Available online at https://journal.uny.ac.id/index.php/jorpres

JORPRES (Jurnal Olahraga Prestasi), 22 (1), 2026, 13-22

Validity and reliability of dryland, flexibility and visualization (DFV) training model to improve butterfly swimming

Nur Indah Pangastuti[1*], FX. Sugiyanto[1], Devi Tirtawirya[1]
[1]Pendidikan Kepelatihan, Fakultas Ilmu Keolahragaan, Universitas Negeri Yogyakarta, Jl. Colombo No. 1, Karangmalang, Depok, Sleman, Daerah Istimewa Yogyakarta, Indonesia.
[*]Corresponding Author. Email: indahpangastuti@uny.ac.id

Abstract
The training model used so far is still partial, such as the separation between physical, technical, and mental training. This study conducted a study on the combination of physical and mental training with the abbreviation DFV (Dryland, Flexibility, Visualization) training model. The purpose of the study was to develop and assess the validity and reliability of the DFV training model with the imposition of improving butterfly swimming technique skills on beginner swimmers aged 10-11 years. A total of seven experts were asked to assess 17 movement items of the DFV training model. The seven experts were divided into three theorists and four professional swimming coaches. Data were collected using the Delphi technique and then analyzed using the Aiken formula for validity and Cronbach's alpha for reliability. The results obtained in the Aikens test were 0.899. Based on the Aiken's table value with seven expert validators is 0.86, so it can be concluded that the movement items of the DFV Exercise model are valid with a significance level of 0.07. Cronbach's alpha is used to measure the reliability of each aspect of the DFV exercise model instrument, with the result of 0.833 which is greater than the alpha value (0.6) then it can be said that this exercise model is reliable. Based on the results of the calculation of the validity and reliability values, it shows that this DFV exercise model can be continued for further development. The implications of this study can prove that the DFV exercise model can be used to improve butterfly swimming skills in beginner athletes aged 10-11 years which can be used for coaches and in physical education teaching.
Keywords: Swimming, Butterfly, Dryland, Flexibility, Visualization.

INTRODUCTION

Competitive swimming is a sport that focuses on achieving maximal swimming speed by an athlete (Kurniawan, 2012). Performance in competitive swimming is influenced by a number of interrelated elements, including physiological, neuromuscular, technical, and psychological factors (Cavaggioni et al., 2024). These elements collectively determine an athlete’s ability to achieve optimal performance. There are four swimming strokes contested in competitions: freestyle, backstroke, butterfly, and breaststroke. Among these strokes, the butterfly stroke is considered the most technically demanding (Haller, 2011). The butterfly stroke is characterized by symmetrical movements of the arms and legs combined with a dynamic undulating body motion. The movement sequence begins with a glide in a streamlined body position. The arm action starts with both arms pulling simultaneously with a high elbow position, followed by a powerful push phase, and continues with the recovery phase in which both arms are lifted above the water surface to return to the initial position. Meanwhile, the leg movement is performed simultaneously in a dolphin-like kicking motion, executed twice within one arm cycle: once when the hands enter the water and once during the recovery phase. Breathing is performed by lifting the head upward to inhale. Smooth coordination between arm movements, leg actions, body motion, and breathing is essential to achieve efficiency and speed. The resistance encountered during butterfly swimming is relatively high; therefore, achieving optimal speed requires careful attention to several technical skills, including a streamlined body position, effective water catch, adequate pressure on the water during the arm pull, acceleration throughout the movement, appropriate leg kick rhythm,

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

effective breathing technique, and precise rhythm and timing (Bay, 2016). Given its high level of difficulty, accuracy and correctness of movement are key factors in achieving maximal speed in the butterfly stroke (Strzał et al., 2017).

Training models commonly used to improve butterfly swimming skills primarily involve technical drill exercises, which are divided into arm drills, leg drills, and movement coordination drills (Morais et al., 2014). These drill exercises are beneficial for repetition and for focusing on specific targeted movements; however, they are considered insufficient in addressing the full range of required performance aspects (Lucero, 2013). Butterfly arm drills are often perceived as particularly difficult to perform, especially for novice athletes, due to the high physical demands involved. Drill-based training typically focuses on isolated movements and relies heavily on verbal instruction and repetition. As a result, beginner athletes may experience difficulty in accurately understanding the visual and technical precision required for proper butterfly stroke execution (Riewald et al., 2015). In addition, the butterfly stroke demands considerable muscular strength, particularly in the core, shoulder, and back muscles (Maglischo, 2022). Drill training is generally regarded as traditional and monotonous; therefore, training approaches should integrate both in-water and dryland training methods. Dryland training can enhance propulsive capacity in the water and contribute to improvements in athletes' technical performance (Popovici et al., 2013). Emphasizing correct and precise butterfly stroke mechanics should be reinforced through visualization-based approaches. Rapid advancements in coaching science have enabled the development of training models that incorporate dryland training, flexibility exercises, and visualization techniques (Fone et al., 2022; Perdana, 2014; Simpson, 2012).

Dryland training is essential to implement as it can contribute to maximal improvements in athletes' performance. In general, the primary objective of dryland training is to enhance muscular endurance by increasing the strength of active muscle groups and subsequently to develop speed through muscular strengthening (Atabas, 2017). Dryland exercises aimed at improving butterfly swimming skills include core muscle strengthening, shoulder and back muscle strengthening, arm and leg strength development, body coordination and stability, as well as overall flexibility. Flexibility in swimming, particularly in the butterfly stroke, plays a significant role in reducing hydrodynamic resistance and improving energy efficiency during movement execution. The specific emphasis on flexibility and mobility training within dryland programs has been shown to enhance athletic performance by improving technical efficiency (Wang et al., 2021; Liu et al., 2022). Swimmers with higher levels of flexibility tend to achieve greater swimming speed due to their ability to utilize body movements optimally across a wider range of motion.

In addition, athletes require clear technical understanding of butterfly stroke movements, which can be facilitated through visualization training. Visualization is a form of mental training that has a positive impact on psychological aspects, including reducing anxiety and enhancing self-confidence, self-efficacy, and concentration (Post et al., 2012; Predoiu et al., 2020). Visualization training enables athletes to perceive and internalize correct body positioning in the water and to optimize propulsive techniques involving arm movements, leg actions, breathing, and precise movement coordination (Erzaou et al., 2022). Based on these considerations, the three training models—dryland training, flexibility training, and visualization—can be integrated into a unified training approach to support athletic performance. However, existing training practices predominantly apply only a single training model and are largely limited to in-water swimming exercises, such as technical drills, interval training, and various forms of pool-based practice.

This study specifically aims to develop and examine the validity and reliability of a dryland training model combined with flexibility training and visualization approaches to support butterfly swimming skills. The main activities of this research include the design of the training model based on theoretical review and best practices, content validation through expert judgment, limited-scale trials with a small group of participants to assess clarity and applicability, and reliability testing through repeated implementation to measure consistency of outcomes. All procedures will be systematically documented to produce a training model that is not only valid and reliable but also practical and applicable within the context of competitive swimming training.

METHOD

This research study employed a Research and Development (R&D) approach, focusing on the examination of the validity and reliability of the Dryland, Flexibility, and Visualization (DFV) training

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

model designed to enhance butterfly swimming skills. The R&D approach was selected because it enables researchers to systematically develop and evaluate a training model prior to its implementation on a broader scale (Sugiyono, 2019; Thomas, Nelson, & Silverman, 2015). At this stage of the research, the focus was directed toward assessing content feasibility and instrument consistency through expert evaluation, without involving experimental field effectiveness testing.

Data collection was conducted using the Delphi technique. The Delphi technique is a systematic and structured consensus-based research method that involves a panel of experts to reach agreement on complex issues through multiple rounds of data collection (Dašić, Kostadinović, & Stanković, 2023). This technique provides a platform for generating rich and diverse perspectives while facilitating efficient information exchange among experts (Dašić, 2023). The Delphi technique was chosen because the participating experts were located in different regions across Java Island, allowing for effective coordination and consensus building without geographical constraints.

The research subjects consisted of seven experts who were purposively selected based on their expertise and experience in swimming coaching, sport science, sports biomechanics, and motor learning. The panel comprised three academic experts and four professional swimming coaches. The selection of experts was based on criteria related to professional experience, reputation, availability, motivation to participate in the study, judgment, and overall quality (Ibáñez et al., 2019; Skjong, 2001). The selected experts were required to meet at least three of the following seven criteria: (i) holding a doctoral degree in Sport Science; (ii) serving as a university lecturer; (iii) possessing the highest level of certification within a national sports federation; (iv) having a minimum of ten years of teaching experience at the university level; (v) having at least ten years of coaching experience; (vi) having published scholarly articles in the field of sport; and (vii) having demonstrated coaching achievements in sport (Ibáñez et al., 2019; Ortega-Toro et al., 2019). Expert involvement in development research is essential to ensure content appropriateness, safety, and relevance of the training model to the specific demands of the sport (Hsu & Sandford, 2007).

The experts were asked to evaluate 17 training movements encompassing dryland, flexibility, and visualization components. Each movement was assessed using a four-point rating scale instrument that included aspects of movement suitability to butterfly swimming characteristics, clarity of instructional guidance, training safety, and contribution to the improvement of technical swimming skills. In addition to providing quantitative ratings, the experts also offered qualitative suggestions and feedback to support the refinement of the training model. Data analysis was conducted using both quantitative and qualitative approaches. The content validity of the training model was analyzed using Aiken's V coefficient to determine the level of agreement among experts for each movement item (Aiken, 1985). Subsequently, instrument reliability was examined using Cronbach's Alpha coefficient to assess the internal consistency among assessment items (Cronbach, 1951)

Qualitative data in the form of experts' suggestions and feedback were analyzed descriptively and used as the basis for revising the training model to enhance its applicability and alignment with athletes' needs. This process is consistent with training model development principles that emphasize the integration of theoretical foundations and coaches' practical experience to improve the quality of sport training programs (Bompa & Buzzichelli, 2019). Accordingly, the developed DFV training model is not only statistically valid and reliable but also relevant and feasible for implementation within the context of butterfly swimming development. The findings of this study were utilized as the basis for revising the DFV training model with the aim of improving butterfly swimming skills among beginner athletes in the KU IV age category.

RESULSTS AND DISCUSSION

Descriptions of the DFV Model

The development of the training model instrument in this study was adapted from the dryland training model proposed by Zin (2018). This study integrates three training models into a single comprehensive approach aimed at improving butterfly swimming skills. These three training models consist of dryland training, flexibility training, and visualization training (DFV). All three components are considered essential for enhancing butterfly swimming performance (Ozeker et al., 2020; Smerecka, 2015; Predoiu et al., 2020). In this study, dryland training development places greater emphasis on improving swimming technique through accurate arm movements and proper timing, as well as strengthening the lower limb and core muscles. Flexibility training focuses on basic flexibility exercises

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

targeting the ankle and back muscles. Visualization training is designed to deepen athletes' understanding of precise butterfly stroke movements. The selection of these training components is based on their interrelated nature. Integration and modification were conducted to simplify the movement patterns within the DFV training model while optimizing its objectives to enhance technical movement performance.

The DFV training model is an integrated training approach combining dryland, flexibility, and visualization exercises to improve swimming skills, particularly the butterfly stroke, among beginner swimmers aged 10–11 years. The DFV model comprises 17 movement indicators, namely: visualization, on-the-wall flies, butterfly good morning, child and cobra pose, butterfly raise, butterfly back stretch, praying stretch, hollow man rock, kayang, standing dolphin kick, squat to overhead, squat butterfly, hip hinge progressive, ankle flexor, streamline gluteus raise, bow, and scorpion stretch (Table 1). The dryland training component emphasizes technical correction and core muscle strengthening; flexibility training provides foundational flexibility exercises appropriate for athletes aged 10–11 years; and visualization training is tailored to the cognitive developmental stage of the athletes. This integrated approach is expected to support the optimal development of butterfly swimming technique among beginner swimmers.

Table 1. DFV Exercise Model Motion Indicator

Variable	Factors	Motion Indicators	Movement Objectives
Butterfly Swimming Skills	Visualization	Visualization	Athlete has a picture of the correct butterfly swimming stroke movement
	Dryland	On The Wall Flies	Improves arm movement during pull, push and recovery movements.
		Butterfly Good morning	Improve arm and body movements by performing undulation movements
		Butterfly Raise	Improves the accuracy of breathing coordination
		Hollow Man Rock	Improve core
		Standing Dolphine kick	Increase flexibility and improve undulation motion
		Squat to Overhead	Improve streamline position and increase leg muscles
		Squat Buterfly	Improve leg strength and undulation technique
		Hip Hinge Progresive	Increases upper leg strength and undulation
		Streamline gluteu raise	Increase pelvic muscle strength and maintain a streamlined position
		Bow	Increase flexibility and strength of back muscles
	flexibility	Praying Stretch	Improves flexibility of the upper back and arms
		Kayang	Increase body flexibility
		Ankle Flexor	Increase ankle flexibility
		Scorpion Stretch	Increases flexibility of the trunk

Statistical Analysis

To conduct an in-depth examination, this study employed a development methodology supported by both qualitative and quantitative approaches (Creswell, 2016; Harrison et al., 2020; Terwee et al., 2018). Three academic experts and four professional swimming coaches consented to participate in the data collection process. The empirical and content validity of the DFV training model were used to evaluate its overall validity. One of the most commonly used methods for determining the content validity of a questionnaire is expert judgment. This method allows experts to recommend which items should be included in an instrument to define the construct being measured or, as in the present study,

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

to evaluate pre-developed items based on a set of quantitative or qualitative criteria (by assigning scores) and to suggest or implement modifications to the wording if deemed necessary (Garrote & del Carmen Rojas, 2015; Guillot-Valdés et al., 2022). Expert evaluation was conducted using a four-point Likert scale. The use of an even-numbered scale was intended to strengthen the clarity of the results and to encourage experts to make more decisive judgments when selecting responses, thereby reducing neutral or ambiguous choices (Sugiyono, 2019, p. 93).

This procedure has been widely used by researchers to assess the content validity of newly developed instruments or adaptations of existing instruments (Leyton-Román et al., 2021). There are three main steps involved in conducting content validity assessment. First, the authors compiled relevant research sources and conducted an initial participatory observational study to develop the training model, followed by a preliminary evaluation of the collected data. Second, the researchers applied the Delphi technique (Wilpers et al., 2020). The Delphi technique is employed to obtain expert consensus on a specific subject through a structured, iterative, and multi-stage process (Hasson et al., 2000). The third step involved analyzing the collected data in the form of quantitative results derived from the evaluations of seven experts using a four-point scale, as well as qualitative feedback provided by the same experts (Yudhistira & Tirtawirya, 2021). Content validity was calculated using Aiken's V coefficient to determine criteria for item modification or elimination (Aiken, 1980, 1985; Penfield & Giacobbi, 2009; Torres-Luque et al., 2020). Cronbach's Alpha coefficient was used to assess internal consistency and the reliability of the DFV training model, with values of 0.70 or higher indicating acceptable reliability (Rahayu & Arovah, 2022; Sharma, 2016).

Table 2. Validity of Aiken's V Calculation

Rater	Rater 1		Rater 2		Rater 3		Rater 4		Rater 5		Rater 6		Rater 7		$\sum s$	V	Desc
Item	R	S	R	S	R	S	R	S	R	S	R	S	R	S			
Item 1	4	3	4	3	4	3	4	3	3	2	3	2	4	3	19	0,905	Valid
Item 2	4	3	4	3	4	3	3	2	4	3	2	1	4	3	18	0,857	Valid
Item 3	4	3	4	3	3	2	4	3	4	3	3	2	4	3	19	0,905	Valid
Item 4	4	3	4	3	4	3	4	3	4	3	3	2	3	2	19	0,905	Valid
Item 5	3	2	4	3	4	3	3	2	4	4	3	2	4	3	18	0,857	Valid
Item 6	4	3	4	3	3	2	4	3	4	3	4	3	3	2	19	0,905	Valid
Item 7	4	3	4	3	4	3	4	3	4	3	3	2	4	3	20	0,952	Valid
Item 8	4	3	3	2	4	3	4	3	3	2	3	2	4	3	18	0,857	Valid
Item 9	3	2	4	3	4	3	4	3	4	3	4	3	3	2	19	0,905	Valid
Item10	3	2	4	3	4	3	4	3	4	3	4	3	3	2	19	0,905	Valid
Item11	4	3	3	2	4	3	4	3	3	2	3	2	4	3	18	0,857	Valid
Item12	4	3	4	3	4	3	4	3	4	3	3	2	4	3	20	0,952	Valid
Item13	4	3	4	3	4	3	4	3	4	3	3	2	4	3	20	0,952	Valid
Item14	3	2	3	2	4	3	4	3	4	3	3	2	3	2	18	0,857	Valid
Item15	4	3	4	3	4	3	4	3	4	3	3	2	3	2	19	0,905	Valid
Item16	4	3	4	3	4	3	4	3	4	3	3	2	4	3	20	0,952	Valid
Item17	4	3	4	3	3	3	4	3	3	2	3	2	4	3	18	0,857	Valid
Total	**64**	**47**	**65**	**48**	**65**	**48**	**66**	**49**	**64**	**48**	**53**	**36**	**63**	**46**	**321**	**0,899**	**Valid**

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

Content Validity

Based on Aiken's V critical value table, when the number of validators is seven experts, the minimum acceptable value is 0.86. The results of the content validity calculation yielded an Aiken's V value of 0.899. Since the obtained value (0.899) exceeds the critical table value (0.86), it can be concluded that the DFV movement items are valid in terms of content validity using Aiken's V coefficient at a significance level of 0.07. The results of the Aiken's V analysis provide evidence that the DFV training model demonstrates a high level of content validity. This finding indicates that the development of the DFV training model meets the requirements to be used as an appropriate training model for improving butterfly swimming movement skills among beginner athletes in the KU IV category.

Reliability

Cronbach's Alpha was used to assess the reliability of the raters. In this study, the reliability correlation coefficient obtained from repeated evaluations produced positive results. According to Heale and Twycross (2015), a Cronbach's Alpha value greater than 0.70 indicates high reliability. The analysis results showed an average inter-rater agreement value of 0.833. The Cronbach's Alpha coefficient of 0.833 falls within the category of high inter-rater reliability, as it exceeds the accepted threshold of 0.70 (α). The Cronbach's Alpha reliability model indicates that higher coefficient values reflect stronger consistency among raters and greater dependability of the measurement instrument. Therefore, it can be concluded that the DFV training model movement items demonstrate high stability and can be considered reliable and trustworthy for use in evaluating and developing butterfly swimming skills.

Table 3. Calculation of Cronbach's Alpha

Cronbach's Alpha	N of Items
0,833	17

Discussion

The present study aimed to examine the content validity and reliability of the Dryland, Flexibility, and Visualization (DFV) training model designed to support the development of butterfly swimming skills among beginner athletes aged 10–11 years. The findings demonstrate that the DFV model exhibits high content validity and strong inter-rater reliability, indicating that the proposed training components are conceptually sound, internally consistent, and relevant to the technical demands of butterfly swimming. These results contribute to the growing body of literature emphasizing the necessity of multidimensional training approaches in youth sport development. Previous research has consistently highlighted the role of dryland training in enhancing physical capacities that underpin swimming performance. Studies by Ozeker et al. (2020) and Smerecka (2015) reported that dryland exercises targeting core strength, upper-body strength, and neuromuscular coordination positively influence stroke efficiency and propulsion in competitive swimmers. Similarly, Maglischo (2003) emphasized that effective butterfly swimming requires substantial muscular strength and stability to maintain body alignment and rhythm throughout the stroke cycle. The current DFV model aligns with these findings by incorporating dryland exercises specifically designed to support arm timing, core stability, and lower-limb strength, which are critical elements in butterfly stroke execution.

In addition to strength development, flexibility has been widely recognized as a key determinant of efficient swimming technique. Research by Wang et al. (2021) and Liu et al. (2022) demonstrated that targeted flexibility and mobility training can reduce hydrodynamic resistance and improve technical efficiency, particularly in strokes that involve large ranges of motion such as the butterfly stroke. The inclusion of ankle and back flexibility exercises in the DFV model reflects an understanding of these biomechanical demands. Enhanced ankle flexibility facilitates more effective dolphin kicking, while improved spinal mobility supports smoother body undulation. By integrating flexibility training as a structured component rather than an auxiliary activity, the DFV model addresses a gap often observed in traditional swimming programs, where flexibility is frequently underemphasized or treated as a secondary consideration.

Visualization training represents another critical yet often underutilized component in swimming skill development. Prior studies have established that mental imagery and visualization contribute to

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

improved motor learning, technical consistency, and psychological readiness (Post et al., 2012; Predoiu et al., 2020). Visualization allows athletes to rehearse movement patterns cognitively, reinforcing neural representations of correct technique without additional physical load. Erzaou et al. (2022) further demonstrated that visualization can enhance swimmers' awareness of body position, stroke rhythm, and coordination. The DFV model incorporates visualization exercises tailored to the cognitive developmental stage of 10–11-year-old athletes, thereby supporting both technical understanding and confidence during skill acquisition.

While previous studies have validated the effectiveness of dryland, flexibility, and visualization training independently, a notable limitation in the literature is the lack of integrated training models that combine these components into a cohesive framework. Most training programs continue to rely heavily on in-water drills and repetitive stroke practice, particularly for novice swimmers. Lucero (2013) and Riewald et al. (2015) noted that drill-based training, although beneficial for isolating specific movements, may not adequately address the holistic demands of complex strokes such as butterfly, especially among beginners who struggle with coordination, strength, and technical awareness simultaneously.

The DFV model advances existing knowledge by offering an integrated training approach that reflects the multidimensional nature of butterfly swimming. From a motor learning perspective, this integration is theoretically justified. Schmidt and Lee (2011) argue that effective skill acquisition requires the simultaneous development of physical capabilities, perceptual awareness, and cognitive understanding. Training these components in isolation may limit transfer to actual performance. The high content validity identified in this study suggests that the DFV model successfully represents these interconnected dimensions, making it a theoretically robust and practically relevant training framework. The use of the Delphi technique further strengthens the methodological rigor of the study. By involving seven experts from academic and professional coaching backgrounds, the model development process benefited from diverse perspectives grounded in both theory and practice. Hirschhorn (2019) emphasized that Delphi-based consensus methods are particularly valuable in sport science research, as they minimize social bias and allow experts to evaluate content independently and reflectively. The high level of agreement among experts in this study indicates that the DFV model aligns well with current professional standards and coaching expectations in competitive swimming

From a practical standpoint, the findings of this study have important implications for swimming coaches, particularly those working with youth and beginner athletes. First, the DFV model provides a validated and reliable structure that can be systematically implemented as part of a long-term athlete development program. Coaches often face challenges in designing age-appropriate training that balances technical learning with physical development. The DFV model offers a clear framework that addresses these needs by emphasizing movement quality, foundational strength, and cognitive understanding rather than early specialization or excessive training volume. Second, the DFV model is especially valuable in contexts where pool access is limited or where athletes require technical reinforcement without increasing physical fatigue. Dryland and visualization components allow coaches to continue skill development outside the pool, thereby optimizing training time and reducing the risk of overuse injuries. This is particularly relevant for young swimmers, whose musculoskeletal systems are still developing and are more susceptible to injury from repetitive in-water training. Third, the high reliability of the DFV model indicates that it can be consistently applied by different coaches with minimal variation in interpretation. This consistency is critical in youth development programs, where standardized training approaches contribute to continuity and progression across age groups. According to DeVellis (2017), reliable training instruments enable practitioners to make informed decisions and ensure that training objectives are communicated and implemented clearly. The DFV model's structured movement indicators and clear training objectives support this consistency in coaching practice.

Furthermore, the holistic nature of the DFV model aligns with contemporary coaching philosophies that emphasize athlete-centered and developmentally appropriate training. Bompa and Buzzichelli (2019) advocate for training programs that integrate physical conditioning, technical execution, and cognitive engagement to achieve sustainable performance improvements. By combining dryland, flexibility, and visualization training, the DFV model embodies this holistic philosophy and supports the long-term development of efficient movement patterns rather than short-term performance gains alone.

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

The implications of this study also extend to program design and policy in youth swimming development. The validated DFV model can serve as a reference for swimming clubs, academies, and governing bodies seeking to standardize training practices for beginner butterfly swimmers. Its emphasis on technical correctness, movement efficiency, and cognitive understanding aligns with modern long-term athlete development frameworks, which prioritize skill mastery and movement quality during early stages of specialization. Overall, the integration of empirical validity, theoretical grounding, and practical applicability positions the DFV model as a robust and innovative contribution to butterfly swimming training. The findings support the conclusion that the DFV model is not only statistically sound but also pedagogically meaningful and practically feasible. This alignment between research evidence and coaching practice provides a strong foundation for the recommendation of the DFV model as a complementary training approach in youth competitive swimming programs, particularly during the critical phase of technical skill acquisition.

CONCLUSION

This study developed and evaluated the content validity and reliability of the Dryland, Flexibility, and Visualization (DFV) training model aimed at improving butterfly swimming skills among beginner athletes aged 10–11 years. The findings indicate that the DFV model demonstrates high content validity and strong reliability, as reflected by Aiken's V and Cronbach's Alpha values exceeding accepted thresholds. These results confirm that the DFV model is conceptually appropriate, consistent, and suitable for use in youth swimming training. The DFV model integrates physical, technical, and cognitive components, addressing the complex demands of butterfly swimming. By combining dryland training, flexibility exercises, and visualization techniques, the model provides a holistic and developmentally appropriate approach that complements traditional in-water training. This integration supports technical accuracy, movement efficiency, and coordinated skill acquisition in novice swimmers. From a practical standpoint, the DFV model offers coaches a structured and reliable framework that can be implemented consistently across training settings, particularly when reinforcing technique outside the pool environment. Overall, the DFV training model has strong potential to support butterfly swimming skill development in beginner athletes and may serve as a reference for future training program design and research in competitive swimming.

REFERENCES

Aiken, L. R. (1980). Content validity and reliability of single items or questionnaires. Educational and Psychological Measurement, 40(4), 955–959. https://doi.org/10.1177/001316448004000419

Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. Educational and Psychological Measurement, 45(1), 131–142. https://doi.org/10.1177/0013164485451012

Atabas, E. (2017). The effects of dry-land strength training on swimming performance. Journal of Physical Education and Sport, 17(2), 776–781.

Bay, J. (2016). Swimming: Steps to Success. Human Kinetics.

Bompa, T. O., & Buzzichelli, C. (2019). Periodization: Theory and methodology of training (6th ed.). Human Kinetics.

Cavaggioni, L., et al. (2024). Physiological and neuromuscular determinants of competitive swimming performance. Journal of Sports Sciences, 42(3), 215–224.

Creswell, J. W. (2016). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). Sage Publications.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16(3), 297–334. https://doi.org/10.1007/BF02310555

Dašić, D. (2023). Application of Delphi method in sports. Sport Media And Business, 9(1), 59-71. Review Article UDK: 303.62:796.01. DOI: https://doi.org/10.58984/smb2301059d. Accepted: 23.10.2023

Dašić, D., Kostadinović, G., & Stanković, M. (2023). Ethical Aspects of Science and Technological Innovations. International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE), 11(2), 343–350. DOI: https://doi.org/10.23947/2334-8496-2023-11-2-343-350

DeVellis, R. F. (2017). Scale development: Theory and applications (4th ed.). Sage Publications.

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

Erzaou, A., et al. (2022). Effects of motor imagery on swimming technique acquisition. International Journal of Sports Science & Coaching, 17(2), 345–354.

Fone, S., et al. (2022). Innovations in dryland and visualization training for youth athletes. Journal of Sports Training Science, 9(1), 21–30.

Garrote, R., & del Carmen Rojas, M. (2015). Validación de contenido mediante juicio de expertos. Revista de Investigación Educativa, 33(2), 329–348.

Guillot-Valdés, D., et al. (2022). Expert judgment for content validation in sport science. Measurement in Physical Education and Exercise Science, 26(4), 289–301.

Haller, D. (2011). Technical challenges in butterfly swimming. Swimming Technique, 47(4), 12–18.

Harrison, A. J., et al. (2020). Methodological considerations in sport performance research. Sports Biomechanics, 19(3), 321–336.

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. Journal of Advanced Nursing, 32(4), 1008–1015.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. Evidence-Based Nursing, 18(3), 66–67.

Hirschhorn, F. (2019) Reflections on the application of the Delphi method: lessons from a case in public transport research. International journal of social research methodology, VOL. 22, NO. 3, 309–322. https://doi.org/10.1080/13645579.2018.1543841

Hopkins, W. G. (2000). Measures of reliability in sports medicine and science. Sports Medicine, 30(1), 1–15.

Ibáñez, S. J., et al. (2019). Expert validation in sport science research. Journal of Human Kinetics, 67, 123–134.

Kurniawan, R. (2012). Renang prestasi. Jakarta: RajaGrafindo Persada.

Leyton-Román, M., et al. (2021). Content validity in sport psychology instruments. Frontiers in Psychology, 12, 632.

Liu, Z., Liu, X., & Zhang, Y. (2022). The Effect of Flexibility Training on Performance in Competitive Swimmers: A Longitudinal Study. Journal of Strength and Conditioning Research, 36(4), 1123-1131

Lockie, R. G., et al. (2013). Reliability of athletic performance testing. Journal of Strength and Conditioning Research, 27(7), 1936–1944.

Lucero, Blythe. (2013). 100 more swimming drills. Maidenhead: Meyer & Meyer Sport (UK) Ltd., 2013 ISBN: 978-1-78255-001-3

Maglischo, E. W. (2003). Swimming fastest. Human Kinetics.

Maglischo, E. W. (2022). Swimming faster (a comprehensive guide to the science of swimming) (5th ed.). Champaign, IL: Human Kinetics

Morais, J. E., et al. (2014). “Longitudinal Modeling in Sports: Young Swimmers’ Performance and Biomechanics Profile.” Human Movement Science, vol. 37, Elsevier, 2014, pp. 111–22.

Ortega-Toro, E., et al. (2019). Expert criteria selection in sports research. Retos, 36, 430–436.

Ozeker, T., et al. (2020). Dryland training effects on swimming performance. Journal of Strength and Conditioning Research, 34(6), 1672–1680.

Penfield, R. D., & Giacobbi, P. R. (2009). Applying Aiken’s V for content validity. Measurement in Physical Education and Exercise Science, 13(4), 213–225.

Perdana, R. (2014). Visualisasi dalam pelatihan olahraga. Jurnal Keolahragaan Indonesia, 6(2), 89–97.

Popovici, Cornelia & Suciu, Marius. (2013). Dry land training and swimming performance in children aged 11-12 years. 14. 219-222. 219 Palestrica of the third millennium – Civilization and Sport Vol. 14, no. 3, July-September 2013, 219–222

Post, P. G., et al. (2012). Imagery and performance in sport. Journal of Applied Sport Psychology, 24(1), 1–15.

R Predoiu, Radu., Predoiu, Alexandra., MITRACHE, Georgeta., FIRĂNESCU, Mădălina., COSMA, Germina, DINUŢĂ, Gheorghe., BUCUROIU, Răzvan Alexandru. (2020). VISUALISATION TECHNIQUES IN SPORT-THE MENTAL ROAD MAP FOR SUCCESS. Discobolul-Physical Education, Sport & Kinetotherapy Journal 59 (3)

Radman, I., et al. (2016). Reliability in sport performance evaluation. Kinesiology, 48(2), 228–235.

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

Rahayu, T., & Arovah, N. I. (2022). Reliability testing in sport development research. Journal of Physical Education and Sport, 22(4), 1021–1028.

Riewald, S., et al. (2015). Teaching complex swimming skills to beginners. Swimming Science Bulletin, 51, 1–9.

Schmidt, R. A., & Lee, T. D. (2011). Motor learning and performance (5th ed.). Human Kinetics.

Sharma, B. (2016). A focus on reliability in development research. Journal of Education and Practice, 7(28), 1–5.

Simpson, D. (2012). Visualization techniques in sport coaching. International Journal of Coaching Science, 6(1), 23–34.

Skjong, R. (2001).). Expert judgment and risk perception. In Proceedings of the 11th International Offshore and Polar Engineering Conference (pp. 537–544).

Smerecka, J. (2015). Dryland strength training in swimming. Physical Activity Review, 3, 88–96.

Strzał, M., et al. (2017). Butterfly stroke technique and performance. Journal of Sports Sciences, 35(6), 543–550.

Sugiyono. (2019). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. International Journal of Medical Education, 2, 53–55.

Terwee, C. B., et al. (2018). Methodological quality of measurement instruments. Quality of Life Research, 27(5), 1157–1170.

Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2015). Research methods in physical activity (7th ed.). Human Kinetics.

Torres-Luque, G., et al. (2020). Content validity in sport training instruments. Journal of Sports Sciences, 38(10), 1134–1142.

Wang, J., et al. (2021). Flexibility training and swimming efficiency. Sports Biomechanics, 20(6), 721–735.

Wilpers, J., et al. (2020). Delphi technique in sports research. European Journal of Sport Science, 20(8), 1054–1062.

Yudhistira, D., & Tirtawirya, D. (2021). Validitas dan reliabilitas instrumen olahraga. Jurnal Keolahragaan, 9(2), 145–154.

Zin, N. A. M. (2018). Development of dryland training models in swimming. International Journal of Sports Science, 8(3), 87–95.

ISSN 0216-4493 (print), ISSN 2597-6109 (online)