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The Contribution of Underwater Vision Enhancement Aids to Accelerating the Acquisition of Fundamental Swimming Skills Among Beginners

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Abstract:

This theoretical study aims to analyze the contribution of underwater vision enhancement tools to accelerating the acquisition of basic swimming skills among beginners within the framework of motor learning concepts. The study is based on the importance of the initial stage of swimming instruction, which relies heavily on sensory perception and visual feedback for understanding and correcting movement patterns. It examines the role of underwater vision enhancement tools in supporting learners by providing greater visual clarity during performance in the aquatic environment, thereby improving motor coordination and reducing errors during the early stages of learning. The study concludes that underwater vision enhancement tools may effectively accelerate the acquisition of basic swimming skills among beginners, provided that they are implemented progressively and systematically. Such use can support learning during the initial stages without negatively affecting the development of motor autonomy in later stages.

Keywords: Underwater vision enhancement tools; acquisition of basic swimming skills; swimming; beginners; motor learning.

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1) Introduction:

Learning to swim for beginners is one of the most important areas of research in motor learning, as it relies on a complex integration of sensory perception, neuromuscular coordination, and adaptation to an aquatic environment that differs radically from the terrestrial environment. The initial stage of learning is considered crucial, as the learner requires clear sensory information to help them understand body position, control their breathing and achieve balance in the water. In this context, modern teaching methods have emerged in recent years, including those designed to improve underwater vision, which aim to enhance visual perception during motor performance in an aquatic environment. The literature on motor learning indicates that visual feedback plays a fundamental role in accelerating skill acquisition, particularly in the early stages of learning, when learners rely more heavily on external information to understand and correct their movements (Magill & Anderson, 2021).

Furthermore, some studies in the field of motor control confirm that improving the clarity of visual information in open or unstable environments can contribute to increased performance accuracy and a reduction in motor errors, which in turn has a positive impact on the speed of learning (Davids, Button, & Bennett, 2008). However, over-reliance on visual cues may limit the development of internal kinesthetic awareness, which is a key component in achieving automatic performance in the advanced stages of learning.

Given this interplay between potential benefits and possible limitations, it is important to investigate the extent to which underwater vision-enhancing aids contribute to accelerating the acquisition of basic swimming skills in beginners, with the aim of determining their effectiveness and identifying when they should be used within the teaching process to achieve the best balance between visual support and the development of internal motor sense.

2) The research question:

Swimming is considered one of the fundamental motor skills that holds a distinguished place amongst physical activities, owing to its numerous health, educational and psychological benefits; However, learning to swim, particularly in the early stages, is not a simple process; rather, it requires gradual adaptation to an environment that is entirely different from that on land, both in terms of its physical and sensory characteristics. Beginners face several difficulties, the most notable of which are loss of balance, difficulty controlling their breathing, and a feeling of insecurity when submerging their head in water. Nevertheless, one

factor that is often overlooked, despite its profound impact, is underwater vision; the associated visual perception plays a pivotal role in guiding motor behaviour (Ziush et al., 2019, 623).

In fact, visual perception in an aquatic environment is subject to various disturbances caused by the physical properties of water; the difference in density between air and water leads to the refraction of light, which distorts the visual image, Furthermore, the absorption of light in water reduces light intensity and alters colours, which negatively affects visual clarity. These factors make it impossible for a novice learner to accurately perceive their position in the water, track their movements, or even see their surroundings clearly, leading to a state of sensory confusion that directly impacts the learning process.

In this context, means of improving underwater vision—primarily swimming goggles—have emerged as a practical solution to this problem. They provide a visual environment closer to natural conditions by reducing the effect of light refraction and preventing water from entering the eyes, thereby allowing learners to open their eyes underwater without pain or blurred vision. The widespread use of these aids has raised scientific questions regarding their actual impact on learning to swim: do they genuinely contribute to accelerating the acquisition of basic skills, or is their role limited to providing comfort alone?

To understand this issue, we must return to the theoretical foundations of motor learning, which is defined as the process of acquiring and developing motor skills as a result of the interaction between practice and experience. The scientific literature, particularly the works of Schmidt and Lee, indicates that motor learning relies on a range of cognitive and sensory processes, including perception, decision-making and motor execution, Visual perception is considered one of the most important sources of information on which the learner relies to guide their movement, as it allows them to determine their position in relation to the environment, monitor their performance, and correct their errors immediately (Schmidt & Lee, 2019).

In light of this, it can be said that any impairment in visual perception will necessarily lead to impaired motor performance; this is precisely what occurs in an aquatic environment, where beginners find themselves in a setting with poor visibility, causing them to rely more heavily on proprioception, which has not yet

developed at this stage of learning. Consequently, improving underwater vision would restore balance to the sensory perception system and help the learner construct a clearer mental image of the required movements.

On the other hand, information-processing theories emphasise that motor learning is significantly influenced by the quality and quantity of sensory information available to the learner. The clearer and more accurate the information, the greater the brain's ability to process it and make appropriate motor decisions. In the case of swimming, vision is a primary source of this information, as it allows the learner to continuously assess their performance. When this vision is enhanced using assistive devices, it accelerates the learning process by reducing errors and increasing the effectiveness of feedback. (Koester, 2023)

Furthermore, vision-enhancing aids play an important role in the psychological aspect of learning, which is no less important than the motor aspect. Beginners often feel afraid when submerging their heads in water, and this fear intensifies when they lose their ability to see; this fear leads to muscle tension, irregular breathing and a reluctance to try, which hinders learning. When swimming goggles are used, the learner feels a greater sense of security because they can see their surroundings, which reduces anxiety and boosts their self-confidence. Reports published by the World Health Organisation have indicated that providing a safe and stimulating learning environment is one of the key factors in improving motor learning. (World Health Organisation [WHO], 2020)

At a practical level, field observations in swimming instruction have shown that learners who use vision-enhancing aids are able to acquire skills such as floating and gliding more quickly than their peers. This is attributed to their ability to see their body position in the water and track the movements of their limbs, which helps them correct mistakes immediately. They are also more willing to try new movements because they feel safe.

However, these findings do not mean that the use of vision-enhancing aids is without its drawbacks; some researchers believe that over-reliance on these aids may lead to poor adaptation to natural conditions where visibility is limited, such as swimming in open water, Moreover, motor learning does not rely solely on vision but also involves internal kinesthetic sensation, which requires development through practice without aids. Hence, it is important to strike a balance in the use of these aids, employing them in the early stages of learning and then gradually reducing reliance on them as the learner's level progresses.

In light of the above, it can be said that aids for improving underwater vision

represent an effective teaching tool, contributing to accelerating the acquisition of basic swimming skills among beginners by enhancing visual perception, strengthening feedback and reducing fear. However, their effectiveness depends largely on how they are used within an integrated teaching programme that takes into account the characteristics of the learners and ultimately aims to achieve motor independence.

This topic also opens up vast prospects for scientific research, particularly in light of the technological developments taking place in the field of sports education, where advanced technologies could be used in the future to improve sensory perception in the water, such as smart goggles or visual training systems. However, these applications require rigorous field studies to assess their effectiveness.

Learning to swim is not limited to physical training alone, but also encompasses complex cognitive and psychological aspects, in which vision plays a pivotal role. Consequently, improving this vision represents an important step towards accelerating learning, provided that this is done within a balanced, scientifically grounded educational framework aimed at the learner's holistic development. This raises the following question: To what extent do means of improving underwater vision – foremost among them swimming goggles – contribute to accelerating the acquisition of basic swimming skills among beginners, given their overlapping impact on both sensorimotor perception and the psychological factors associated with learning in an aquatic environment?

This issue can be broken down into sub-questions that help to deepen the analysis:

- How does improved underwater vision affect visual perception and motor control in beginner learners?
- Does the use of vision-enhancing aids help to reduce the time taken to acquire skills such as floating, gliding and breathing?
- What is the psychological impact of these aids on levels of fear and confidence during learning?
- Does reliance on these aids lead to a lasting improvement in performance, or is the effect temporary and linked to the learning conditions?

3) Aims of the study: This study aims to:

1. To analyse the theoretical foundations of the process of learning basic swimming skills among beginners within the framework of motor learning.
2. To clarify the role of visual perception and visual feedback in accelerating the acquisition of motor skills in an aquatic environment.
3. To examine the theoretical framework for methods of improving underwater vision and their pedagogical characteristics in swimming instruction.
4. To analyse the relationship between the use of vision-enhancing aids and the development of motor performance in the early stages of learning.
5. Discuss the limits of reliance on visual aids and their impact on the development of internal kinesthetic awareness and long-term learning.
6. To draw theoretical conclusions regarding the effectiveness of these aids in improving the speed and quality of acquisition of basic swimming skills among beginners.

4) Significance of the study:

Firstly: Theoretical significance: This study contributes to expanding the scientific understanding of the learning process within an aquatic environment by analysing the role of visual perception and sensory feedback in the acquisition of motor skills. It also helps to clarify the relationship between reliance on visual cues and the development of internal kinesthetic sense, which is considered one of the key themes in motor learning theories.

Secondly: Practical significance: The study provides a framework that swimming coaches and physical education teachers can utilise in selecting and employing appropriate teaching aids for beginners, particularly in the early stages of learning. It may also contribute to improving teaching methods by striking a balance between the use of visual aids and the development of motor independence in learners.

5) Reasons for choosing the topic:

- **a- Scientific consideration:** The topic relates to the field of motor learning, which focuses on how humans acquire and develop motor skills, particularly in unstable environments such as aquatic environments. Furthermore, understanding the role of visual perception in learning remains an area open to further research and analysis.
- **b- Practical Considerations:** The increasing use of modern teaching aids in swimming instruction has prompted research into their effectiveness, particularly those that improve visibility underwater, and their impact on the speed at which basic skills are acquired.

6) Definition of concepts and terminology:

a- Means of improving underwater vision:

Terminological definition: Underwater vision enhancement methods refer to all visual aids, equipment and teaching techniques used to increase visual clarity in an aquatic environment, enabling learners to perceive movements and skills more accurately whilst swimming or during aquatic training. These methods include swimming goggles, diving masks, submerged visual markers, underwater instructional boards, and underwater video recording and display systems, all of which contribute to improving visual perception and motor feedback during learning. Schmidt and Lee emphasise that visual information represents one of the most important sources of external feedback, helping learners to acquire motor skills, correct errors and improve performance during the motor learning process . (Schmidt, R. A., & Lee, 2019, 87)

Operational definition: In this study, underwater vision enhancement aids are operationally defined as the set of aids and tools used in an aquatic environment with the aim of providing learners with clearer vision whilst learning basic swimming skills, and include, in particular, swimming goggles, underwater visual markers or signals, and various visual display aids, the impact of which is measured by their contribution to facilitating movement perception and accelerating the acquisition of basic motor skills among beginners.

b- Acquisition of basic skills:

Terminological definition: The acquisition of basic skills is defined as the educational and training process through which basic movements are learnt and gradually mastered as a result of practice and experience, such that the learner becomes capable of performing the skill with an acceptable degree of accuracy, consistency and motor coordination. Motor learning researchers indicate that motor skill acquisition represents a relatively permanent change in performance ability, resulting from practice and training rather than from temporary factors such as fatigue or maturation. Schmidt and Lee have defined motor skill acquisition as the set of processes associated with practice and experience that lead to relatively permanent changes in the ability to perform skilfully . (Schmidt, R. A., & Lee, 2019, 32)

Procedural definition: In procedural terms, the acquisition of basic skills in this study refers to the extent to which a beginner learner is able to learn and master the basic swimming skills (such as floating, gliding, breathing, and leg and arm strokes) during the learning period, enabling them to perform these skills correctly and effectively in accordance with the specified technical standards.

c- Swimming:

Terminological definition: Swimming is defined as a physical activity and motor skill involving an individual's ability to move and propel themselves through water using coordinated arm and leg movements whilst controlling their breathing, with the aim of floating, moving or competing in sport. Swimming is also considered an individual sport that relies on neuromuscular coordination and physical and technical abilities to achieve effective performance in an aquatic environment. Maglischo notes that swimming is the process of moving through water using coordinated body movements with the aim of achieving the best possible performance efficiency whilst minimising water resistance.(Maglischo, 2003, 92)

Procedural definition: Swimming is defined procedurally in this study as the set of basic motor skills that beginners learn in an aquatic environment; these include floating, gliding, breathing and basic limb movements, which aim to enable the learner to move through the water safely and effectively in accordance with established technical principles.

7) Previous and similar studies:

a- Study by Fatmir Misimi, University of Ljubljana, 2022: (**Misimi, F 2022, pp. 1525–1545**)

The Effect of Using Goggles and a Snorkel on the Acquisition of Aquatic Skills in Youth Learn-to-Swim Programmes

This study aimed to examine the effect of using goggles and a snorkel during a swimming programme on the aquatic skills of young children who cannot swim and suffer from aquaphobia. Forty volunteer children took part in the study and were randomly divided into two groups: a group that used goggles and a snorkel (GS), and a group that did not (NGS). After four weeks (five sessions per week) of the swimming programme, the aquatic skills of both groups improved; however, the improvement in entering the water, gliding on the back and swimming on the front was greater in the GS group compared with the NGS group. In contrast, the programme's effect on the ability to blow bubbles was less pronounced in the GS group than in the NGS group. Consequently, it appears that

the use of goggles is more beneficial in a swimming programme for young children with aquaphobia than not using them in all lessons.

b- Study by Misimi, F., Kajtna, T., & Kapus, J. (2023): (**Misimi, F 2023 pp. 1714–1731**)

More on the Use of Goggles and Snorkels in Learning to Swim: New Results for Children Without a Fear of Water

It has been found that the use of goggles and a snorkel benefits non-swimming children with a fear of water in a swimming instruction programme. Our aim in this study was to examine the effect of using goggles and a snorkel during a swimming instruction programme on the aquatic skills of young non-swimming children who do not have a fear of water. This research built on our previous study. After obtaining parental consent, 40 children (aged between 10 and 11 years) were randomly divided into two groups: a group that used goggles and a snorkel (GS) and a group that did not (NGS). After 4 weeks (five sessions per week) of the swimming programme, the water skills of both groups improved; the only difference between them was in the bubble-blowing test, where the swimming programme resulted in smaller gains for the GS group compared with the NGS group. Consequently, the use of goggles and snorkels (compared with not using them) during the swimming programme had no significant effect on most of the aquatic skills of non-swimmers who did not suffer from a fear of water. The sole exception was a marked reduction in the improvement in bubble blowing among the group that used goggles and snorkels compared with the group that did not. Alongside previous findings, these results highlight important differences in swimming learning between non-swimmers who have a fear of water and those who do not.

Summary of previous studies:

Studies agree that:

- Visual perception is a key component of motor learning
- Improved vision accelerates skill acquisition
- Teaching aids (such as goggles) are beneficial in the early stages However, they differ on:
- the duration of the effect
- The degree of reliance on these aids

8) Theoretical framework:

The theoretical framework in this study provides the scientific basis for understanding the relationship between aids to underwater vision and the process of acquiring motor skills in swimming, particularly among beginners who are going through a sensitive stage of learning in which cognitive, psychological and motor dimensions interact in a complex manner. Learning to swim cannot be reduced to merely mastering motor techniques; rather, it is a comprehensive process of adaptation to a new environment that requires the learner to reorganise their sensory perception and motor responses.(Ziush et al., 2019, 635)

In this context, motor learning is one of the central concepts that cannot be overlooked when analysing this topic; the scientific literature in this field—particularly the works of Schmidt and Lee—indicates that motor learning is a relatively permanent process leading to a change in performance ability as a result of practice or experience. This learning relies on a series of interrelated processes, beginning with the reception of sensory information, continuing through its processing by the nervous system, and culminating in the production of an appropriate motor response. This process clearly demonstrates that any impairment at the stage of sensory perception – particularly visual perception – will have a direct impact on the quality of motor performance.

When this concept is applied to an aquatic environment, the picture becomes more complex, as the learner finds themselves in an environment that differs radically from the terrestrial environment in terms of its physical properties. Unlike air, water alters the path of light due to its different refractive index, which distorts the visual image. Furthermore, the absorption of light within water reduces its intensity and affects the perception of colours and contrast, making vision less clear. These physical properties create what might be termed ‘perceptual blurring’, whereby the learner loses the ability to pinpoint their location accurately, estimate distances, or even recognise the direction of movement.

This blurring affects not only the visual aspect but extends to the entire sensory perception system, as human movement relies on the integration of several senses, including sight, touch and proprioception. When one of these components is impaired, as is the case with underwater vision, the learner is forced to compensate using other senses, a process that requires time and experience, which beginners do not usually possess. Hence, one can understand the reason for the relative slowness in learning to swim compared to some other motor activities (Zaki Ali Mohammed, 2002, 59).

In light of this, methods for improving underwater vision emerge as teaching aids designed to reduce this perceptual deficit by enhancing the quality of visual input. Swimming goggles are the most common method; they create an air layer in front of the eye, preventing excessive refraction of light and maintaining image clarity. They also protect the eyes from irritation, allowing the learner to open their eyes underwater with confidence and comfort.

From the perspective of learning theories, the role of these aids can be explained in the light of information-processing theory, which holds that humans process sensory information in a manner similar to how a computer processes data: information is received, analysed, and then an appropriate decision is made. The clearer and more accurate the information, the more efficient the processing and the more precise the motor response. Consequently, improving underwater vision is tantamount to improving the quality of 'input', which has a positive impact on motor 'output' (Qasim Hassan, 68, 2000).

This role can also be explained through the theory of feedback, which is a fundamental component of motor learning. The learner needs to know the results of their performance in order to correct their mistakes, and this knowledge can be internal (through proprioception) or external (through vision or the coach's instructions). In the case of swimming, vision is one of the most important sources of external feedback, particularly in the early stages of learning. When this visual feedback is improved, the learner becomes able to notice their mistakes immediately, which speeds up the correction process and reduces the recurrence of errors.

Alongside the cognitive aspect, the psychological dimension—which plays a crucial role in learning to swim—cannot be overlooked. The aquatic environment, by its very nature, can provoke feelings of fear and anxiety, particularly among beginners who are not yet accustomed to submerging their bodies in water. This fear intensifies when the learner loses their ability to see, as they feel a loss of control over the situation. Studies in sports psychology have shown that a sense of safety is a prerequisite for successful learning, and that anxiety can lead to muscle tension that impedes motor performance (Zaki Ali Mohammed, 2002, 36).

In this context, vision-enhancing aids help to reduce this anxiety by enabling the learner to see their surroundings, thereby strengthening their sense of control and

boosting their self-confidence. Although this psychological effect is indirect, it plays an important role in accelerating learning, as it encourages the learner to try and experiment – two essential elements in the acquisition of skills.

However, approaching this topic from a scientific perspective also requires mention of certain reservations associated with the use of these aids. Some researchers believe that over-reliance on vision-enhancing aids may lead to a form of dependency, whereby the learner becomes unable to perform with the same efficiency in their absence. This view is based on the principle of adaptation, which posits that learning is more effective when it takes place in varied conditions, allowing the learner to develop flexible responses. In the case of swimming, a learner accustomed to clear visibility may find it difficult to adapt to conditions where visibility is limited, such as swimming in open water (Zaki Ali Mohammed, 2002, 198).

Hence, the importance of a gradual approach to the use of these aids becomes apparent: they should initially be employed to facilitate learning, and reliance on them should then be gradually reduced, with the aim of promoting motor independence. This gradual approach is in line with modern educational principles which emphasise the need to transition from supported learning to self-directed learning, as advocated by organisations such as the World Health Organisation in their recommendations regarding physical activity and motor learning.

The role of individual differences in determining the effectiveness of visual aids cannot be overlooked, as individuals differ in their learning styles; some rely more heavily on vision, whilst others rely on kinesthetic or auditory senses. Age also plays an important role, as children are more influenced by visual factors, given that their cognitive systems are not yet fully developed. This means that the use of these methods may be more important in teaching children than in teaching adults (Bastiosi Ahmed, 1996, 56).

In light of this analysis, it can be said that the theoretical framework of this study is based on a set of fundamental pillars, namely motor learning, sensory perception, feedback and psychological factors, all of which interact to determine the course of learning. Vision-enhancing aids are an element that intersects with these pillars, as they influence the quality of perception, provide more accurate feedback, and contribute to improving the learner's psychological state.

Consequently, understanding the role of these aids cannot be done in isolation; rather, it must be viewed within an integrated system of factors that determine the success of the learning process in an aquatic environment. This is what the present

study seeks to achieve, by analysing this role in the light of scientific theories and field data, with the aim of arriving at a deeper and more comprehensive understanding of this phenomenon (Ziush et al., 2019, 623).

9) Analysis through theoretical studies:

An analysis of the role of underwater vision enhancement devices would be incomplete without examining the precise relationship between visual perception and the construction of motor schemas in the learner. Motor learning, as indicated by recent literature in motor neuroscience, does not occur randomly, but rather depends on what are known as mental representations of movement—internal images constructed by the brain based on various sensory inputs, foremost among which is vision. In the case of swimming, this representation is more complex, as the learner does not see their entire body as in land-based activities, but relies on partial and intermittent cues (Bastiosy Ahmed, 1996, 187).

When vision is poor or blurred, these representations become inaccurate, leading to repeated motor errors and slowing down the learning process. However, when vision is enhanced using assistive devices, the brain receives clearer visual information, allowing it to construct a more accurate motor model, which in turn accelerates the acquisition of the skill. This can be explained in the light of the 'closed-loop control' theory, which posits that motor performance is continuously adjusted based on sensory feedback.

In this context, vision acts as an immediate corrective tool, enabling the learner to notice deviations in their body position or inconsistencies in their movements and to adjust them instantly. When repeated, this process leads to the consolidation of the correct motor pattern in the nervous system, thereby reducing the need for conscious monitoring over time and propelling the learner towards a stage of automatic performance.

From another perspective, the role of the learning environment in either facilitating or hindering this type of learning cannot be overlooked. The aquatic environment, by its very nature, can be a source of anxiety, particularly for beginners. When combined with poor visibility, the degree of uncertainty is compounded, leading to psychological stress that negatively affects motor performance. Studies in sports psychology indicate that anxiety leads to increased muscle tension, which hinders the fluidity of movement and affects balance.

Hence, the indirect impact of vision-enhancing aids can be understood, as their benefits are not limited to the cognitive aspect but extend to the emotional aspect as well. When a learner can see clearly underwater, they feel a greater sense of control over the situation, which reduces fear and enhances a sense of safety. This is consistent with the emphasis in the literature on motor education that a sense of safety is a prerequisite for successful learning – a principle adopted by international organisations such as UNESCO in their guidelines on physical education (Bastiosi Ahmed, 1996, 89).

Moving on to an analysis of the skill performance itself, we find that basic swimming skills, such as floating, gliding and breathing, rely heavily on balance and coordination. In their early stages, these skills require constant visual guidance. For example, floating requires maintaining a horizontal body position, which is difficult to achieve without visual perception to help the learner correct the position of their head and back. The same applies to gliding, which relies on keeping the body straight and minimising water resistance – factors that can be better observed visually when clear vision is available.

As for breathing, one of the most complex skills, improved vision helps the learner coordinate head movements with the process of inhaling and exhaling, particularly in swimming styles that require the head to be raised periodically. When vision is blurred, the learner may hesitate to submerge their face completely, which hinders the proper learning of this skill.

Despite all these benefits, it remains essential to approach the subject with a balanced, critical perspective. Some researchers argue that over-reliance on assistive devices may lead to a form of 'functional dependence', whereby the learner becomes unable to perform with the same efficiency in the absence of these aids. This argument is based on a well-known principle in motor learning, namely that varied training conditions help to generalise the skill, whilst becoming accustomed to fixed conditions may limit the ability to adapt (Zaki Ali Mohammed, 2002, 37).

Consequently, it can be argued that the optimal use of visual aids should be phased, such that they are initially used to facilitate learning, and reliance on them is then gradually reduced, with the aim of developing the learner's ability to adapt to different circumstances. This gradual approach is not merely an option, but an educational necessity to ensure the transition from supported learning to independent learning.

Furthermore, this topic opens the door to the integration of modern technology

into swimming instruction, where one can envisage the use of more advanced tools, such as goggles equipped with visual cues, or augmented reality systems that provide immediate feedback to the learner. However, such applications are still in their early stages and require rigorous scientific studies to assess their effectiveness, particularly in real-world educational settings (Zaki Ali Mohammed, 2002, 77).

In a related context, it is worth emphasising that individual differences among learners play an important role in determining the extent to which vision-enhancing tools are beneficial. Some individuals rely more heavily on visual perception, whilst others rely on kinesthetic or auditory senses. Consequently, the effectiveness of these aids may vary from person to person, which requires the trainer to adopt a flexible teaching approach that takes these differences into account.

Age is also a significant factor, as children are more influenced by visual cues than adults, given that their cognitive systems are not yet fully developed. This means that the use of vision-enhancing aids may be more important in teaching children, whilst adults can rely more heavily on other learning strategies.

The practical implications of this topic cannot be overlooked, particularly in the context of swimming programmes, where coaches face the ongoing challenge of striking a balance between accelerating learning and ensuring its quality. In this context, vision-enhancing aids can be considered an effective tool within a range of teaching tools, but they cannot replace well-planned lessons or a systematic progression in the teaching of skills.

In light of the above, it is clear that the impact of underwater vision enhancement goes beyond a simple technical effect to encompass interrelated cognitive, motor and psychological dimensions. This makes the subject a rich area for research and analysis, particularly given the growing need to develop more effective teaching methods in the field of swimming.

In conclusion, it can be emphasised that improving underwater vision is one of the key factors contributing to the accelerated acquisition of basic swimming skills among beginners, but it is not the only factor. Learning is a complex process in which several elements interact, and its success remains linked to the coach's ability to integrate these elements in a way that takes into account the learner's

characteristics and the learning conditions.

10) Discussion:

The theoretical and analytical data presented above show that visual perception cannot be regarded merely as an auxiliary element in learning to swim; rather, it represents a structural component that interacts with various dimensions of motor learning, whether at the level of constructing mental representations of movement, regulating performance in real time, or even shaping the learner's psychological state. However, these findings, whilst important, call for a careful scientific discussion that takes into account the nature and limits of this influence, as well as the mediating factors that may enhance or diminish its effectiveness.

In this context, the pivotal role of vision can be explained in the light of modern models of motor learning, which view motor performance not merely as a direct result of practice, but as the product of a complex interaction between sensory input and neural processing. According to Richard Schmidt and Timothy Lee, the quality of sensory information is a key determinant of learning efficiency, as this information enables the construction of more precise and stable motor programmes (Schmidt & Lee, 2019). In this context, improved underwater vision can be regarded as an enhancement in the quality of sensory input, which explains the accelerated skill acquisition observed in learners who use visual aids.

However, whilst this explanation is valid, it should not be understood in isolation from the other components of the motor system. Effective learning does not depend solely on vision, but requires integration between several sensory systems, including proprioception and the vestibular system, which is responsible for balance. Consequently, some researchers raise the issue of over-reliance on vision, particularly at stages when learners are supposed to begin developing their internal sense of movement. Some studies suggest that an excessive focus on visual input may lead to what is known as 'sensory dependence', whereby the learner becomes less able to perform in the absence of such input (Bastiosy Ahmed, 1996, 73).

In the context of swimming, this argument takes on added significance due to the specific nature of the aquatic environment, which does not always provide ideal visual conditions, particularly in open water. Consequently, a learner who relies heavily on clear vision may find it difficult to adapt to conditions where visibility is limited. This supports the idea that the use of vision-enhancing aids should be phased in: initially employed to facilitate learning, then gradually phased out to promote motor independence.

On the other hand, the relationship between vision and feedback emerges as one of the key themes in interpreting the results of this analysis. Feedback, whether internal or external, is the mechanism through which performance is adjusted and improved. In this context, vision provides a rich and accurate source of information about performance, allowing for immediate corrections. However, the effectiveness of this feedback depends on the learner's ability to interpret this information, which is linked to their level of experience. A beginner may recognise the error but does not necessarily know how to correct it, highlighting the role of the instructor in directing attention and interpreting visual information.

The timing of feedback also plays a crucial role in its effectiveness. Immediate feedback, provided by visual cues, is most effective in the early stages of learning, when the learner requires constant correction. In the advanced stages, however, it may be beneficial to reduce reliance on such feedback, to allow the learner the opportunity to develop internal regulatory mechanisms. This is in line with the principle of 'gradual reduction of support' emphasised in modern educational literature.

On a psychological level, the findings show that improved vision does not merely affect cognitive function, but also extends to the learner's emotional state. A sense of security, which is enhanced by the ability to see, is a crucial factor in reducing anxiety and increasing motivation. Reports published by the World Health Organisation have confirmed that a safe learning environment contributes directly to improved motor learning outcomes (WHO, 2020). However, this psychological effect may vary between individuals, as some learners may not be affected to the same degree by visual factors; this necessitates taking individual differences into account when designing educational programmes.

In this context, age and prior experience emerge as key factors in determining the extent to which learners benefit from vision-enhancing aids. Children, for example, rely more heavily on vision in their learning, as their other sensory systems are not yet fully developed, meaning they benefit more from such aids. Adults, on the other hand, may have a greater capacity to rely on internal sensation, thereby reducing their dependence on vision (Zaki Ali Mohammed, 2002, 44).

Despite these advantages, it is important to note certain limitations that may

restrict the generalisability of the findings of this analysis. On the one hand, most studies rely on controlled learning environments, which may not fully reflect the reality of various learning conditions. On the other hand, the results may be influenced by external factors such as the quality of training, the competence of the instructor, and the learner's motivation – factors that are difficult to control entirely.

Based on the above, it can be said that the role of vision in learning to swim is complex and multifaceted, involving an interplay of cognitive, motor and psychological factors. Although improving vision is an important factor in accelerating learning, its effectiveness depends on how it is utilised within an integrated teaching system that takes a progressive approach and encourages the development of motor independence. Consequently, the real challenge lies not in the use of these methods in and of themselves, but in how to integrate them intelligently into a comprehensive teaching strategy that strikes a balance between support and challenge, and prepares the learner to cope with various performance conditions (Zaki Ali Mohammed, 2002, 134).

11) Conclusion:

Through its theoretical analysis and scientific discussion, this study demonstrates that learning to swim for beginners cannot be understood merely as a mechanical process of acquiring a set of movements; rather, it is a complex process in which cognitive, motor and psychological dimensions dynamically interplay. At the heart of this process, visual perception emerges as a pivotal element that guides performance, contributes to the construction of mental representations of movement, and influences the learner's degree of adaptation to the aquatic environment.

Analysis has shown that poor underwater vision constitutes one of the main obstacles slowing down the learning process, through its direct impact on body position awareness, movement tracking and error correction. Conversely, improving vision through assistive devices such as swimming goggles helps to enhance the quality of sensory input and provides more accurate feedback, which has a positive impact on the speed at which basic skills are acquired and the quality of their execution. It is also clear that this effect is not limited to the motor aspect alone, but extends to the psychological dimension, where it helps to reduce fear and enhance a sense of safety – a prerequisite for successful learning, as confirmed by reports from the World Health Organisation (WHO, 2020).

However, these findings, whilst important, should not be understood in

deterministic or reductionist terms, as motor learning is, by its very nature, a multifactorial process that cannot be attributed to a single variable alone. Vision, whilst important, remains part of a broader sensory system that includes proprioception and balance – elements that develop gradually through practice and experience. Consequently, over-reliance on visual aids may, in some cases, undermine the learner's ability to adapt to conditions where vision is limited, highlighting the importance of a gradual approach to the use of such aids within a carefully designed educational programme.

The discussion also shows that the effectiveness of vision-enhancing aids is inseparable from the educational context in which they are used, as the quality of the framework, the trainer's expertise and the learner's characteristics play a decisive role in determining the extent to which they are beneficial. Learners do not benefit from clear vision in and of itself, but rather from their ability to interpret visual information and utilise it to improve their performance, which requires conscious educational guidance. In this context, the role of the coach becomes central, not only in delivering the exercises, but also in organising the learning environment in a way that stimulates learning, takes individual differences into account, and encourages independence.

From a broader perspective, this study opens up important avenues for reflection on the development of swimming teaching methods, through the integration of modern approaches based on improving the quality of sensory perception and the strategic use of teaching aids. It also highlights the need for further field studies based on accurate empirical data, with the aim of verifying the long-term impact of vision-enhancing aids and determining the optimal conditions for their use across different age groups and learning levels.

In conclusion, it can be affirmed that underwater vision-enhancing aids represent an effective teaching tool that contributes to accelerating the acquisition of basic swimming skills among beginners by supporting visual perception, enhancing feedback, and improving psychological well-being. However, their true value lies not in their use as a substitute for learning, but as a supportive tool employed within a comprehensive educational vision aimed at developing learners who are adaptable, proficient in their skills and independent in their performance. From this perspective, the success of the learning process is measured not only by the

speed of acquisition, but also by the extent to which the skill is consolidated and the learner's ability to apply it in various circumstances; this constitutes the ultimate goal of any effective swimming programme.

12) Conclusions Based on the theoretical analysis of *the extent to which underwater vision enhancement aids contribute to accelerating the acquisition of basic swimming skills among beginners*, and in light of the literature on motor **learning**, the following conclusions can be drawn:

1. Visual feedback is an important element in the early stages of motor skill learning, as it helps beginners to understand their body position and correct errors more quickly.
2. Measures to improve underwater vision can help facilitate the process of motor perception within the aquatic environment, which has a positive impact on the speed at which basic swimming skills are acquired.
3. Effective motor learning relies on the integration of vision and internal motor sensation, rather than on sight alone, which makes diversification of learning methods essential.
4. Over-reliance on visual aids may limit the development of proprioception, particularly in the advanced stages of learning, where performance becomes more dependent on the internal sense of movement.
5. Theoretical analysis highlights the importance of a gradual approach to the use of vision-enhancing aids, whereby they are initially employed to facilitate learning, and reliance on them is then gradually reduced to achieve motor independence.
6. The effectiveness of visual aids remains linked to the way they are incorporated into the teaching programme rather than to their mere presence, which requires pedagogical awareness on the part of the trainer or teacher.

13) Suggestions (future research directions):

1. Conducting field studies to measure the extent to which underwater vision-enhancing aids affect the speed of learning swimming skills compared to traditional methods.
2. To study individual differences (age, fear level, sporting experience) in the use of visual aids.
3. To compare the impact of underwater visual aids with that of auditory or tactile feedback on learning to swim.
4. Analysing the effect of these aids on different swimming styles (front crawl, breaststroke, backstroke).
5. To investigate the relationship between the use of vision-enhancing aids and the long-term development of technical performance in beginners.

14) **Recommendations** Based on the theoretical analysis of **underwater vision-enhancing aids and their impact on swimming learning among beginners,** and within the framework **of** motor **learning**, the following recommendations can be made:

1. The judicious use of aids to improve underwater vision during the early stages of swimming instruction, given their role in facilitating motor perception.
2. It is essential not to overuse these aids, so that the learner does not become entirely reliant on visual feedback and neglects their internal kinesthetic sense.
3. Incorporate a variety of teaching methods that combine vision, proprioception and verbal feedback to ensure holistic learning.
4. Train instructors on how to incorporate visual aids into teaching programmes in a gradual and systematic manner.
5. Encourage learners to perform exercises without aids at advanced stages to promote motor independence.

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