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ANALYSIS OF BREASTSTROKE TECHNIQUE IN CHILDREN AGED 8 -12 YEARS

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Abstract
This study investigated the conformity of breaststroke swimming technique in 8-12-year-old students at SD Islam Al-Azhar 14 Semarang, recognizing that efficient technical mastery is crucial for optimal swimming performance and minimizing water resistance. Initial observations indicated common errors in breaststroke mechanics, particularly concerning body position and arm/leg movements during the start glide. This quantitative descriptive study involved 15 students from the swimming extracurricular program. Data were collected via video recordings of their breaststroke movements, subsequently analyzed using Kinovea software version 0.9.5 to objectively measure kinematic parameters, specifically arm and leg angles during the start glide phase. The results revealed an average arm angle of 131.4° (± 1.1°) and an average leg angle of 123.6° (± 1.2°) during the glide. These findings indicate that most students had not yet fully achieved the ideal streamline position, essential for maximizing glide efficiency. The observed deviations underscore the critical need for targeted coaching that provides specific, continuous visual and kinesthetic feedback. The study concludes that most students have not yet fully achieved the ideal streamline position crucial for minimizing drag and maximizing glide efficiency.

Keywords:*Breaststroke;Technique;Streamline;Motion Analysis;Kinovea*
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INTRODUCTION

Sport is an integral part of human life, encompassing diverse dimensions and objectives. As stipulated in Law of the Republic of Indonesia Number 3 of 2005 concerning the National Sports System, educational sports are explicitly recognized as an essential component of the learning process. Through active participation in sports, individuals can not only enhance physical fitness and achieve accomplishments but also develop mental skills, internalize positive values, and build a foundation for a healthy lifestyle. This law underscores the crucial role of sports in shaping the physical and mental character of citizens, while also ensuring

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that every individual has the opportunity to develop their potential through athletic activities.

Among the various popular sports, swimming stands out as a highly favored physical activity, enjoyed for both recreational purposes and competitive pursuits, ranging from children to master athletes competing in international championships like FINA (Moser et al., 2021; Ginting & Hakim, 2020). Swimming has also been integrated into school physical education curricula, given its multidimensional benefits, which include boosting self-confidence, stimulating physical growth, developing social skills, and providing refreshing recreational opportunities (Iksan & Denay, n.d.). The widespread availability of adequate swimming facilities in many areas, particularly in urban centers, further solidifies swimming's position as a favored sport among the public (Zahra et al., 2024).

To achieve optimal swimming performance, various interconnected factors come into play, including physical condition, technical skills, strategic tactics, and mental endurance (Febrianti et al., 2024). Specifically in the technical aspect, mastering efficient swimming movements is key. Swimming, including breaststroke, is a highly technical sport with a complex series of movements and strict rules (Chainok et al., 2022; Zahra et al., 2024). There are four main competitive swimming styles—breaststroke, freestyle, backstroke, and butterfly—each demanding specific technical mastery and distinct training approaches (Zahra et al., 2024; Pitwanto, n.d.).

The correct mastery of technique, especially in breaststroke, is an extremely influential internal factor for achieving success (Febrianti et al., 2024). Without a deep understanding and effective application of proper techniques, such as coordination of arm and leg movements, breathing technique, and optimal body position, swimming speed will be hindered, and optimal results will be difficult to attain. Beyond just physical ability, precise technical skill is the foundation for enhancing performance in every championship. Various supporting elements such as arm span, height, leg length, oxygen capacity, agility, balance, coordination, strength, flexibility, movement speed, and psychological aspects like motivation,

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concentration, and self-confidence, all contribute to achieving peak performance in swimming (Fitri Sovia Can, Hendri Irawadi, Argantos, 2021). Furthermore, the length and frequency of arm strokes, as well as stroke count, are biomechanical aspects that significantly determine swimming efficiency and speed (Universitas et al., 2016).

Initial observations of students practicing breaststroke at TK Al Azhar Semarang swimming pool revealed variations and several errors in movement technique, particularly concerning body position and arm strokes. Differences in body position (flat and wave) and common errors such as raising the hips too high can impede movement efficiency and even lead to injuries. Similarly, errors in the out-sweep and in-sweep phases of arm movements, such as too small a pull or sweeping too early, reduce the propulsive force generated, thus affecting speed. A detailed analysis of the conformity of breaststroke movement techniques is crucial to identify and rectify these aspects, enabling the enhancement of student swimming performance (Arisandi & Afrizal, 2019). Given the importance of mastering specific techniques and the common occurrence of errors in breaststroke, this research will focus on a detailed analysis of breaststroke techniques in students of SD Islam Al Azhar 14 Semarang. This study aims to provide insights into the conformity of movement techniques in the start phase, body position during glide, arm strokes, and leg kicks, aspects that have historically received less in-depth attention compared to other swimming styles.

METHOD

This study employs a quantitative descriptive approach, a method that emphasizes the use of numerical data to draw valid and objective conclusions, based on a descriptive analytical study aimed at discovering facts with precise interpretation through accurate data combination (Yuliani, 2018). This study investigated the conformity of breaststroke swimming technique in 8-12-year-old students at SD Islam Al-Azhar 14 Semarang, recognizing that efficient technical mastery is crucial for optimal swimming performance and minimizing water

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resistance. After obtaining permission, the research commenced with observation and coordination with the swimming instructor at SD Islam Al Azhar 14 Semarang to select a sample of 18 students aged 8-12 years participating in the extracurricular swimming program, from a total population of 32 students. Data collection involved recording videos of the students' breaststroke movements twice using an HP camera and a GoPro Hero 9 mounted on a tripod, ensuring the physical and mental readiness of the sample and the proper condition of the equipment. The video recordings were then transferred to a laptop for analysis using Kinovea software version 0.9.5, utilizing slow-motion and pause features to analyze the detailed movement techniques of breaststroke in the start phase, body position during glide, arm strokes, leg kicks, and coordination, based on angles, distance, and speed. The results of this quantitative analysis will then be described to obtain a systematic, factual, and accurate overview of the conformity of breaststroke movement techniques, serving as a basis for optimal recommendations (Arisandi & Afrizal, 2019). The research was conducted at the swimming pool of SD Al Azhar 14 Semarang, with observations on May 24, 2025, and data collection in June 2025.

RESULT AND DISCUSSION

The primary focus is on assessing the conformity of breaststroke swimming technique, specifically during the start glide phase, arm movements, leg movements, and coordination, in a sample of children aged 8-12 years. The research findings were derived from an objective assessment of each child's movement conformity with the indicators of optimal breaststroke swimming technique. This evaluation was based on thorough observation of the children's movements captured through photos and video recordings, encompassing the start glide phase, arm movements, leg movements, and coordination phase.

This study involved 15 participants who were present from the total determined sample, all of whom signed informed consent forms indicating their willingness to participate in the research until completion. The sample distribution by age group was as follows: 2 children aged 12 years, 6 children aged 10-11 years,

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and 7 children under 10 years (ranging from 6-9 years). The collected data were subsequently analyzed using Kinovea software version 0.9.5.

As initial data with the potential to influence swimming performance, the analysis of the breaststroke start glide began with anthropometric data collection. This data included the age, height, weight, and Body Mass Index (BMI) of the samples, summarized in Table 1.

Table 1. Anthropometric Data of SD Al-Azhar 14 Semarang Children's Swimming Club Athletes

Characteristic	Mean ± SD	Min	Max
Age (years)	8.93 ± 2.28	6	12
Height (m)	1.27 ± 0.10	1.1	1.4
Weight (kg)	21.2 ± 6.1	14	30
BMI (kg/m²)	12.92 ± 1.81	10.42	15.31

Based on Table 1, it can be observed that the average age of the samples was 8.93 years with a standard deviation of ± 2.28 years, indicating a fairly wide age range from 6 to 12 years. The average height of the samples was recorded at 1.27 meters (± 0.10 m), ranging from 1.1 meters to 1.4 meters. For body weight, the average was 21.2 kg (± 6.1 kg), with a range from 14 kg to 30 kg. Meanwhile, the average BMI of the samples was 12.92 kg/m² (± 1.81 kg/m²), with a minimum value of 10.42 kg/m² and a maximum of 15.31 kg/m². This anthropometric data provides a fundamental understanding of the physical characteristics of the studied sample group, which is important for understanding the context of their swimming performance.

Specific analysis of breaststroke glide technique involved measuring the arm and leg angles while in the water. These analysis results, representing the best data from two opportunities given to each athlete, are summarized in Table 4.2.

Table 2. Analysis Results Data for Arm and Leg Angles during the Glide Phase (n = 15)

Angle	Mean ± SD	Min	Max
Arm Angle	131.4° ± 1.1°	129.4°	132.6°
Leg Angle	123.6° ± 1.2°	121.1°	125.2°

Table 2 indicates that the average arm angle during the glide phase was 131.4° with a standard deviation of 1.1°, ranging from 129.4° to 132.6°. As for the

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leg angle, the average recorded was 123.6° with a standard deviation of 1.2°, ranging from 121.1° to 125.2°. These results provide a quantitative indication of the students' body position during the glide, which is a crucial aspect of swimming efficiency.

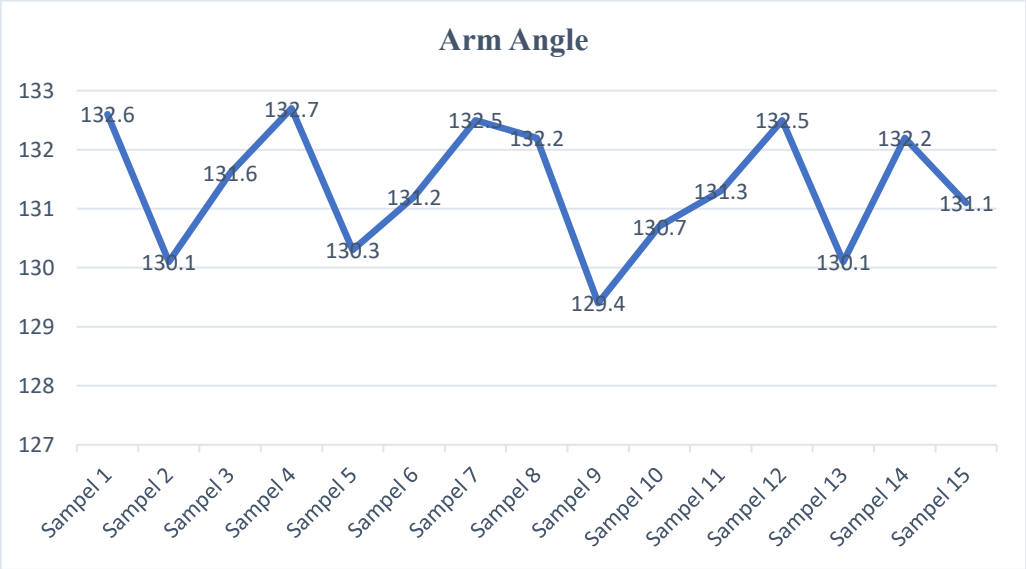

Figure 1. Arm Angle Data during the Glide Phas

The individual analysis of arm angles during the glide phase reveals interesting variations among the 15 samples. Although the group average was 131.4°, there were significant individual differences. Sample 4 recorded the highest angle at 132.7°, potentially indicating a very straight arm extension or a lower head position, though this would need further visual verification. Conversely, Sample 9 showed the lowest angle at 129.4°, which could suggest slightly bent arms or a slightly higher head position, thereby reducing the level of streamline. Sample 1 recorded 132.6°, very close to the maximum value, followed by Sample 7 and 12, both at 132.5°. Samples 8 and 14 also had identical angles of 132.2°. Meanwhile, other samples showed values closer to or slightly below the average: Sample 2 and 13 both at 130.1°, Sample 5 at 130.3°, Sample 10 at 130.7°, Sample 15 at 131.1°, Sample 6 at 131.2°, Sample 11 at 131.3°, and Sample 3 at 131.6°. This pattern

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indicates differences in each student's ability to maintain an optimal streamline position with correct arm alignment during the glide after the start.

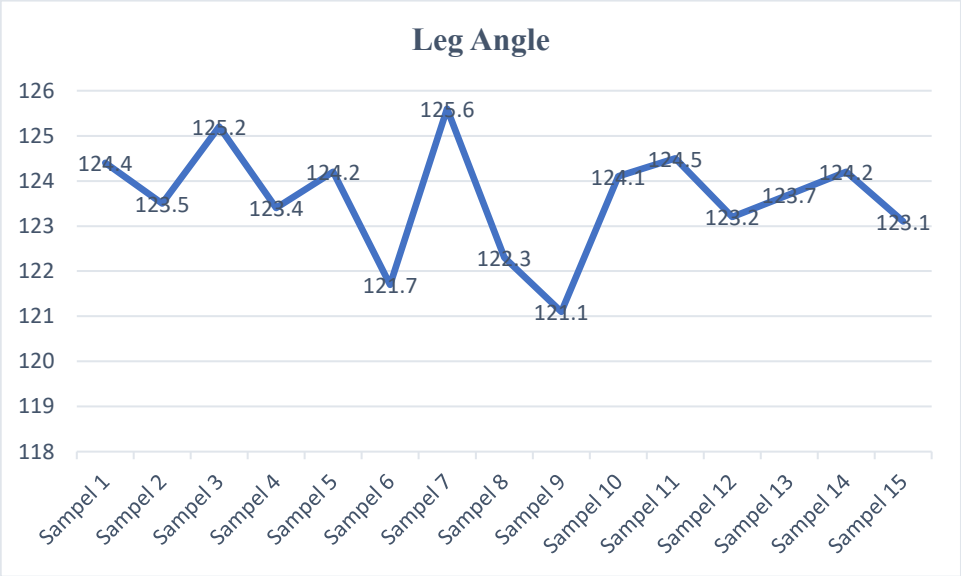

Figure 2. Leg Angle Data during the Glide Phase

The individual analysis of leg angles during the glide phase also revealed variations among the samples. Sample 7 recorded the largest leg angle at 125.6°, which may indicate that the legs were not fully together or were slightly bent/open, thus increasing drag. In contrast, Sample 9 recorded the lowest leg angle at 121.1°, demonstrating a tighter and straighter leg position, closer to the ideal streamline. Sample 6 showed 121.7°, and Sample 8 at 122.3°. Sample 15 recorded 123.1°, followed by Sample 12 at 123.2°, Sample 4 at 123.4°, Sample 2 at 123.5°, Sample 13 at 123.7°, Sample 10 at 124.1°, Sample 5 and 14 both at 124.2°, Sample 1 at 124.4°, Sample 11 at 124.5°, and Sample 3 at 125.2°. The overall average leg angle was 123.6°. These deviations suggest that some students may not yet be fully capable of keeping their legs tightly together in a streamlined position after the start push-off, which can increase resistance and reduce glide efficiency.

The results of this analysis underscore the importance of optimal body position, particularly arm and leg angles, during the breaststroke start glide phase for elementary school-aged children. In this phase, the primary goal is to minimize

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water resistance (drag) and maximize the initial propulsion from the start block and wall. An ideal streamline position requires the body to be straight and elongated, with arms locked directly above the head and legs together and straight backward, forming a single, continuous line. An excessively wide arm angle or overly open legs will create a larger surface area, resulting in significant drag and reducing both glide distance and speed.

The average arm angle of 131.4° and leg angle of 123.6° indicate that, in general, the students of SD Al-Azhar 14 Semarang still require further guidance to achieve a more efficient streamline position. Although the standard deviation values are relatively small, the individual variations between minimum and maximum values suggest differing levels of technical mastery among the samples. Students with angles closer to the ideal (e.g., a smaller arm angle indicating better streamlining from a side view, or a leg angle closer to 0° meaning tightly closed legs) will have an advantage in minimizing drag.

The detailed analysis using Kinovea, which allows for precise angle measurements and frame-by-frame visualization of movements, is extremely valuable for coaches. This data can be used as objective feedback for each student, enabling coaches to identify specific errors such as arms not being fully together, the head being too elevated, or legs not being perfectly straight. Consequently, training programs can be tailored to address these technical deficiencies, for example, through drills focused on body streamlining, core strength for stability, and shoulder and ankle joint flexibility. Improvements in this crucial start glide phase are fundamental as they form the foundation for the entire sequence of efficient and fast breaststroke movements. Enhanced efficiency in this initial phase directly contributes to achieving better swimming performance.

CONCLUSION

Based on the analysis and discussion, this study concludes that the mastery of breaststroke start glide technique among 8-12-year-old students at SD Islam Al-Azhar 14 Semarang shows variations, despite a relatively narrow statistical range. Kinematic data, analyzed with Kinovea software, revealed an average arm angle of

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131.4° and an average leg angle of 123.6° during the glide phase. These findings indicate that most students have not yet fully achieved the ideal streamline position crucial for minimizing drag and maximizing glide efficiency. The observed deviations highlight the critical need for specific and continuous visual and kinesthetic feedback, supported by motion analysis technology like Kinovea. Implementing targeted drills focused on improving body streamline, strengthening core muscles, and enhancing flexibility is expected to significantly improve breaststroke start glide technique in young athletes, thereby contributing to overall swimming performance enhancemen.

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