

Validation and reliability of a test instrument for assessing basic swimming competences in primary school children

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Abstract:

Basic swimming competences represent motor performance dispositions that enable children to move safely in an aquatic environment and constitute the essential foundation for learning to swim. To effectively support the development of these competences, it is crucial to design an appropriate assessment tool that allows the didactic and methodological aspects of swimming education in schools to be adequately adapted. The aim of the present study was to verify the reliability and validity of a newly developed test battery—WABAC (Water Basic Competence)—designed to assess the fundamental swimming competences of children in early school age. The research sample consisted of 2 739 pupils from the 1st to 4th grades of primary schools (50.1% boys), aged 7 to 10 years. The test battery included seven aquatic tasks, each evaluating specific motor skills related to aquatic movement and safety. Performance in individual test items was assessed using a three-point rating scale. In terms of reliability, Cronbach's alpha ($\alpha = 0.9501$) indicated a very high level of internal consistency across all test items. Similarly high coefficients were observed for both boys ($\alpha = 0.9485$) and girls ($\alpha = 0.9518$). When analyzed by grade, the reliability values ranged from $\alpha = 0.9074$ to 0.9599 , confirming the strong stability of the test battery across subgroups. For validity assessment, Pearson's correlation analysis and exploratory factor analysis (EFA) were applied. The EFA revealed a single dominant factor—Gliding on the front—representing a common dimension of swimming competences. The results support the use of the WABAC test battery as a simple, reliable, and pedagogically applicable tool for evaluating the basic swimming competences of children in the early school years.

Key words: motor skills, pedagogy, assessment, children, education, water safety

Introduction

Physical activity represents a fundamental determinant of children's health, physical literacy, and overall well-being (Jekauc et al., 2017). Early engagement in structured and varied movement experiences supports the development of fundamental motor competencies, which are critical for long-term participation in physical activities and health-related fitness (Herrmann, Heim, & Seelig, 2019; Scheuer, Bund, Becker & Herrmann, 2017; Herrman et al., 2015). Recent evidence also emphasizes that developing these competencies at early school age predicts higher physical literacy and sustained participation in sport through adolescence (Barnett et al., 2023; Hulteen et al., 2022).

A recent meta-analysis of global sports and leisure activities worldwide found that swimming is still rated as one of the top five physical activities that children and adolescents participate in during their leisure time in Africa, the Eastern Mediterranean, the Western Pacific, the Americas, and Europe (Hulteen et al., 2017). Among these, aquatic competence holds a distinctive role, as it not only enhances physical and motor development but also directly contributes to personal safety and drowning prevention (Stallman, Moran, Quan, & Langendorfer, 2017; Rejman et al., 2020). Further studies confirm that swimming-based activities contribute to both motor coordination and psychosocial well-being when introduced within school curricula (Button & Julier, 2019; Zhao et al., 2024). Accordingly, many educational systems integrate swimming and aquatic education into their physical education curricula to ensure that all children acquire the essential skills for safe and confident movement in water environments. This approach aligns with current models of aquatic literacy that connect physical, affective, and cognitive domains to holistic water competence development (Fonseca-Pinto & Murcia, 2025; Costa et al., 2021).

Basic swimming and aquatic competences are functional, teachable motor abilities that enable individuals to float, glide, control breathing, orient underwater, and propel efficiently in water (Morgado et al., 2020). These competences form the foundation for learning formal swimming techniques and for maintaining safety in aquatic contexts. Despite this recognized importance, the systematic and standardized assessment of

aquatic competences in primary school children remains limited, as existing tools often vary in structure, scope, and psychometric quality.

Several efforts have been made to design valid instruments for assessing swimming and aquatic competence in children. The Swimming Competence Assessment Scale (SCAS) (Sundan, Haga, & Lorås, 2023) offers a well-structured evaluation framework encompassing core aquatic tasks such as entry, propulsion, floating, diving, and exit. Its major strengths include a rigorous content validation through the Delphi technique and alignment with the national curriculum in Norway. Nevertheless, the instrument's design is context-specific and may not be fully adaptable to other educational or infrastructural conditions where facilities, class sizes, and instructional models differ.

The Scale to Measure Aquatic Competence in Children (SMACC) (Moreno-Murcia et al., 2020) expanded the construct of aquatic competence by integrating physical, cognitive, and affective dimensions, in accordance with the concept of holistic physical literacy. However, it targets preschool children aged 3–6 years, which limits its applicability to primary-school populations who display higher levels of coordination and autonomy. In addition, the subjective nature of observational scoring in SMACC requires intensive rater training and may reduce inter-rater reliability if not standardized.

The Swimming Competence Questionnaire (SCQ) (Li et al., 2020) represents a self-assessment tool developed in Hong Kong, offering an accessible way to measure perceived swimming competence in large groups. While it demonstrates acceptable psychometric properties, its reliance on self-reported data is problematic in younger populations who tend to over- or underestimate their abilities. Similarly, the Aquatic Movement Protocol (AMP) (Langendorfer et al., 2018) demonstrated strong internal consistency and provided valuable insights into the relationship between aquatic and land-based motor coordination. Yet, its demanding testing conditions and technical complexity limit its practicality for use in ordinary school swimming lessons.

A recent and conceptually advanced approach is represented by the Aquatic Competence Assessment for Children (ACA-C) developed by Fonseca-Pinto and Murcia (2025). This tool introduces the concept of a Personal Aquatic Competence Index (PACI), integrating physical performance with perceived safety and cognitive awareness in aquatic settings. The ACA-C offers a comprehensive, multidimensional assessment framework suitable for children aged 6–12 years. Its strength lies in connecting physical, affective, and perceptual domains, thus aligning closely with the modern paradigm of aquatic literacy. However, while psychometrically sound, its administration requires specific environmental setups and observer calibration, which may restrict its feasibility in large-scale school contexts or short instructional sessions.

Systematic reviews (Costa et al., 2021; Moura et al. 202) emphasize this methodological diversity and the persistent lack of standardized, age-appropriate, and pedagogically efficient tools for evaluating basic aquatic competence. Existing instruments often fail to balance psychometric rigor with practical feasibility — either focusing narrowly on physical skills without considering safety and confidence or being too resource-intensive for routine school use. Moreover, relatively few studies have rigorously analyzed reliability (e.g., internal consistency, inter-rater agreement) and validity (e.g., construct, content, and predictive validity) within real educational conditions.

For school swimming education, these limitations have tangible pedagogical consequences. Teachers and instructors must make rapid and accurate judgments about pupils' water safety levels and learning progress. Without valid and reliable assessment tools, such judgments risk being subjective, inconsistent, or dependent on individual instructor experience. Establishing the validity of an assessment ensures that test items genuinely measure the intended construct — in this case, basic aquatic competence — while verifying reliability guarantees that outcomes are stable, reproducible, and comparable across time, gender, and evaluators.

Therefore, the current study aimed to develop and psychometrically validate the Water Basic Competence (WABAC) test battery — a simple, structured, and age-appropriate tool for assessing fundamental swimming and aquatic competences among primary school children aged 7–10 years. The test battery was designed to be feasible within regular school swimming courses, while maintaining high psychometric quality. Specifically, the research sought to verify the internal consistency, construct validity of the WABAC instrument, contributing to the development of reliable, standardized, and pedagogically practical tools that can improve the safety, efficiency, and individualization of school-based swimming instruction.

Material & methods

The primary aim of this study was to verify the reliability and validity of a newly developed test battery designed to assess basic swimming competencies in primary school-aged children for safe movement in the aquatic environment (WABAC).

A total of 3,004 pupils from the 1st to 4th grades of primary schools across Slovakia participated in the testing. Based on exclusion criteria—namely, incomplete test protocols, age below 6 or above 12 years, and non-completion of the swimming course—265 participants were removed from the dataset. Consequently, the final sample comprised 2,739 pupils, with an almost equal gender distribution: 50.1% boys ($n = 1,371$) and 49.9% girls ($n = 1,368$).

For analytical purposes, pupils were grouped according to their school grade, allowing a more precise observation of developmental differences in performance across the test items. The mean ages were 7.2 years in

the 1st grade (n = 536), 7.9 years in the 2nd grade (n = 704), 8.7 years in the 3rd grade (n = 811), and 9.8 years in the 4th grade (n = 864). Participants were recruited from various primary schools, and informed consent was obtained from their legal guardians.

Data collection took place during organized school swimming courses conducted in 2023 and 2024 in collaboration with the Sport Institute. None of the participants had received systematic swimming instruction prior to the course. The swimming lessons were carried out in indoor 25-meter pools, and each test item was administered at the beginning of the course. Testing was supervised by experienced swimming instructors who had been uniformly trained in the testing methodology and assessment procedures, all following an identical standardized protocol.

The research protocol was reviewed and approved by the Ethics Committee of the Faculty of Physical Education and Sports, Comenius University in Bratislava (Ref. 9/2023), and conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). All data were anonymized, and participation in the study was entirely voluntary.

The test battery was developed to evaluate fundamental aquatic skills and abilities of children in early school age. The process of selecting and structuring the test tasks was informed by findings from previous national and international studies (Čechovská & Miler, 2008; Macejková & Benčuriková, 2014; Stallman et al., 2017; Scheuer et al., 2017; Morgado et al., 2020).

Competency assessments were implemented to measure swimming skills in a way that is age-appropriate yet sufficiently rigorous. They were conducted regularly to monitor individual progress, provide structured feedback, and enable the adjustment of instruction and training programs according to the specific needs of each participant. This systematic approach ensured that all participants reached the minimum level of aquatic competency necessary for safety, while also identifying individuals who required additional support or targeted instruction. During 2023 and 2024, several studies were carried out to verify the validity and reliability of the WABAC test battery on different samples of school-aged children. By 2025, the battery comprised seven test items, summarized as the aquatic fundamentals measured by the WABAC (Water Basic Competence), presented in Table 1.

Table 1 Description of the WABAC Test Battery

Item	Item task	Qualification	Evaluation
T1 Floating on the front	Starting from a standing position, the swimmer takes a deep breath and glides into a horizontal chest position with the upper limbs slightly higher than the lower limbs (front star).	Ability to hold a horizontal body position with the face submerged.	1 point: Unable to complete the task.
			2 points: Uses an aid (e.g., water noodle) to achieve a bent chest position with a submerged face and a 3-second breath hold.
			3 points: Achieves this position independently, keeping the face underwater and holding the breath for at least 5 seconds.
T2 12.5 m flutter kicking with a kickboard	From a push off the wall or pool bottom, the swimmer maintains a streamlined body position and performs continuous flutter kicks while holding the kickboard. The arms are extended and the forearms rest on the board. The swimmer inhales above the water and exhales with the face submerged.	Ability to swim up to 12.5 m using flutter kicks with a kickboard.	1 point: Unable to complete the task.
			2 points: Swims up to 6 m with coach or noodle assistance, showing technical and breathing errors.
			3 points: Swims 12.5 m independently with correct flutter kick technique and breathing.
T3 Jump into the water	From a standing position at the pool edge (toes over the rim), the swimmer jumps forward and enters the water feet first (max depth 1.5 m).	Ability to jump straight forward from the pool edge and enter the water feet first.	1 point: Unable to jump.
			2 points: Uses a noodle for assistance but manages a feet-first landing.
			3 points: Independently performs the jump from a standing position and lands feet first.
T4 Catching an object from the depth	The swimmer submerges the entire head and torso to a specified depth and retrieves an object from the bottom of the pool (e.g., puck or ring).	Ability to dive to a depth of 1.5 m, orient underwater, and retrieve an object from the pool bottom.	1 point: Unable to complete the task.
			2 points: Attempts independent submersion but fails to retrieve the object.
			3 points: Independently submerges the head and retrieves the object successfully.
T5 Floating on the back	Starting from a standing position, the swimmer glides into a horizontal back position with the upper limbs slightly higher than the lower limbs (back star).	Ability to hold a horizontal body position on the back at the water surface.	1 point: Unable to complete the task.
			2 points: Uses an aid (e.g., water noodle under shoulders or back) and maintains position for up to 3 seconds.
			3 points: Achieves this position independently and maintains it for at least 5 seconds.

T6 Immersion and exhalation in water	The swimmer stands in shoulder-deep water facing the pool wall, holds the gutter with both hands at shoulder level, takes a deep breath through the mouth, submerges the face below the surface, and exhales through both the nose and mouth into the water for at least 5 seconds.	Ability to inhale through the mouth, submerge the head, and exhale through both the nose and mouth.	1 point: Unable to complete the task.
			2 points: Brief submersion, holding breath underwater for up to 3 seconds without exhaling.
			3 points: Independently inhales through the mouth, submerges the head (including face and ears), and exhales through the nose and mouth for at least 5 seconds ("bubbling").
T7 Gliding on the front	After pushing off from the pool wall or bottom, the swimmer assumes a streamlined position with arms extended overhead and the face submerged.	Ability to maintain a streamlined horizontal chest position while gliding through the water.	1 point: Unable to complete the task.
			2 points: Completes the task with a buoyancy aid (holding a noodle or kickboard in extended arms) and glides up to 5 m.
			3 points: Independently glide forward in the prescribed horizontal chest position for at least 5 m.

To assess the success and quality of task execution, each movement task (test item) was evaluated using a three-point rating scale: 1 point – not performed / unsuccessful, 2 points – partially performed / in progress, 3 points – fully performed / successfully completed. Accordingly, each participant could obtain a minimum total score of 7 points and a maximum of 21 points. Frequency and percentage analyses were used to evaluate the success rates of the participants in each test item according to school grade. To verify the reliability of the test battery, Cronbach's alpha was calculated as an indicator of internal consistency. To analyze the validity of the WABAC test battery, Pearson's correlation analysis and exploratory factor analysis (EFA) were applied.

Results

According to the results of the frequency and percentage analyses, in the 1st-grade group, the lowest success rate was observed in T7 – Gliding on the front, where only 34.44% of participants successfully completed the task and achieved the maximum score of three points. Conversely, the highest success rate was recorded in T6 – Immersion and exhalation in water, where 70.83% of participants achieved three points. In the 2nd-grade group, the lowest success rate was found in T4 – Catching an object from the depth, with 45.45% of participants scoring three points, while the highest success rate occurred in T3 – Jumping into the water, successfully completed by 65.34% of pupils. In the 3rd-grade group, the lowest success rate again appeared in T7 – Gliding on the front (62.63%), and the highest in T3 – Jumping into the water, where up to 80.51% of pupils achieved the maximum score. In the 4th-grade group, the lowest success rate, somewhat unexpectedly, was observed in T5 – Floating on the back, which was successfully completed by 79.89% of pupils. The highest success rate was found in T2 – 12.5-m flutter kicking with a kickboard, where 92.01% of participants achieved three points. During T2 performance, controlled breathing into the water and adopting a streamlined body position were not required, which may be related to the slightly lower success rate (81%) observed in T7 – Gliding on the front. Overall, the frequency and percentage results indicate a progressive increase in success rates across test items with advancing school grade — that is, younger pupils achieved lower scores, whereas older pupils demonstrated higher performance levels. A detailed overview of success rates across all test items and grades is presented in Table 2.

Table 2 Frequency and Percentage Analysis of Success Rates in WABAC Test Items

		<i>n</i>	<i>mean age</i>	<i>average p</i>	<i>n 1p</i>	<i>% 1p</i>	<i>n 2p</i>	<i>% 2p</i>	<i>n 3p</i>	<i>% 3p</i>
T1 Floating on the front	1. grade	360	7,2	2,22	62	17,22	156	43,33	142	39,44
	2. grade	704	7,9	2,41	119	16,90	177	25,14	408	57,95
	3. grade	811	8,7	2,61	49	6,04	215	26,51	547	67,44
	4. grade	864	9,8	2,80	21	2,43	127	14,7	716	82,87
T2 12.5 m flutter kicking with a kickboard	1. grade	360	7,2	2,12	132	36,66	51	14,16	177	49,16
	2. grade	704	7,9	2,21	222	31,53	113	16,05	369	52,41
	3. grade	811	8,7	2,66	96	11,83	82	10,11	633	78,05
	4. grade	864	9,8	2,88	33	3,82	36	4,17	795	92,01
T3 Jump into the water	1. grade	360	7,2	2,34	87	24,16	65	18,05	208	57,77
	2. grade	704	7,9	2,38	190	26,98	54	7,67	460	65,34
	3. grade	811	8,7	2,67	110	13,56	48	5,91	653	80,51
	4. grade	864	9,8	2,82	59	6,83	35	4,05	770	89,12
T4 Catching an object from the depth	1. grade	360	7,2	2,00	129	35,83	102	28,33	129	35,83
	2. grade	704	7,9	2,10	247	35,08	137	19,46	320	45,45
	3. grade	811	8,7	2,41	175	21,58	126	15,54	510	62,89
	4. grade	864	9,8	2,72	76	8,80	90	10,42	698	80,79
T5 Floating on the back	1. grade	360	7,2	2,16	78	21,67	148	41,11	134	37,22
	2. grade	704	7,9	2,24	173	24,57	192	27,27	339	48,18
	3. grade	811	8,7	2,53	110	13,56	163	20,1	538	66,34
	4. grade	864	9,8	2,75	44	5,09	129	14,93	691	79,98

T6 Immersion and exhalation in water	1. grade	360	7,2	2,52	67	18,61	38	10,56	255	70,83
	2. grade	704	7,9	2,47	129	18,32	117	16,62	458	65,06
	3. grade	811	8,7	2,68	82	10,11	94	11,59	635	78,3
	4. grade	864	9,8	2,85	32	3,70	68	7,87	764	88,43
T7 Gliding on the front	1. grade	360	7,2	2,11	86	23,88	150	41,66	124	34,44
	2. grade	704	7,9	2,20	186	26,42	194	27,55	324	46,02
	3. grade	811	8,7	2,51	96	11,83	207	25,52	508	62,63
	4. grade	864	9,8	2,77	32	3,70	132	15,27	700	81,01

To verify the reliability of the swimming competence test battery, Cronbach's alpha was computed. The results revealed a very high level of internal consistency for the total sample, with an alpha coefficient of 0.9501, which according to standard interpretative criteria ($\alpha \geq 0.90$ = excellent) represents excellent reliability. When analyzed separately by gender, similarly high values were obtained for both boys ($\alpha = 0.9485$) and girls ($\alpha = 0.9518$). Cronbach's alpha values across all age categories also remained consistently high, ranging from $\alpha = 0.9074$ to $\alpha = 0.9599$. Stability of reliability was further confirmed when the sample was divided by school grade, with coefficients of $\alpha = 0.9414$ (1st grade), $\alpha = 0.9506$ (2nd grade), $\alpha = 0.9502$ (3rd grade), and $\alpha = 0.9470$ (4th grade). These findings demonstrate excellent reliability of all test items in assessing the basic swimming competencies of primary-school-aged children, providing a robust foundation for evaluating their safety-related aquatic proficiency.

For the purpose of validity verification, Pearson's correlation analysis was conducted between all individual test items. The results revealed significant positive relationships, with correlation coefficients ranging from $r = 0.65$ to $r = 0.85$ (Figure 1). The strongest correlations were observed between T1 – Floating on the front and T7 – Gliding on the front ($r = 0.85$), and between T5 – Floating on the back and T7 – Gliding on the front ($r = 0.83$). These findings indicate a strong interconnection between static balance (hydrostatic body properties) and the ability to maintain a horizontal body position in water (hydrodynamic properties). The results confirm that the individual tests measure related aspects of swimming competence, and that their performances are mutually interdependent.

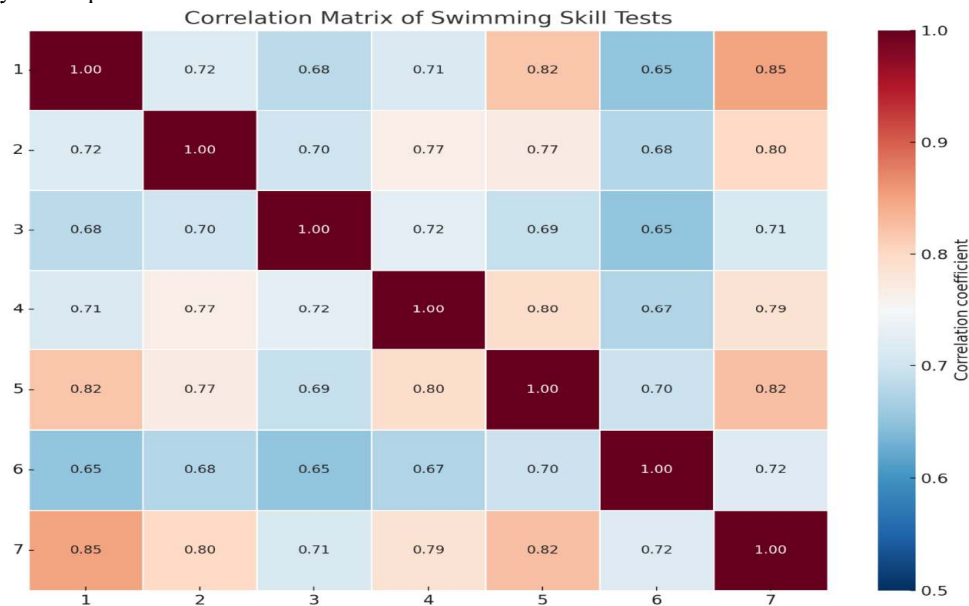


Figure 1. Correlation analysis of the test items. Legend: 1 - Floating on the front, 2 - 12.5 m flutter kicking with a kickboard, 3 - Jump into the water, 4 - Catching an object from the depth, 5 - Floating on the back, 6 - Immersion and exhalation in water, 7 - Gliding on the front

To further assess construct validity, an Exploratory Factor Analysis (EFA) was applied under the assumption of a single common latent factor representing overall swimming competence. The analysis was conducted on standardized data using a common factor extraction method without rotation. The results showed that all test items exhibited high factor loadings on one dominant factor, indicating that they measure a shared underlying ability or attribute. The highest loadings were found for T7 – Gliding on the front (0.93) and T5 – Floating on the back (0.90), followed by T1 – Floating on the front (0.88), T4 – Catching an object from the depth (0.86), T2 – 12.5 m flutter kicking with a kickboard (0.86), T3 – Jumping into the water (0.79), and T6 – Immersion and exhalation in water (0.78). The factor structure was also represented graphically, visually confirming the strong coherence among all test items and their shared relationship with the latent construct (Figure 2).

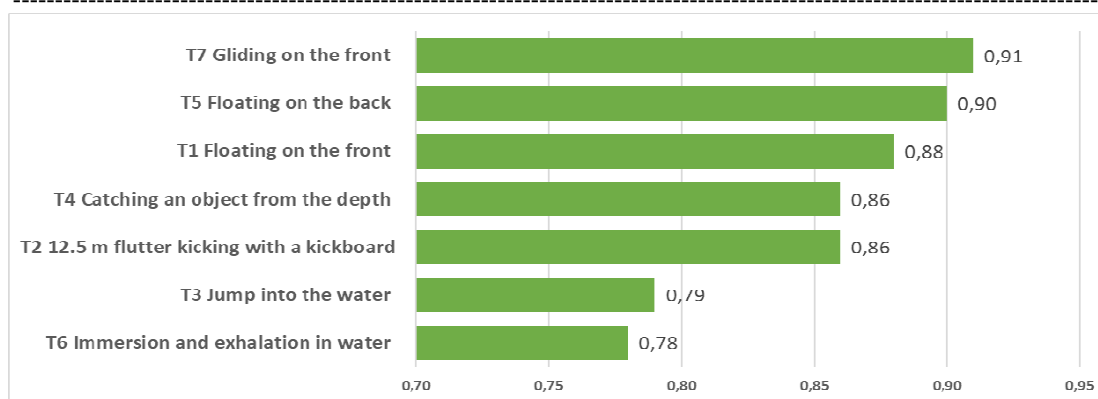


Figure 2. Exploratory Factor Analysis of the WABAC test battery.

The results of the analysis support the hypothesis that the test battery evaluates a unified construct of swimming competence and demonstrates construct validity in terms of internal structure. These findings further suggest that Gliding on the front acts as a central latent indicator reflecting general aquatic movement proficiency. It encapsulates aspects of hydrodynamics and movement coordination, showing close interrelations with other elements of swimming competence.

Discussion

The findings of the present study confirm that the WABAC test battery is a psychometrically sound, age-appropriate instrument for assessing basic aquatic competences in primary school children. The high internal consistency (Cronbach's $\alpha = 0.9501$) and robust construct validity indicate that the seven-item structure effectively captures the core components of aquatic competence—floating, gliding, immersion, and propulsion. These results are consistent with previous psychometric investigations in the field of aquatic competence assessment (Moreno-Murcia et al., 2020; Li et al., 2020; Sundan et al., 2023; Fonseca-Pinto & Murcia, 2025), all of which emphasize the need for reliable, educationally feasible testing protocols. Similar levels of reliability and construct validity have also been documented in broader motor competence assessments for children, confirming that aquatic movement tests can achieve comparable psychometric standards (Barnett et al., 2023; López-Pastor et al., 2021).

Compared to the Swimming Competence Assessment Scale (SCAS) developed by Sundan, Haga, and Lorås (2023), WABAC demonstrates similar content coherence but a simpler and more adaptable design. While SCAS underwent a rigorous Delphi validation and aligns closely with national curricula in Norway, its use is contextually limited and requires specific facility standards (Olstad et al., 2019). WABAC, in contrast, was validated in typical Slovak primary school swimming environments, showing greater applicability in ordinary educational settings. This context-specific adaptability is in line with contemporary calls for scalable and inclusive testing tools across diverse educational systems (Zhao et al., 2024; Button & Julier, 2019).

In relation to the Scale to Measure Aquatic Competence in Children (SMACC) by Moreno-Murcia et al. (2020), which integrates cognitive and affective dimensions of aquatic literacy, the WABAC focuses primarily on observable motor performance. Although this narrower focus enhances objectivity and ease of scoring, it may overlook the psychological and safety-awareness components increasingly emphasized in contemporary models of aquatic literacy (Fonseca-Pinto & Murcia, 2025). Future iterations of WABAC could therefore benefit from including complementary measures of confidence and perceived safety, as suggested by the Personal Aquatic Competence Index (PACI) within the Aquatic Competence Assessment for Children (ACA-C) tool developed by Fonseca-Pinto and Murcia (2025). Integrating perceived safety and affective confidence has been shown to significantly enhance children's overall aquatic literacy and retention of water safety behaviors (Stallman et al., 2021; Quan et al., 2020).

From a broader pedagogical perspective, this comparison highlights a conceptual shift in recent research—from purely motor assessments toward multidimensional models of aquatic literacy that incorporate cognitive, affective, and perceptual factors. The ACA-C represents this new paradigm, linking measurable aquatic performance with children's perceived safety and emotional confidence in the water. Incorporating such dimensions into WABAC would enhance its ecological and educational validity, providing a more holistic understanding of aquatic competence relevant to both physical education and drowning-prevention programs. Recent literature also supports the integration of psychosocial learning outcomes—such as enjoyment, motivation, and self-efficacy—into aquatic education frameworks, aligning with the physical literacy perspective (Whitehead, 2023; Costa et al., 2021).

The Swimming Competence Questionnaire (SCQ) by Li, Hagger, and Chow (2020) provides a self-reported measure of perceived competence, offering a broader assessment of children's swimming self-efficacy. However, self-assessment is problematic for younger children due to limited self-perception accuracy (Costa et al., 2021). The performance-based nature of WABAC avoids this issue, ensuring objectivity and high inter-rater

reliability. Similarly, compared to the Aquatic Movement Protocol (AMP) (Langendorfer et al., 2018), WABAC's streamlined test structure minimizes administrative complexity while maintaining psychometric integrity. Comparable advantages have been reported in other simplified competence-based assessment batteries designed for school environments, which emphasize teacher usability and cross-cultural applicability (Fransen et al., 2022; López-Pastor et al., 2021).

A major strength of the present research lies in its exceptionally high psychometric quality. The WABAC test battery achieved an internal consistency coefficient of Cronbach's $\alpha = 0.9501$, which surpasses the threshold commonly considered "excellent" in reliability testing. This indicates that all items consistently measure a single underlying construct—basic aquatic competence. The use of both correlational and exploratory factor analyses further strengthened construct validation, confirming that the items collectively represent one dominant factor, "Gliding on the front." Such methodological rigor provides strong empirical evidence that the instrument is both reliable and valid across gender and age groups, ensuring the stability and replicability of the results. Compared to earlier aquatic competence tools (e.g., SMACC, SCQ), which often relied on subjective or self-reported indicators, WABAC's performance-based design enhances objectivity and minimizes evaluator bias. These psychometric outcomes are consistent with best-practice guidelines for test validation in motor behavior research (American Educational Research Association [AERA], 2014).

Another significant strength is the study's large and representative sample size ($N = 2,739$), which substantially increases the statistical power and external validity of the findings. The inclusion of pupils from multiple Slovak primary schools ensures that the results reflect real educational conditions rather than idealized laboratory settings. This ecological validity makes WABAC highly applicable to everyday school environments (Rzavská et al., 2022), distinguishing it from more complex or resource-dependent tools such as the SCAS (Sundan et al., 2023) or AMP (Langendorfer et al., 2018). The instrument's pedagogical practicality—its short administration time, simple scoring rubric, and minimal equipment requirements—makes it suitable for large-scale school use. Furthermore, all instructors were trained under a unified testing protocol, reducing procedural variability and reinforcing the internal consistency of data collection. Together, these elements demonstrate that the WABAC battery is not only psychometrically robust but also educationally feasible and scalable, offering a valuable diagnostic and instructional tool for both researchers and practitioners in school-based swimming education.

Conclusions

The present study verified the psychometric properties of the Water Basic Competence (WABAC) test battery and confirmed its high reliability and construct validity in assessing fundamental swimming competences among primary school children aged 7–10 years. The results of both correlational and exploratory factor analyses demonstrated strong interrelations among all test items and identified a single dominant factor—Gliding on the front—representing a general dimension of aquatic competence. This finding indicates that the WABAC battery measures a unified construct encompassing key components of water safety, buoyancy control, and basic propulsion.

The high internal consistency (Cronbach's $\alpha = 0.9501$) and consistent reliability across gender and school grades underline the robustness and stability of the instrument. Moreover, its pedagogical simplicity, brief administration time, and minimal equipment requirements make it highly feasible for implementation within regular school swimming curricula. As such, the WABAC test battery provides an efficient, objective, and standardized means for teachers and instructors to evaluate pupils' aquatic abilities and to tailor instruction according to individual needs.

Despite these strengths, certain limitations should be acknowledged. The current validation did not include inter-rater reliability analysis or longitudinal tracking to assess predictive validity over time. Future research should therefore extend the evaluation to include multiple raters, diverse educational contexts, and follow-up measurements. Additionally, integrating effective and cognitive dimensions—such as confidence and perceived safety—could contribute to developing a more holistic understanding of aquatic literacy.

In summary, the WABAC test battery constitutes a reliable, valid, and educationally practical tool for assessing basic aquatic competences in primary school children. It bridges the gap between psychometric rigor and pedagogical applicability and provides a solid foundation for further research and innovation in school-based swimming education and drowning prevention initiatives.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used ChatGPT 5.1 (OpenAI) to improve the quality, clarity, grammar, and fluency of the English language in the manuscript. After using this tool, the author(s) reviewed and edited the content as necessary and assume full responsibility for the final publication.

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