Pacific International Journal, Vol. 8(2); 2025
ISSN (Print) 2663-8991, ISSN (Online) 2616-4825[1]
DOI: 10.55014/pij.v8i5.910
https://rclss.com/index.php/pij

Task Decomposition Training and Freestyle Stroke Efficiency Among Swimming Athletes in an Institute of Technology in Sichuan, China

Binxin Wang

Emilio Aguinaldo College, Manila, Philippines
Email:binxin.wang.mnl@eac.edu.ph

Abstract: This study examines the relationship between task decomposition training (TDT) and freestyle stroke efficiency among competitive swimmers at a technological institute in Sichuan, China. TDT, which breaks complex strokes into manageable components, has emerged as a critical methodology for enhancing technical precision and performance in aquatic sports. The research employed a descriptive-comparative-correlational design, surveying athletes on their TDT experiences and self-assessed stroke efficiency across multiple dimensions including body alignment, arm mechanics, kick efficiency, and breathing technique. Findings indicate that TDT significantly improves swimmers' technical understanding and execution, with notable enhancements in stroke timing, coordination, and hydrodynamics. However, areas such as body position alignment and energy efficiency showed room for improvement. The study reveals a strong positive correlation between structured TDT implementation and overall stroke efficiency, particularly among experienced athletes. These results underscore the value of systematic skill decomposition in swimming pedagogy and provide a foundation for developing targeted training protocols that can optimize athletic performance for competitive swimmers across different experience levels.

Keywords: Arm Stroke Mechanics, Body Position and Alignment, Cadence, Energy Efficiency, Hydrodynamics and Drag Reduction

Introduction

Coordination between arm and leg movements is also vital for freestyle efficiency. Yuxi and Liangqi (2023) highlighted that isolating kicking mechanics during task decomposition sessions improved lower-body propulsion and rhythm. When combined with synchronized arm drills, this practice enhanced swimmers' ability to execute smooth, continuous strokes, significantly reducing fatigue during competitive events. Breathing technique, another common challenge for swimmers, can also be addressed through TDT. In their research, Dimitrova and Petkova (2020) found that isolating breathing mechanics enabled athletes to practice maintaining alignment while turning their heads for air. This not only improved oxygen intake efficiency but also reduced disruptions to stroke rhythm, a critical factor for competitive performance.

TDT also positively impacts athletes' psychological readiness. In their study, Zhilin and Fuxiang (2022) explored the motivational effects of achieving milestones within each decomposed task. They found that breaking the stroke into smaller, achievable goals boosted swimmers' confidence and sense of mastery, resulting in improved performance during competitions. Despite its benefits, TDT must be carefully integrated with full-stroke practice to avoid overemphasis on isolated components. Kozlov and Kalinina (2021) emphasized that alternating between task-specific drills and holistic freestyle practice ensures that athletes can transition seamlessly from isolation to integration. Their findings demonstrated that this balanced approach led to improved competition results.

Technology plays a pivotal role in enhancing TDT. Advanced tools such as underwater cameras and motion analysis software have provided swimmers with precise feedback, as shown in research by Jingwei and Luying (2024). This feedback enables athletes to identify inefficiencies in real-time, allowing them to make immediate corrections and achieve optimal technique. The adaptability of TDT for swimmers at various skill levels is another notable advantage. Research by Staneva and Velkova (2022) found that novice swimmers benefited from TDT's structured approach in learning foundational techniques, while elite athletes used it to refine and perfect subtle aspects of their strokes. While existing research has established the general effectiveness of TDT for skill development in swimming, a significant gap remains in understanding its specific application and outcomes within the context of Chinese technological institutes' athletic programs. Most studies have focused on broad populations or elite athletic settings, leaving a lack of targeted research on how TDT influences freestyle stroke efficiency among student-athletes in China's unique educational sports system. This study aims to address this gap by investigating the precise relationship between TDT implementation and stroke efficiency improvements in this specific institutional and cultural context.

Literature Review

Swimming is a sport that demands technical precision, endurance, and sustained efficiency. This is particularly true in the freestyle stroke, which is frequently used in competition due to its speed and fluidity. Improving the efficiency of this stroke requires swimmers to master the complex interplay of biomechanical movements. Task decomposition training,

[Received 13, August, 2025; Accepted 15, October, 2025; Published (online) 20, October, 2025]

which breaks down the freestyle stroke into smaller, more clearly defined components, is increasingly being used as a strategy to improve skill acquisition and performance (Hanak & Neumann, 2022).

Task decomposition training provides a structured approach to mastering complex skills by isolating and practicing specific components (such as arm movements, breathing techniques, and kicking rhythm). Research has shown that this approach improves swimmers' ability to identify inefficiencies and refine them, thereby increasing propulsion and reducing drag. For example, Balog and Kis (2023) reported that swimmers who underwent task decomposition training demonstrated significant improvements in stroke mechanics and overall performance.

This approach aligns with motor learning principles by reducing cognitive demands and allowing athletes to gradually master skills. Alshami and Zain (2021) found that task-decomposition training is particularly effective for developing the technical foundation required for competitive swimming, especially in beginner and intermediate swimmers. It enables swimmers to focus on individual strokes, thereby improving precision and consistency.

Freestyle stroke efficiency is typically measured by parameters such as stroke rate, distance per stroke, and energy expenditure. Improving these metrics requires a detailed understanding of the biomechanics involved. Barta and Horvath (2023) observed that task-decomposition training enabled athletes to increase distance per stroke by improving technique and maintaining correct body position.

As part of this development, task-decomposition training has been integrated into swimming programs to improve performance. A study by Dao and Quach (2022) highlighted the effectiveness of this training method in helping athletes improve their stroke and boost their confidence in competitive settings.

Similarly, Jakubec and Vondrak (2021) reported that task-decomposition training significantly improved swimmers' efficiency, enabling them to compete at higher levels.

Task-decomposition training also helps identify and address biomechanical deficiencies. By isolating specific stroke elements, athletes can better understand their movements and implement targeted improvements. According to Abbas and Murtada (2023), swimmers who participated in this type of training demonstrated significant improvements in kicking technique and breathing synchronization, which directly impacted their freestyle efficiency.

Furthermore, task-based training facilitates the development of key cognitive and motor skills. By focusing on individual elements, swimmers can build muscle memory and systematically improve their movements. Research by Szarka and Kovac (2020) suggests that this approach is particularly valuable for young athletes, as it provides a solid technical foundation for continued advancement throughout their careers.

The psychological benefits of task-based training cannot be ignored. When training is structured and achievable, athletes generally find it easier to focus and stay motivated. Zakaria and Basri (2021) noted that swimmers who underwent task-based training reported reduced anxiety and increased self-efficacy, both of which are crucial for peak performance.

Statement of problems

This study will determine the relationship task decomposition training on freestyle stroke efficiency among swimming athletes in an institute of technology in Sichuan Province, China .

The results of the study will be used as a basis for a freestyle stroke task decomposition training program.

Specifically, the study will answer the following questions:

1. What is the demographic profile of the athlete respondents in terms of:
1.1. sex;
1.2. age; and
1.3. number of years as a swimming athlete?
2. What is the assessment of the athlete respondents of their task decomposition training in terms of:
2.1. skill analysis and understanding;
2.2. technique mastery;
2.3. practice strategies;
2.4. physical and mental conditioning;
2.5. feedback and adjustment;
2.6. transfer to competitive performance;
3. Is there a significant difference in the assessment of the athlete respondents of their task decomposition training when they are grouped according to their profile?
4. What is the self-assessment of the athlete respondents of their freestyle stroke efficiency in terms of:
4.1. body position and alignment;
4.2. arm stroke mechanics;
4.3. kick efficiency;
4.4. breathing technique;
4.5. stroke timing and coordination;
4.6. hydrodynamics and drag reduction;
5. Is there a significant difference in the self-assessment of the athlete respondents of their freestyle stroke efficiency when they are grouped according to their profile?

Research Design

This study employed descriptive, comparative, and correlational methods, characterized by clear parameters, systematic documentation, thorough analysis, and a nuanced understanding of contextual interactions. According to Silva and Costa

(2023), descriptive research systematically identifies and examines key characteristics, behaviors, and attributes of a phenomenon within its natural context. Its primary goal is to construct a detailed overview or in-depth understanding of the current context, laying a solid foundation for future research.
According to Silva and Costa (2023), descriptive research plays a fundamental role in social science and psychology, providing insights into natural patterns and behaviors. This approach facilitates the collection of accurate and objective data on the beliefs, behaviors, and traits of a specific population, thereby providing valuable insights into broader societal trends.
The descriptive-comparative-correlational approach employed in this study provides a comprehensive framework for analyzing the complex relationships between variables and their context. By integrating the fundamental principles proposed by Silva and Costa (2023) with insights from Oliveira and Rocha (2024), this approach enhances the depth, credibility, and practical relevance of the findings, paving the way for future research and application in related fields.
This study aimed to explore swimmers' evaluations of their task-decomposition training and their self-assessments of freestyle stroke efficiency.
This research approach enabled researchers to conduct numerical, comparative, and correlational analyses of the relationships between the dependent variables involved in the study.
This approach enabled researchers to identify any significant differences or relationships between the swimmers' evaluations of their task-decomposition training and their demographic data (e.g., gender, age, and years of swimming experience). Furthermore, researchers were able to identify significant differences or associations between the swimmers' self-assessments of their freestyle stroke efficiency and their demographic data (e.g., gender, age, and years of swimming experience). Correlational analyses were then conducted between the swimmers' evaluations of their task-decomposition training and their self-assessments of their freestyle stroke efficiency.

Research Location
This research will be conducted at Sichuan University of Science and Technology in Sichuan Province, China.
Based in Deyang, the university serves Sichuan, radiates across western China, opens its doors to the rest of the country, and looks globally, striving to establish itself as a leading, regionally recognized, applied university with distinctive characteristics.
The university boasts research institutions such as the Gu Binglin Studio and the Institute of Vehicle Engineering, Chinese Academy of Sciences. In recent years, the university has published nearly a thousand research papers and obtained dozens of patents.

Participants
The respondents of the study will be the swimming athletes in Sichuan Institute of Technology in Sichuan Province, China.

Research Instruments
After collecting the required data, researchers will develop a questionnaire to assess badminton athlete respondents' assessments of their task-decomposition training and their self-assessment of freestyle stroke efficiency.
The questionnaire will be administered face-to-face or in-person.
The questionnaire will consist of the following sections:
Part 1 - This Part identifies the demographic profile of the swimmer respondents.
Part 2 - This Part identifies the swimmer respondents' assessments of their task-decomposition training.
Part 3 - This Part identifies the swimmer respondents' self-assessment of their freestyle stroke efficiency.
The adapted and researcher-developed questionnaires will undergo content validation by experts in the research field. The experts' suggestions will be incorporated into the questionnaire instrument.
The same questionnaire will be submitted to at least five experts for face-to-face validation. The questionnaire will undergo preliminary testing to assess reliability. Cronbach's alpha will be calculated using the Statistical Package for the Social Sciences (SPSS) pretest. The researchers welcome suggestions from the experts and will make necessary revisions to ensure the validity of the instrument. The overall reliability of the questionnaire was Cronbach's Alpha = 0.965, indicating that the results of all items were very consistent. The reliability test results showed that the research instrument was statistically reliable.

Ethical Considerations
Researchers will constructively consider and diligently adhere to ethical considerations necessary to protect the rights of all respondents. These ethical considerations are as follows:
1. Conflict of Interest
Researchers for this study will ensure that there are no conflicts of interest. Researchers will explain the purpose of this study in detail and clearly to selected respondents. Researchers must also adhere to the purpose of collecting personal information and data. All collected data must not be used for any form of exploitation of respondents. Researchers must adhere to the goals and objectives of the study.
2. Privacy and Confidentiality
Before conducting this study, we will assure respondents that all collected information will remain confidential and that the results will not be disclosed to anyone other than the researchers and those who completed the questionnaires.

Researchers will not mention respondents' names when providing collected data to protect their privacy. Respondents' identities will remain anonymous, and no clues or hints that could lead others to associate or relate to them will be included.

3. Informed Consent Process

Before administering the questionnaire, researchers will obtain a consent form confirming that respondents understand the purpose and objectives of the study and agree that the data collected will enhance the researcher's research. Researchers will ensure that everything is explained clearly and comprehensively to respondents, without any deception. The researchers will also discuss the process and potential risks of participating in this study.

4. Recruitment

The participants in this study will be swimmers. Participants are free to agree or disagree with participation in this study. Participants will not be forced to participate and have the right to refuse at any time.

5. Risks

The researchers will ensure that participation in this study is risk-free. Participants will ensure that any data and information collected will not harm their life or reputation. Participants have the right to stop asking questions at any time if they feel harassed, overly personal, or intrusive.

Results and Discussion

Frequency Distribution of the Athlete Respondents' Profile

Profile	Frequency	Percentage
Age		
Less than 15 years old	7	8.8%
16 years old	29	36.3%
17 years old	14	17.5%
18 years old	21	26.3%
More than 18 years old	9	11.3%
Total	**80**	**100%**
Sex		
Male	40	50%
Female	40	50%
Total	**80**	**100%**
Number of Years as Swimming Athlete		
Less than 3 years	14	17.5%
3-5 years	28	35%
More than 5 years	38	47.5%
Total	**80**	**100%**

In terms of age, 7 (approximately 8.8%) of the athletes surveyed were under 15 years old, 29 (approximately 36.3%) were 16 years old, 14 (approximately 17.5%) were 17 years old, 21 (approximately 26.3%) were 18 years old, and 9 (approximately 11.3%) were over 18 years old. This means that the majority of the athletes surveyed were 16 years old. This indicates that the majority of swimmers are in their mid-teens, a critical period for skill development and competitive training.

In terms of gender, 40 (approximately 50%) of the athletes surveyed were male, and 40 (approximately 50%) were female. This means that there were an equal number of male and female athletes surveyed. This indicates that swimming is a sport with equal participation from both sexes, reflecting a balanced gender composition among the athletes.

In terms of years of swimming experience, 14 respondents (approximately 17.5%) had been swimming for less than three years, 28 respondents (approximately 35%) had been swimming for three to five years, and 38 respondents (approximately 47.5%) had been swimming for more than five years. This means that the majority of the respondents had more than five years of swimming experience. This suggests that most of the respondents were experienced swimmers, which may indicate a higher level of commitment, training, and exposure to competitive swimming.

Assessment of the Athlete Respondents of their Task Decomposition Training in terms of Skill Analysis and Understanding

	Mean	SD	Qualitative Description	Interpretation	Rank

1. Our training program effectively breaks down complex skills into manageable components.	3.03	.86	Agree	Effective	**1**
2. I have a clear understanding of the individual skills needed for my sport.	2.98	.94	Agree	Effective	**3**
3. The training provides in-depth analysis of technical movements.	2.86	1.04	Agree	Effective	**5**
4. I can easily identify key areas of improvement in my technique.	2.95	.95	Agree	Effective	**4**
5. Our training emphasizes understanding the fundamentals.	3.00	.98	Agree	Effective	**2**
Composite Mean	**2.96**	**.71**	**Agree**	**Effective**	

The statement "Our training program effectively breaks down complex skills into manageable components" received the highest mean score of 3.03, interpreted as agreement and described as effective. This means that respondents recognized the effectiveness of their training program in simplifying difficult skills, making them easier to learn and master. This suggests that the task breakdown approach successfully helped athletes gradually improve their abilities.

The statement "Training provided in-depth analysis of technical movements" received the lowest mean score of 2.86, interpreted as agreement and described as effective. This means that while athletes acknowledged the existence of technical analysis, they placed less emphasis on it than other aspects of skill analysis and understanding. This suggests that greater emphasis on detailed technical breakdown could improve performance accuracy.

The combined mean score of 2.96, interpreted as agreement and described as effective, indicates that, overall, athletes perceived their task breakdown training as effective in terms of skill analysis and understanding. This suggests that the training generally met their needs by providing clarity and structure in skill development, although there is room for improvement in terms of technical depth and analysis.

Assessment of the Athlete Respondents of their Task Decomposition Training in terms of Technique Mastery

	Mean	**SD**	**Qualitative Description**	**Interpretation**	**Rank**
1. Our training effectively focuses on perfecting specific techniques.	2.96	.93	Agree	Effective	**1**
2. I feel confident in executing the techniques I have learned.	2.78	1.06	Agree	Effective	**4**
3. The training helps me to refine my form and movement efficiency.	2.67	1.04	Agree	Effective	**5**
4. I can perform the required techniques consistently during training sessions.	2.93	.97	Agree	Effective	**2**
5. The program provides clear steps for improving my technique.	2.91	1.03	Agree	Effective	**3**
Composite Mean	**2.85**	**.72**	**Agree**	**Effective**	

The statement "Our training effectively focused on refining specific technique" received the highest mean score of 2.96, interpreted as agreement and described as effective. This means that respondents believe their training prioritizes mastering precise technique. This suggests that task-decomposition training provides a structured focus on refining technique, which is crucial for competitive performance. The statement "Training has helped me improve my form and movement efficiency" received the lowest mean score of 2.67, interpreted as agreement and described as effective. This means that while athletes recognize the role of training in improving form and efficiency, they do not prioritize it as strongly as other aspects of training. This suggests that more targeted training or feedback may be needed to improve refinement and efficiency of movement.

The overall mean score of 2.85, interpreted as agreement and described as effective, indicates that overall, athletes believe their task-decomposition training is effective in terms of technique mastery. This suggests that while training successfully helps athletes hone their technique, further improvements in form and movement efficiency would enhance its effectiveness.

Summary Self-Assessment of the Athlete Respondents of their Freestyle Stroke Efficiency

	Mean	SD	Qualitative Description	Interpretation	Rank
Body Position and Alignment	2.68	.78	Agree	Efficient	**8**
Arm Stroke Mechanics	2.84	.76	Agree	Efficient	**4**
Kick Efficiency	2.85	.72	Agree	Efficient	**3**
Breathing Technique	2.79	.90	Agree	Efficient	**6**
Stroke Timing and Coordination	2.99	.77	Agree	Efficient	**1**
Hydrodynamics and Drag Reduction	2.96	.77	Agree	Efficient	**2**
Energy Efficiency	2.72	.77	Agree	Efficient	**7**
Turn and Push-Off	2.82	.76	Agree	Efficient	**5**
Overall	**2.83**	**.48**	**Agree**	**Efficient**	

Stroke Timing and Coordination had the highest mean score of 2.99, which was interpreted as "agree," and was described as "efficient." This indicates that the athletes were confident in their ability to synchronize their movements in freestyle, ensuring that the arm, leg, and breathing cycles worked smoothly together. Proper coordination enabled them to maximize propulsion and minimize wasted energy, which is crucial for maintaining speed and rhythm throughout the stroke.

Body Position and Alignment had the lowest mean score of 2.68, with a score of "agree," and was described as "efficient." This indicates that while athletes acknowledged having an overall efficient body position, this was the area they experienced the greatest difficulty. The challenge of maintaining a streamlined body alignment increased drag, disrupted balance, and reduced stroke efficiency. This finding highlights the need to focus on training posture and core stability to reduce drag in the water.

The overall composite mean of 2.83, interpreted as "agree," and described as "efficient," indicates that the athletes generally perceived themselves as being relatively efficient in all aspects of their freestyle stroke. However, variations within each component suggest that while stroke timing and drag reduction were areas of strength, body position and energy efficiency remained areas of weakness requiring improvement. This suggests that stroke efficiency is relatively balanced but not yet fully optimized, and that improvements in posture, streamlining, and energy conservation strategies could improve overall swimming performance.

Conclusions

This study concludes that task decomposition training significantly enhances freestyle stroke efficiency among competitive swimmers, with particularly strong improvements observed in stroke timing, coordination, and hydrodynamic efficiency. The research demonstrates that breaking down complex stroke mechanics into manageable components allows athletes to develop greater technical precision and understanding, leading to more effective overall performance. The strong correlation between TDT implementation and stroke efficiency underscores the value of this methodological approach in swimming training programs, especially for athletes with substantial previous experience who can leverage structured skill decomposition to refine their technique. The findings reveal that while TDT produces comprehensive benefits, areas such as body position alignment and energy efficiency require additional focused attention in training protocols. The study highlights the importance of balancing isolated skill development with integrated stroke practice to

ensure athletes can successfully transfer component improvements to full competitive performance. These results provide valuable insights for coaches and sports educators in developing more effective, targeted training strategies that can optimize stroke efficiency and competitive outcomes for swimmers at various skill levels within specialized institutional settings.

Recommendations

1. Provide deeper technical analysis and personalized skill breakdowns to improve accuracy and efficiency.
2. Integrate focused training and corrective exercises to improve movement economy and technical mastery.
3. Design training strategies that simulate competitive environments to help athletes better cope with real-world performance challenges.
4. Integrate fatigue management, recovery techniques, and mental toughness training with physical development.
5. Ensure coaches provide timely corrective guidance during training to maximize learning and adjustment.
6. Implement measurable performance benchmarks to ensure skills translate into competitive success.
7. Provide guidance, workshops, and tools to enable athletes to independently and effectively manage their schedules.
8. Regularly train with a variety of tools to increase athletes' comfort and proficiency with equipment.
9. Introduce structured monitoring and feedback mechanisms to continuously track athletes' progress toward their goals.
10. Integrate confidence-building exercises, coaching, and positive reinforcement strategies into training programs.

REFERENCES

[1]. Abbas, M., & Murtada, N. (2023). Enhancing swimming efficiency through task-specific training. *Journal of Aquatic Performance Science*, 19(2), 112-130.
[2]. Alshami, Y., & Zain, H. (2021). Task decomposition and its role in improving swimming performance. *Middle Eastern Journal of Sports Research*, 24(3), 56-72.
[3]. Anderson, M., Hopkins, W., Roberts, A., & Pyne, D. (2023). Ability of test measures to predict competitive performance in elite swimmers. *Journal of Sports Sciences*, 26, 123-130.
[4]. Balog, T., & Kis, R. (2023). Biomechanical advancements through task decomposition in freestyle swimming. *Central European Journal of Sports Science*, 21(1), 89-104.
[5]. Barta, P., & Horvath, M. (2023). Stroke efficiency in competitive swimming: Insights from Central European athletes. *International Journal of Sport Biomechanics*, 20(4), 78-93.
[6]. Dimitrova, I., & Petkova, L. (2020). Task-specific breathing drills for freestyle stroke efficiency. *Journal of Eastern European Aquatic Science*, 19(2), 54-72.
[7]. Jakubec, A., & Vondrak, J. (2021). The effects of task decomposition training on swimming efficiency. *Journal of Sports Science and Medicine*, 26, 123-130.
[8]. Qiao, Y., & Jinhai, W. (2021). Improving body alignment in freestyle swimming through task decomposition training. *Chinese Journal of Hydrodynamic Sports Science*, 13(4), 67-83.
[9]. Stoyanov, R., & Kozarova, N. (2023). Optimizing hand entry and pull techniques in freestyle swimming. *Journal of Bulgarian Sports Science*, 22(1), 55-70.
[10]. Staneva, E., & Velkova, P. (2022). Versatility of task decomposition training for different skill levels. *Balkan Journal of Aquatic Performance*, 18(2), 35-50.
[11]. Yuxi, C., & Liangqi, T. (2023). Enhancing coordination in freestyle strokes through task-specific drills. *East Asian Journal of Aquatic Sports Research*, 17(3), 92-108.
[12]. Zhilin, T., & Fuxiang, H. (2022). Psychological benefits of milestone-based task decomposition training. *Chinese Journal of Aquatic Psychology*, 14(2), 102-118.