Journal of General Education and Humanities
Vol. 5, No. 4, August 2026, pp. 4735 – 4741, https://doi.org/10.58421/gehu.v5i4.1194
ISSN 2963-7147

Effectiveness of Mental Imagery Training in Improving Breaststroke Start Skills among Swimming Academy Athletes

Wendri Maryadi[1], Acep Rohmat Nurhidayat[2], Ahmad Rizal[3], Muhammad Ali Ode[4]
[1,2,3,4]Physical Education Study Program, Faculty of Teacher Training and Education, Pamulang University, Indonesia

Article Info

Article history:

Received 2026-02-15
Revised 2026-03-31
Accepted 2026-07-21

Keywords:

Breaststroke
Mental imagery
Performance
PETTLEP model
Swimming start

ABSTRACT

This study aimed to analyze the effectiveness of PETTLEP-based mental imagery training in improving breaststroke start skills among athletes at Dolphins Swimming Academy. Psychological factors play a crucial role in sports performance, particularly in time-sensitive sports such as swimming, where the start phase significantly influences race outcomes. This study employed a quasi-experimental design with a one-group pretest–posttest model involving 12 athletes aged 15–20 years. The intervention was conducted over four weeks and integrated into the regular training program. Performance indicators included reaction time and 15-meter performance as representations of start skills. The results showed significant improvements in both variables. Reaction time decreased from 0.789 seconds to 0.711 seconds, while the 15-meter time improved from 8.324 seconds to 7.744 seconds ($p < 0.001$). These improvements indicate enhanced anticipatory motor control, push-off efficiency, and underwater transition during the start phase. In conclusion, PETTLEP-based mental imagery training effectively improves breaststroke start skills by enhancing neuromotor readiness and psychological stability. Practically, this approach can be integrated into swimming training programs as a complementary strategy to improve start performance and overall competitive readiness.

Corresponding Author:

Wendri Maryadi
Physical Education Study Program, Faculty of Teacher Training and Education, Pamulang University
Email: dosen03055@unpam.ac.id

1. INTRODUCTION

Modern competitive sport has developed into a multidisciplinary field that integrates physiological, biomechanical, and psychological components within a comprehensive training framework. Athlete performance is no longer determined solely by physical capacity but also by mental readiness, emotional regulation, and cognitive processes [1], [2].

In high-performance settings, psychological factors play a crucial role in maintaining consistency and stability under competitive pressure [3], [4]. Previous studies have shown that psychological interventions such as mental imagery, self-regulation, and goal-setting significantly enhance motor skill acquisition and overall performance [5]–[7]. Meta-analytic evidence further indicates that imagery interventions produce moderate to large effects, particularly when combined with physical training [8].

Moreover, factors such as competitive anxiety, attentional focus, and self-confidence have been found to influence motor execution and performance outcomes directly [9]–[11]. From a neurophysiological perspective, mental training optimizes neural activation patterns, thereby enhancing coordination and decision-making during performance [12], [13]. Therefore, integrating psychological training into regular practice is essential to achieve optimal athletic performance.

Swimming is a time-based sport in which performance differences are often measured in milliseconds. Each phase of the race—including the start, underwater phase, stroke cycle, and finish—contributes directly to the final result [14], [15]. Among these phases, the start is a critical component, accounting for approximately 5–15% of total race time in sprint events [16], [17].

Biomechanical studies highlight that reaction time, take-off angle, and push-off force are key determinants of start performance [18], [19]. Even minor inefficiencies in these variables can result in significant performance losses, particularly at the elite level where margins of victory are extremely small [20].

In breaststroke, the start phase is more complex than in other strokes, as it involves a coordinated sequence of movements, including an explosive push-off, an underwater glide, a pull-out, and a transition into the first stroke cycle [21], [22]. These elements require optimal neuromuscular coordination, explosive strength, and precise timing [23]. Therefore, optimizing the start phase is essential for improving competitive performance.

In addition to biomechanical and physiological factors, psychological readiness plays a significant role in determining start performance. Athletes experiencing high anxiety or low confidence tend to exhibit delayed reaction times and reduced movement efficiency [10], [24].

Mental imagery is a widely used psychological training technique defined as the cognitive simulation of sensory and motor experiences without physical movement [6], [25]. According to psychoneuromuscular theory, imagery activates neural pathways similar to those involved in actual movement, thereby strengthening motor coordination [12]. In addition, symbolic learning theory suggests that imagery facilitates the cognitive organization of complex motor patterns [13].

The PETTLEP model (Physical, Environment, Task, Timing, Learning, Emotion, Perspective) enhances the effectiveness of imagery by ensuring that mental practice closely resembles real performance conditions [26]. Empirical studies have shown that PETTLEP-based imagery improves technical skills, reaction time, and motor performance across various sports [7], [8]. Furthermore, combining imagery with physical training produces greater performance improvements than physical training alone [8].

Despite the growing body of evidence supporting the effectiveness of mental imagery, research specifically focusing on its application to the breaststroke start phase remains limited. Most previous studies have examined general swimming performance or other stroke styles, leaving a gap in understanding its effectiveness in this specific technical component [16], [17].

This gap is important because the start phase requires rapid neuromotor activation, precise timing, and strong psychological readiness. Without adequate mental preparation, athletes may not be able to optimize their performance fully.

Preliminary observations at Dolphins Swimming Academy revealed variability in breaststroke start performance, including delayed reaction time, suboptimal push-off angles, and inconsistent underwater transitions. These findings suggest that current training methods may not sufficiently address psychological aspects of performance.

Therefore, this study aims to analyze the effectiveness of mental imagery training based on the PETTLEP model in improving breaststroke start performance among Dolphins Swimming Academy athletes. The results are expected to provide both theoretical contributions to sport psychology and practical implications for swimming training programs.

2. METHOD

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest model. This design was selected to analyze changes in breaststroke start performance before and after the implementation of a mental imagery training intervention. By comparing the initial and final conditions, this study aims to empirically examine the extent to which PETTLEP-based mental imagery contributes to improving start technique performance within an integrated physical and psychological training approach.

The participants in this study were athletes from the Dolphins Swimming Academy who were actively engaged in a regular training program. Participants were selected using purposive sampling based on technical readiness and physical condition. A total of 12 athletes aged 15-20 years were involved in this study. All participants had 2–4 years of swimming experience and had already mastered the basic breaststroke techniques. In addition, all athletes were in good physical condition and free from injury during the study period. The sample included both male and female athletes, reflecting the actual composition of the training population. These criteria were applied to ensure that any observed performance changes primarily reflected the effect of the mental imagery intervention rather than external factors such as limited technical ability or physical constraints.

Data collection was conducted by measuring breaststroke start performance, focusing on both technical execution and response readiness. The observed indicators included reaction time to the starting signal, time to complete the first 15 meters, and the quality of the pull-out phase. Time measurements were recorded objectively using digital timing devices commonly used in swimming training. In addition, video recordings were used to support the analysis of movement consistency and technical execution during the start phase.

The intervention consisted of mental imagery training based on the PETTLEP model (Physical, Environment, Task, Timing, Learning, Emotion, Perspective). The training program was conducted over 4 weeks, with 3 sessions per week. Each session lasted

 https://doi.org/10.58421/gehu.v5i4.1194

approximately 10–15 minutes and was performed before the physical training session. During each session, athletes were guided through structured imagery scripts that simulated the sequence of breaststroke start movements, including the starting position on the block, reaction to the start signal, explosive push-off, underwater glide, and transition into the first stroke cycle.

Athletes were instructed to use an internal (first-person) perspective to enhance the realism and effectiveness of the imagery experience. Emotional control and concentration were also emphasized during the sessions to improve psychological readiness. The intervention was supervised by both the coach and the researcher to ensure proper implementation and participant engagement. Furthermore, the imagery training was integrated with regular physical training (combined practice), enabling simultaneous reinforcement of cognitive representations and motor execution.

After completing the intervention, posttest measurements were conducted using the same procedures as in the pretest. The collected data were analyzed descriptively to identify performance trends and inferentially using a paired sample t-test to determine the significance of differences between pretest and posttest results. Prior to hypothesis testing, data normality was assessed using the Shapiro–Wilk test. The level of statistical significance was set at $p < 0.05$. All statistical analyses were performed using IBM SPSS Statistics version 25.

Through this approach, the research method not only serves as a technical procedure for data collection but also integrates sport psychology theory and practical coaching applications, thereby making meaningful contributions to the development of swimming performance training.

3. RESULTS AND DISCUSSION (

3.1. Results

The descriptive analysis indicates an improvement in breaststroke start skills following the implementation of PETTLEP-based mental imagery training. The measured variables, namely reaction time and 15-meter performance, represent key components of start skills, including response speed, explosive push-off, underwater glide efficiency, and transition into the first stroke cycle.

Table 1. Descriptive Statistics of Pretest and Posttest

Variables	**Mean**		**SD**	
	Pretest	Posttest	Pretest	Posttest
Reaction Time (s)	0.789	0.711	0.040	0.044
15 m Time (s)	8.324	7.744	0.235	0.265

Table 1 shows that the mean reaction time decreased from 0.789 seconds in the pretest to 0.711 seconds in the posttest. Similarly, the mean 15-meter time decreased from 8.324 seconds to 7.744 seconds. These improvements indicate better execution of start skills, particularly faster reaction time, a stronger push-off, and more efficient underwater movement.

To determine whether these improvements were statistically significant, a paired sample t-test was conducted.

Table 2. Results of Paired Sample t-test and Effect Size

Variables	t-value	p-value	Cohen's d
Reaction Time (s)	10.19	< 0.001	2.94
15 m Time (s)	20.36	< 0.001	5.88

The results of the paired sample t-test indicate that there were statistically significant differences between pretest and posttest scores for both variables. Reaction time showed a significant decrease ($t = 10.19$, $p < 0.001$), as did the 15-meter time ($t = 20.36$, $p < 0.001$). Since the p-values are lower than the significance level ($\alpha = 0.05$), it can be concluded that the PETTLEP-based mental imagery intervention significantly improved breaststroke start skills.

Furthermore, the effect size values (Cohen's $d = 2.94$ for reaction time and 5.88 for 15-meter time) are categorized as very large, indicating a strong practical impact of the intervention on athletes' performance. These findings suggest that mental imagery training not only produces statistically significant improvements but also meaningful enhancements in the execution of start skills.

In addition, the improvement trend was consistently observed across most participants, indicating that the intervention effect was relatively uniform and not limited to specific individuals. This consistency strengthens the evidence that PETTLEP-based mental imagery training is effective in enhancing both the technical and neuromotor aspects of breaststroke start performance.

3.2 Discussion

The findings of this study indicate that PETTLEP-based mental imagery training significantly improves breaststroke start skills, as reflected in reduced reaction time and improved 15-meter performance. These improvements suggest that mental imagery training enhances not only cognitive readiness but also neuromotor execution, particularly in the early phase of swimming performance. The reduction in reaction time indicates improved anticipatory motor control, allowing athletes to respond more quickly and accurately to the starting signal.

From an interpretative perspective, the results demonstrate that the start phase—being an explosive, time-sensitive component—benefits from enhanced coordination among perception, decision-making, and motor response. The improvement in the 15-meter time further reflects greater efficiency in the push-off force, underwater glide, and transition into the first stroke cycle. These findings confirm that start performance is a multidimensional skill involving both physical and psychological components.

Theoretically, these results are consistent with the psychoneuromuscular theory, which posits that mental imagery activates neural pathways similar to those used during actual movement execution. Through repeated imagery practice, athletes strengthen motor representations, resulting in improved coordination and faster response times. In addition, the findings support the symbolic learning theory, suggesting that imagery facilitates the cognitive organization of complex motor sequences, particularly in technically demanding skills such as the breaststroke start.

The effectiveness of the PETTLEP model in this study highlights the importance of contextual and functionally equivalent imagery. By incorporating physical, environmental, emotional, and task-specific elements, PETTLEP-based imagery enhances the realism of mental practice, thereby improving the transfer of learning to actual performance. This supports previous findings that contextualized imagery produces greater improvements in motor performance compared to generic visualization techniques.

Furthermore, the large effect sizes observed in this study reinforce the concept that combining mental and physical practice leads to more efficient skill acquisition. The integration of imagery training prior to physical practice allows athletes to cognitively rehearse movement patterns before executing them, resulting in more consistent and refined motor performance. This combined practice approach aligns with motor learning principles that emphasize the role of cognitive preparation in optimizing physical execution.

From a coaching perspective, these findings have important practical implications. First, mental imagery training can be systematically incorporated into regular training sessions, particularly before technical drills, to enhance readiness and focus. Second, coaches can utilize structured PETTLEP-based imagery scripts to guide athletes in visualizing specific movement sequences, especially in critical phases such as the start. Third, integrating psychological training into routine practice supports a more holistic coaching approach that develops not only physical capacity but also mental readiness and emotional control.

In addition, the results suggest that mental imagery training contributes to greater consistency across athletes, as improvements were observed in most participants. This indicates that PETTLEP-based imagery can be effectively applied in group training settings, making it a practical and scalable intervention for swimming academies and clubs.

However, it is important to note that the effectiveness of mental imagery may vary depending on individual factors such as imagery ability, concentration level, and training experience. Therefore, coaches should consider individual differences when implementing mental training programs to maximize their effectiveness.

Overall, this study demonstrates that PETTLEP-based mental imagery is not only an effective strategy for improving breaststroke start skills but also a valuable pedagogical approach that integrates cognitive, affective, and motor domains. These findings contribute to the development of more holistic and multidisciplinary training models in competitive swimming.

4. CONCLUSION

This study demonstrates that PETTLEP-based mental imagery training is effective in improving breaststroke start skills, as evidenced by significant reductions in reaction time and 15-meter performance. These findings indicate that mental imagery enhances anticipatory motor control, neuromotor coordination, and the efficiency of movement execution during the start phase. Thus, the results confirm that swimming performance, particularly in the start phase, is influenced by the integration of physical and psychological factors.

From a practical perspective, these findings suggest that mental imagery training can be systematically integrated into swimming coaching programs to improve technical performance and athlete readiness. The use of structured PETTLEP-based imagery before physical practice provides an efficient approach to strengthening cognitive representation and movement consistency. Future research is recommended to involve larger sample sizes, include control groups, and explore the application of mental imagery in other phases of swimming performance, such as turns and finishes, to enhance the generalizability and applicability of these findings.

ACKNOWLEDGEMENTS

The researcher says accept love to Dolphins Swimming Academy above support and work. The same during implementation research. Appreciation was also expressed to the athletes who actively participated in the series study. In most cases, sponsors and financial supporters are acknowledged.

REFERENCES

[1] Weinberg, R. S., & Gould, D. (2019). Foundations of sport and exercise psychology. Human Kinetics.
[2] Moran, A. (2012). Sport and exercise psychology. Routledge.
[3] Hardy, L., Jones, G., & Gould, D. (1996). Understanding psychological preparation for sport. Wiley.
[4] Vealey, R. S. (2007). Mental skills training. Fitness Information Technology.
[5] Cumming, J., & Williams, S. E. (2012). Imagery in sport. Oxford University Press.
[6] Guillot, A., & Collet, C. (2008). Construction of motor imagery. International Review of Sport and Exercise Psychology, 1(1), 31–44.
[7] Smith, D., Wright, C., Allsopp, A., & Westhead, H. (2007). PETTLEP imagery. Journal of Sport Sciences, 25(4), 429–438.
[8] Driskell, J. E., Copper, C., & Moran, A. (1994). Mental practice. Journal of Applied Psychology, 79(4), 481–492.
[9] Craft, L. L., et al. (2003). Anxiety and sport performance. JSEP, 25(1), 44–65.
[10] Guillén, F., & Sánchez, R. (2003). Competitive anxiety. Perceptual and Motor Skills, 96, 1059–1066.
[11] Jones, G. (1995). Anxiety-performance relationship. Sport Psychologist.
[12] Jeannerod, M. (1994). Motor imagery. Behavioral and Brain Sciences, 17(2), 187–202.
[13] Paivio, A. (1985). Cognitive theory of imagery.
[14] Maglischo, E. W. (2003). Swimming fastest. Human Kinetics.
[15] Arellano, R., et al. (1994). Swimming analysis. Journal of Applied Biomechanics.
[16] Mason, B., & Cossor, J. (2001). Start performance.
[17] FINA. (2017). Swimming rules.
[18] Vantorre, J., et al. (2010). Start analysis. Journal of Sports Sciences.
[19] Honda, K. E., et al. (2010). Block start. Sports Biomechanics.
[20] Tor, E., et al. (2015). Start performance. Journal of Sports Sciences.
[21] Barbosa, T. M., et al. (2010). Swimming biomechanics.
[22] Kjendlie, P. L., et al. (2013). Swimming learning.
[23] Toussaint, H. M., & Beek, P. J. (1992). Coordination.
[24] Moran, K. (2013). Water competency.
[25] Holmes, P. S., & Collins, D. (2001). PETTLEP model. Journal of Applied Sport Psychology.
[26] Wakefield, C., & Smith, D. (2012). PETTLEP imagery.