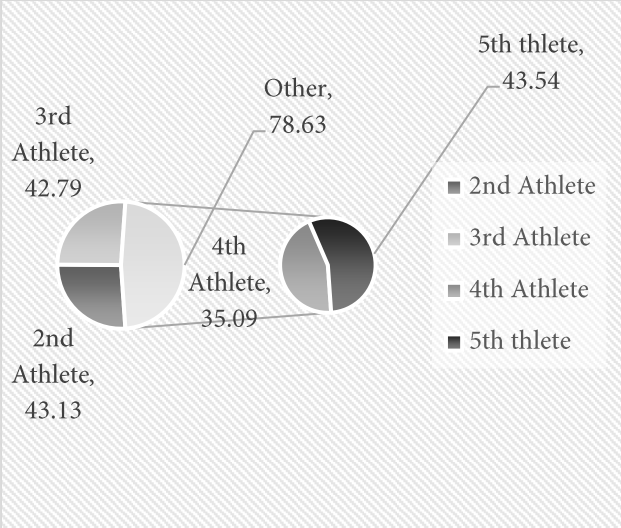

Figure 6. The t-test Analysis Findings for The Side Water Entrance Angle of The Paddle for the 2nd To 5th Athletes, Comparing the Entry Angle on The Left Side of Two Individuals Entering the Water.

Analysis of the Side Angle

The water entry angle of the stroke is affected by the athlete's side profile height. The angle at which the athlete enters the water will be less than 45 degrees, which is determined by the length of the stroke and the athlete's height. An individual's height directly affects the angle at which their stroke will enter the water. As height increases, maintaining bodily equilibrium becomes more challenging. The buoyancy gradually decreases as the paddle is submerged in the water, reaching its lowest point when the paddle is perpendicular to the water surface. The athlete resists the upward force exerted by the water and expends energy in performing tasks that do not contribute to their physical power, thus depleting a portion of their energy reserves. Moreover, the notable difference in the water entry angle on each side of the stroke (Table 5 and Figure 7) could potentially result in yawing or reduced stroke efficiency, as the athlete must continuously realign their direction.

Table 5

The Disparity in The Mean Stroke Angles Among the Three Top-Tier Competitors in the 60-Meter Competition Unit: Academic Qualification

	Difference Between Left and Right Front	Difference Between Left and Right Sides
1st	1.81	0.95
2nd	2.16	0.89
3rd	1.80	5.02
4th	1.79	0.89
5th	1.82	0.58

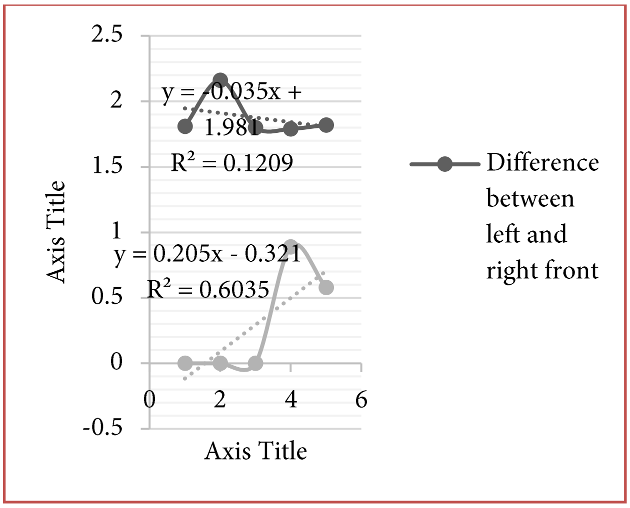

Figure 7: The Disparity in The Mean Stroke Angles Among the Three Top-Tier Competitors in the 60-Meter Competition Unit: Academic Qualification.

Regulation of Stroke Intensity and Velocity

The stroke force is the force exerted by the rower on the oar to propel the bamboo raft forward. The forward movement of the bamboo raft is solely propelled by this force. In addition to the angle, any difference in the paddling power applied to each side of the bamboo float can cause the float to yaw, affecting the paddling rhythm and efficiency. In severe cases, it may result in crossing into another lane, leading to the cancellation of competition results.

Moreover, the occurrence of a stroke causing a substantial splash in fluid mechanics (Ke, 2023) disrupts the movement of water, resulting in the formation of vortices and turbulence. The presence of vortices and turbulence can cause drag and affect the forward movement of the single bamboo Drift. Increased water splashes can lead to the dissipation of water energy, thereby reducing the propulsion of the bamboo drift. Therefore, it is crucial to minimise the splash caused by the stroke.

During the 60-meter straight race, the first athlete demonstrated consistent stroke effort and improved body stability throughout the stroke. The stroke pole may be utilised to counteract the deflection resulting from the force of the stroke. The centre of gravity of an object. Nevertheless, athletes ranked 2nd to 5th exhibited insufficient body stability during bamboo drifting. The swimmers adjusted the focal point of their stroke in the water to maintain their body's centre of gravity. The decrease in stroke efficiency had a negative impact on their competition performance.

All five athletes completed the 60-meter straight race with 22 strokes each. Three participants executed a total of seven strokes during their activity. There was no significant variation in the distance covered by each stroke, but the time taken for each stroke differed. The information is presented in Table 6 and Figure 8. Therefore, as the athlete's stroke force increases, the speed at which the bamboo floats also increases.

Table 6

Displaying the Statistical Data of 5 Exceptional Athletes' Individual Strokes in the 60-Meter Straight Race

	7 Strokes	Single Time	Total Distance (Rice)	Total Time (Second)	Speed (M/S)
1st	2.88±0.41	1.11±0.05	21.06	7.53	2.69
2nd	2.90±0.39	1.42±0.11	20.87	9.37	2.19
3rd	2.87±0.21	1.51±0.12	21.04	10.09	1.98
4th	2.91±0.43	1.40±0.13	20.98	10.45	1.97
5th	2.86±0.33	1.49±0.15	20.78	10.87	1.95

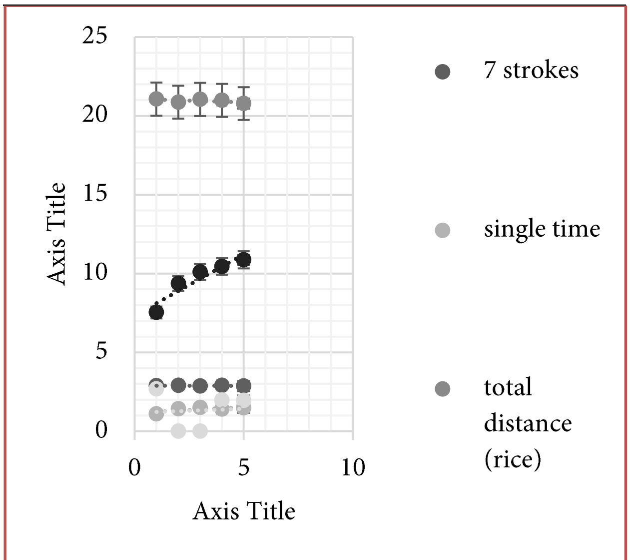

Figure 8: Displaying The Statistical Data of 5 Exceptional Athletes' Individual Strokes in the 60-Meter Straight Race.

The resistance encountered while rowing in the opposite direction increases as the rowing rod penetrates the water to a greater extent. The water splash magnitude is inversely proportional to the disruption level of the bamboo float's movement. In contrast, the potency of the bamboo float increases as its concentration rises. During the paddling procedure, all three competitors maintain a forward arching position and exert force by pushing backwards. Initially, they lower the centre of gravity and increase the stroke's range upon entering the water. In addition, maintaining a stable body posture can lead to higher power output. Moreover, it is essential to maintain a consistent distance of 30-50 cm between the paddle pole and the bamboo float while paddling in the water. The heights of athletes lead to differences in the distances between the paddling stick and the bamboo float. The relationship between height and distance is positively correlated, indicating that an increase in height corresponds to an increase in distance. The relationship is tailored to the individual's height and flexibility. Proximity of the stroke to the floating body may compromise the athlete's body stability during force exertion.

Moreover, when the paddle touches the water, firmly hold it with both hands and immediately submerge it into the water. When entering the water, it is important to move from point A to point B and insert the rod (Figure 9). When transitioning from point B to point C, retract both hands horizontally as much as possible. When establishing a fulcrum using the upper hand, employ the lower hand to execute a backward stroke, thereby facilitating a seamless shift of the body's centre of gravity in a rearward direction. Apply a diagonal upward force on the rowing oar using both hands when it is at an angle of approximately 45 degrees relative to the water surface. Concurrently, raise the rod diagonally using the lower hand. To successfully perform a rod change, apply downward force on the rod using the upper hand. Point D represents the location where the opposite end of the rowing rod is positioned for immersion in the water, with the aim of reducing its size. The interval between point C (water departure) and point D (water entry) results in a steeper gradient for segments A, B, and C D of this trajectory line, while segments B and C become more stable. Maximise power efficiently with a single stroke. The three athletes could improve their stroke technique.

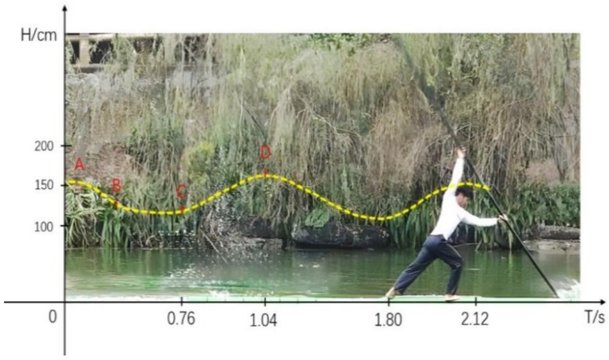

Figure 9: Diagram Illustrating the Trajectory of The Centre of Gravity for The First Athlete Throughout One Complete Cycle of Strokes on Both Sides.

Management of Bamboo Drift Direction

The 60-meter sprint occurred on a man-made lake known for its tranquil and motionless water. The wind was calm that day. All three athletes yawned during the competition, but none of them crossed paths. Various factors contribute to the yaw of the bamboo float. Examples of factors that contribute to instability in the body's centre of gravity include variations in stroke strengths and durations on each side. The presence of these elements will inevitably lead to yaw. An often-overlooked factor is the inclination of the stroke.

All three athletes employ a technique that involves alternating left and right strokes. When viewed from the front, Cheng the typeface represented by the "∞" character is commonly known as the "8" glyph stroke technique (Figure 10). During the athlete's paddling motion, the pole is held perpendicular to the ground. The upper hand exerts a diagonal upward force, while the lower hand pulls upward. At this stage, the pole is in close proximity to the body. Afterwards, the pole is adjusted to initiate movement in the opposite direction. When the paddle is perpendicular to the water surface, it penetrates the water, causing it to expand outward. When the front paddle is removed from the water, its exit angle is significantly smaller than its entry angle. The left stroke movement causes the tail to move away from the pole of the stroke, resulting in the body floating towards the left. Presently, the athlete must exert deliberate effort to alter the trajectory of the ball, thereby disrupting the fluidity of the stroke. Moreover, the abduction of the stroke will affect the athlete's body posture regulation during the game.

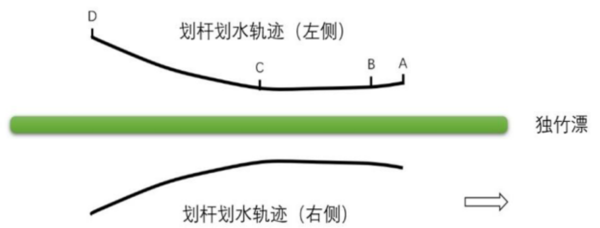

Figure 10: Stroke Chart During the 60 – Meter Straight Race.

Prospective of Psychology

The study findings demonstrate the multidimensional nature of achieving a single bamboo in motion through various techniques. According to cognitive research, the effectiveness of this technique is linked to a strong ability to concentrate and a heightened awareness of the surrounding environment. Enhanced attentional focus and sensory processing improve decision-making. The emotional tests demonstrated the strong emotional resilience and balance of the individuals who exercised, highlighting the integration of mind and body. Furthermore, a high level of concentration is associated with increased current awareness and tolerance, without making judgements. This is a characteristic of the state achieved through the single bamboo floating technique.

The findings of this study highlight the close relationship between psychology and martial arts training, emphasising the significance of body experience, such as the sensation of one hand floating, as a powerful tool. Engaging in practices that enhance cognitive clarity, emotional control, and meditation not only enhances martial arts skills but also contributes to overall well-being and inner harmony. This has far-reaching effects beyond the realm of martial arts, providing valuable insights into promoting mental health, managing stress, and enhancing performance across different fields.

This research highlights the intricate connections between psychology and martial arts training, specifically demonstrated through the practice of bamboo training. This study addresses the information gap in these areas by highlighting the cognitive, emotional, and mindfulness aspects of body movement. This research provides valuable insights into embodied cognition and its potential impact on human performance and well-being. In the future, it is important to conduct an extensive study on the long-term effects of martial arts training on psychological resilience, cognitive function, and emotional regulation. This exploration will provide valuable insights into the subject.

Conclusion

Through a comprehensive analysis of the pole-stroke techniques used by elite single-bamboo athletes, it is determined that athletes should prioritise certain elements in their training. These include leaning forward and pushing back, entering the water with a dive, maintaining a straight pole position, shifting the body's centre of gravity backward, lifting the pole out of the water, and rising up. The key components of a stroke cycle in an academic context involve the actions of pushing down, pulling forward, pushing forward, and pushing back. Improving stroke technique can maximise stroke efficiency and reduce energy loss, ultimately boosting athletes' competitive performance.

The success of the single bamboo float in racing is heavily dependent on factors such as the athlete's positioning on the float, the angle at which they enter the water with their stroke, their ability to manage stroke force and pace, and their control over the float's direction. Utilising proper body positioning and employing an effective paddling method can reduce resistance and optimise the efficiency of paddling. Meanwhile, ensuring a strong paddling force and maintaining control over pace will ensure the stability and consistency of athletes during competitions.

The yaw phenomenon observed in athletes during competition is not solely due to the difference in stroke strength between both sides, but is also closely linked to the angle of the stroke. This phenomenon not only affects stroke efficiency and disrupts the stroke rhythm, but also negatively impacts stroke stability. Therefore, it is essential to focus on maintaining a predominantly linear stroke trajectory during training to improve the accuracy of heading control and stability in competitive situations.

For optimal stroke technique training, coaches and athletes are encouraged to utilise cutting-edge technology tools such as the Dartfish technical analysis system. This allows them to closely observe and analyse athletes' stroke motions in real time, leading to enhanced performance. This facilitates quick adjustments and optimisation of technical aspects.

In order to improve stroke efficiency and stability during competition, it is recommended to prioritise the enhancement of athletes' physical training. This can be achieved by specifically targeting the strength of their upper and lower limbs, as well as their core stability. At the same time, it is crucial to give priority to athletes' flexibility and coordination training to improve the adaptability and range of stroke techniques.

To ensure optimal heading control during competition, athletes should incorporate simulated paddling exercises that mimic different wind directions and current conditions into their training regimen. This will enhance their ability to adapt and make necessary adjustments to changes in direction. Moreover, it is crucial to improve the management of the paddle's angle when it is not submerged to reduce any potential deviation in direction caused by the paddle being lifted away from the water.

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