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RESEARCH ARTICLE

REVISED Teaching Self-efficacy and Teaching Methods in the Aquatic Environment

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Abstract

Background

Studies have shown that perceived self-efficacy can influence teachers' emotional state, thoughts and behaviours, and students' learning. It's also an important referential of professional satisfaction. Teaching theories influence learning, human development, motivation levels and, consequently, continuity of practice in favour of healthy lifestyle. Research on aquatic educators and teaching theories is both limited and essential, as aquatic literacy is considered a vital component of physical literacy, enabling individuals to better interact with aquatic environments.

Methods

For this study we used an online questionnaire, aimed at aquatic educators, which was answered voluntarily and anonymously to 1) assess the professionals' perception of self-efficacy; 2) which teaching theories are most used by aquatic educators and 3) identify the teaching theory used by professionals who perceive themselves as most effective. It has been deposited and can be consulted at <https://doi.org/10.6084/m9.figshare.27316242.v1>.

Results

All teaching theories can generate a feeling of self-efficacy in teachers despite having different results, with the theories that involve students more actively (cognitivist and constructivist) being those that generate a greater feeling of self-efficacy in teachers. Comprehensive Aquatic Method (MAC) is a method that is more closely related to

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theories focused on active student participation and, consequently, it is a theory that generates a high perception of self-efficacy in teachers.

Conclusions

Levels of self-efficacy influence aquatic educators satisfaction, educator physical, mental and emotional health, as well as student learning. It is recommended that aquatic educators give prevalence to the cognitivist and constructivist teaching theories being MAC a privileged methodology approach for promoting active lifestyle habits throughout life.

Keywords

methods, aquatic literacy, teaching, self-efficacy

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REVISED Amendments from Version 1

The new version of the document takes on board the recommendations of the reviewers: standardising the terminology used; revising the text to clarify the information; checking that the objectives are in line with the document as a whole, introducing more recent references on the subject in question and revising the term teaching methodologies to teaching theories.

Any further responses from the reviewers can be found at the end of the article

Introduction

Considering aquatic literacy as an integral part of physical literacy (Albarracín & Moreno-Murcia, 2018), allows to increase the vision on the contents and impact of school physical education. The development of aquatic literacy, as part of a larger concept called water competence, in the school-aged population can contribute to the reduction of physical inactivity and is certainly determinant for the prevention of drowning not only at school age but also in the adult future. In order to reach as many children and youth as possible, it is necessary to make the practice accessible to all, and only the school has this inclusive opportunity. But it is not enough the content that can be offered to the students, it is important how this content is shared considering the benefits for the teacher, for the student and the retention not only of the learning but more than anything else of the enjoyment of an active lifestyle, which finds in the aquatic activities one more way to stay active. To achieve success in any activity, it is very important that one must have a strong and positive beliefs in their own abilities (Hussain & Khan, 2022). In this sense, the study of teacher self-efficacy, is considered as a key element for professional satisfaction, motivation (Ortan et al., 2021), emotional self-regulation (Shahzad & Naureen, 2017), professional well-being, school success and progress (Barni et al., 2019), promotion of positive learning results, students behaviours (Bordelon et al., 2012) and motivation (Lauermann & ten Hagen, 2021).

Teachers self-efficacy is a priority in promoting effective teaching and learning environments and in the last years the evidence recognized the relation with teachers well-being (Salas-Rodríguez et al., 2021). However the scarcity of studies in countries with spanish (Salas-Rodríguez et al., 2021) and portuguese speaking languages, this is even more pronounced when we focus on aquatic education, what gives to this study particularly relevance.

According to Bandura's (1977, 1997) theory, self-efficacy refers to teachers beliefs about their abilities to successfully complete a specific task with positive quality of teaching and learning outcomes. In turn, and according to the view of, Ainley & Carstens (2018) define self-efficacy as "the beliefs that teachers have about their ability to implement certain teaching behaviours that influence students' educational outcomes, such as achievement, interest and motivation". These types of personal beliefs tend to be rigid (Ortan et al., 2021) and from a theoretical perspective, teacher self-efficacy is a multi-faceted affective construct (Zakariya 2020).

People with a high sense of self-efficacy tend to see themselves in a successful situation, which is a positive incentive in their performance (Schwarzer et al., 2000), are more confident and have greater pro-activity in task solving (Peng & Mao, 2015), adopt creative teaching strategies, address educational challenges effectively (Li, 2023), have better connexion with her students (Wettstein et al., 2021). In contrast, people with a low sense of self-efficacy are more prone to depression, anxiety (Bandura, 1997) and to have more problems with student discipline and behaviour (Ortan et al., 2021), avoid challenging activities, view creative activities and situations as difficult to handle, consider most things negative, and lose easier confidence in their abilities (Hussain & Khan, 2022). Perceived teacher self-efficacy is an essential element that can influence teachers' thoughts, behaviours and emotions (Bandura, 1997; Pendergast et al., 2011; Poulou et al., 2019), the receptiveness to experiment new theories in an attempt to meet the needs of the learners (Shahzad & Naureen, 2017), as well as student learning (Dellinger et al., 2008). However, most studies on teacher self-efficacy seem to focus predominantly on job satisfaction (Zakariya, 2020).

For several decades, attempts have been made to discover those teaching characteristics that best demonstrate high effectiveness in professional work (Korthagen, 2004; Koster et al., 2005), in order to configure an effective teaching style and thus make it possible to link teaching variables with self-efficacy (Avalos, 2011).

Tschannen-Mora & Woolfolk Hoy (2001) review all the sources in which the construct of teacher efficacy appears, concluding that teacher self-efficacy is not only related to student outcomes in terms of performance, motivation and self-efficacy, but is also to some extent linked to the behaviours that students display in the classroom as a result of the teacher's methodological intervention. In this sense, relating information on the characteristics of teaching theory (from more behaviourist to more constructivist perspectives) and teacher self-efficacy could help to determine which practices lead to greater benefits including in general educational system (Luo et al., 2024).

Teaching theories

A diverse range of teaching theories exists in educational contexts, often categorized as autonomy-supportive or controlling. The teacher's approach significantly influences student learning outcomes, determining whether students succeed or struggle academically (Shahzad & Naureen, 2017; Woolfolk, 1998). Research indicates that teaching theories in sports not only affect technical, tactical, and physical skills but also psychological and social dimensions (Emmanouel et al., 1992). For instance, in aquatic skill instruction, the teacher's influence extends beyond motor skills, impacting levels of intrinsic motivation.

Healthy variability in teaching (Mosston & Ashworth, 2002) provides numerous opportunities for interaction between teachers and students, highlighting the significance of enhancing decision-making skills (Hein et al., 2015). One theory is based on behaviourist teaching theory, characterized by a strictly teacher-directed approach where students merely replicate tasks. This teaching theory relies on environmental reinforcement and leads to rote, repetitive learning based on stimulus-response dynamics (Hein et al., 2012).

In contrast, the cognitivist, learner-centered methodology (Bechter et al., 2019) focuses on knowledge acquisition through creating mental structures and understanding learning processes (Dyson et al., 2004). Here, learners actively engage in problem-solving, evaluating alternatives based on their knowledge (Hein et al., 2012).

The constructivist theory shifts the focus to students, allowing them to set learning objectives, select content, and choose assessment methods (Barker et al., 2014; Kirk & Macdonald, 1998). This approach fosters active participation, enabling students to solve problems with teacher support, thereby constructing their own understanding of the subject matter (Nuñez & Oliver, 2020; Goodyear & Dudley, 2015).

A fourth approach, known as laissez-faire, involves minimal teacher intervention, where the teacher only organizes equipment and manages time and space without engaging with learners during activities (Hein et al., 2012).

The evolution of pedagogy reflects a shift from instructional to constructivist theories, demonstrating that learner-centered approaches yield significant benefits (Barker et al., 2014; Bechter et al., 2019; Walseth et al., 2018), improved students motivation, more confidence and strengthened relationships (Bremner et al., 2022). More passive teaching theories, characterized by authoritative directives, can hinder learners' autonomy, leading to anxiety, boredom, and indiscipline (Reeve & Tseng, 2011). Such theories often focus on isolated, non-contextualized tasks that fail to engage learners as active learners, diminishing their learning outcomes (Blomquist et al., 2001).

Conversely, active involvement theories encourage learners to become creative, social learners who construct their own knowledge and identify areas for improvement (Dyson et al., 2004). These approaches emphasize the simultaneous development of technical skills, tactical understanding, and decision-making through real-game situations and problem-solving, exemplified by Teaching Games for Understanding (TGfU) and the Comprehensive Aquatic Method (MAC) (Moreno-Murcia & Ruiz, 2019).

Introduced by Moreno and Gutiérrez in 1998, the MAC is a constructivist approach that centers on learner interests and needs, promoting autonomy and interaction. It employs play as a medium, with the educator fostering a positive, varied learning environment (Moreno-Murcia & González, 2022). This methodology encourages problem-solving and exploration in aquatic environments, developing knowledge, skills, and attitudes that contribute to learner autonomy and personal growth (De Paula & Moreno-Murcia, 2018). Such models facilitate opportunities for all learners to solve problems, make decisions, and demonstrate leadership (Metzler, 2011), equipping them with essential competencies for various life stages and contexts.

Utilizing cognitive and constructivist teaching theories in sport education can enhance information retention and enjoyment (Batez et al., 2021). This focus is vital for promoting youth participation in regular physical activity, particularly as many learners would choose to opt out of physical education if it were optional. over 50% of 10th and 11th graders reporting a lack of interest in the current curriculum (Ha, Johns & Shiu, 2003).

Addressing challenges in identifying relevant PE content, actively engaging learners, and building self-efficacy among educators and learners is essential for fostering health and social well-being through physical activity, with aquatic activities playing a critical role in drowning prevention.

Teaching self-efficacy and teaching theories

Self-efficacy is a construct that has been analysed in the field of education in general and in specific contexts, such as school physical education and physical-sport activity (Balaguer et al., 1995) and is one of the most widely used theories in

sport teaching and motor performance (Feltz, 1995). An extensive number of studies have accumulated over decades on the basis of Bandura's (1986) social cognitive theory, especially in relation to people's beliefs about their abilities, i.e., about self-efficacy evaluations and achievement behaviours in sport (Beauchamp et al., 2019). For example, the study by Moritz et al. (2000) found that self-efficacy is a consistent correlate of performance in sport. In this sense, the nature and direction of the efficacy-performance relationships differ depending on whether intrapersonal or interpersonal effects are considered (Beattie et al., 2016; Vancouver, 2018). That is, while learners who display high self-efficacy beliefs in relation to others may be more likely to show better outcomes and performance, the nature of the efficacy-performance relationship may differ markedly when intra-individual effects are examined.

Some studies (Vancouver & Purl, 2017) have shown that when task-related information and feedback are ambiguous, within-person effects tend to be negative, but when such information and feedback are unambiguous, within-person effects tend to be positive. When participants are provided with performance feedback, higher levels of self-efficacy are related to better subsequent performance, and when feedback is not available, the self-efficacy-performance relationship is negative (Beattie et al., 2016). This suggests that teaching method employed by the teacher can support learners in achieving both their current and future goals. The methodology implemented by the teacher can help to facilitate the construction of particular self-efficacy beliefs, as long as individuals have sufficient information on which to base their judgements of ability (Beauchamp et al., 2023) and in continuity self-efficacy allows the teacher to optimise and adjust the teaching method, but also the teacher-learner, teacher-family interactions, cooperation between the elements of the educational team, decision-making and the atmosphere in the educational environment (Chacón, 2005; Ortan et al., 2021).

Therefore, self-efficacy is based on a person's beliefs about his or her own ability to plan, organise and execute the actions necessary to reach a certain achievement (Bandura, 1997). Specifically, in teaching, this is an intrapersonal motivational variable that helps to increase learners' persistence, commitment and enthusiasm for practices (Skaalvik & Skaalvik, 2007). Beliefs about teaching effectiveness are constructed on the basis of two elements of the teaching-learning process: the task and the context (Chao et al., 2017). In this sense, the effective teacher should master different teaching theories and know how to adjust them to the needs of each context. As more confident is the teacher in their ability to teach effectively, better teaching strategies he will choose to implement and a better impact it will have on their classroom performance (Luo et al., 2024).

Evidence indicates that, in general, teachers with higher self-efficacy are more likely to manage the classroom effectively (Tschannen-Moran & Woolfolk Hoy, 2007), to use more constructivist and higher quality instruction (Holzberger et al., 2013; Suprayogi et al., 2017), developing challenging approaches (Deemer, 2004), using creativity-focused instruction and comprehensive and meaningful learning (Deemer, 2004), encouraging learner autonomy and keeping learners motivated on task (Chao et al., 2017; Miller et al., 2017). Also, high self-efficacy values are associated with professionals who are more passionate about their teaching mission (Fernet et al., 2014), with greater control over their emotions, and even have less tendency to show anger or rage in front of their learners' behaviour (Shahzad & Naureen, 2017). It is very clear that the perception of teacher self-efficacy influences their professional practice with determining results in the learning processes of learners (Pan, 2014) in the generality of educational processes where physical education is an important part, as it has a direct relationship with the promotion of active lifestyle habits and can influence the rate of personal aquatic competence from childhood through the practice of physical activity in the aquatic environment guided by professionals committed to their mission.

The current study

In order to analyse the teaching theories chosen most frequently by aquatic educators, it is important to know their self-efficacy belief system (what I feel confident about doing, what I think the learners' role should be in class, how to act so that they learn, how to act to control/avoid indiscipline, etc.), as this is the main basis for the professional's decision making when planning and directing the activity. There is a tendency to choose the activities in which one feels more confident to the detriment of those in which one feels less competent.

Teacher self-efficacy is a critical factor that variably influences (positively and negatively) learner performance, being more significant than class size, socio-economic status or the starting level with which the learner arrives (Darling-Hammond & Youngs, 2002; Hindman & Stronge, 2009; Klassen & Tze, 2014; Staiger & Rockoff, 2010). There are numerous studies on self-efficacy in the context of Physical Education (Curran & Standage, 2017; De Meyer et al., 2016; Leo et al., 2020), however, there are few studies that relate teachers' self-efficacy beliefs in practices and how they actually use these practices in their classroom (Poulou et al., 2019). Furthermore, we have not found research that verified the relationship between teaching theories and teacher self-efficacy in teaching in the aquatic environment.

For this reason, we consider answering the following questions related to the aquatic educators' belief system on teaching theories and self-efficacy from the teaching perspective: What is the aquatic educator's perception of self-efficacy? Which teaching theories are most used by aquatic educators? and what teaching theories the most effective educators use?

The main objective of this study was to analyse the relationship between teaching theories, the MAC and teaching self-efficacy, as well as to check which type of teaching methodology (cognitive, constructivist, behaviourist or laissez-faire) predicted the comprehensive aquatic method. Considering the results of the previously mentioned research, it is expected to find a predictive model where teaching theories that actively involve learners will positively predict the MAC in aquatic educators. It is also expected that teacher self-efficacy will be predicted by the most learner-involving theories (constructive, cognitive and MAC).

Methods

Participants

A total of 607 aquatic educators (305 males and 302 females), from Ibero-America, aged between 18 and 61 years ($M = 36.58$, $SD = 13.02$) participated in this research and during February and April from 2024 the data analysis was done. The selection criteria for the sample were that they were at least 18 years old, with at least 6 months of teaching experience in the aquatic environment and that they were in possession of a qualification. By age, they were classified into three groups: under 25 years old ($n = 162$), between 25 and 40 years old ($n = 197$) and over 40 years old ($n = 248$). The educators' training was as follows: graduates in Physical Activity and Sport Sciences ($n = 147$), Physical Education Teachers ($n = 285$), Sports Technicians ($n = 102$) and other qualifications ($n = 73$). According to the years of experience of the aquatic educators, they had the following values: less than 1 year ($n = 75$), between 1-5 years ($n = 75$), between 6-10 years ($n = 277$) and more than 10 years ($n = 92$). The aquatic educators who participated in the study were teaching learners aged 0-6 years ($n = 126$), 7-12 years ($n = 117$), 13-18 years ($n = 41$), over 18 years ($n = 36$) and all ages ($n = 287$).

Measures

This study used three questionnaires, that were organised into a single document that combine the questions from the three mentioned, without being clear what type of content the participants were responding to. The use of these instruments has been possible with permission obtained from all authors of which type of tool and it was presented in three languages: Spanish, Portuguese and Brazilian.

Comprehensive aquatic method (MAC). The scale validated by Castañón-Rubio et al. (2022) was used with permission obtained from the authors to use these tool, to measure the use of the comprehensive aquatic method in aquatic educators. This scale consisted of 26 items divided into 3 subscales as follows: a) way of teaching, consisting of 10 items (e.g. "In each class I evaluate the objectives"); b) game, consisting of 9 items (e.g. "I adapt the games taking into account the resource and characteristics of the aquatic installation"); c) the way of teaching, consisting of 10 items (e.g. "I offer possibilities of choice (groupings, materials, etc.) to participants."). Responses were recorded on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The internal consistency obtained for each of the dimensions was .93, .88, .87, respectively, and .91 for the global MAC, considering the three dimensions as one.

Teaching theories. In order to analyse the teachers' perception of the use of their teaching theory, the adaptation of the Teaching-Learning Methods Scale in Physical Education (TLMS-PE; Leo et al., 2020) was used with permission obtained from the authors. This questionnaire is composed of the introductory sentence (e.g., "In my classes..."), followed by 19 items organised in five dimensions: 5 items to assess the behaviourist teaching theory (e.g., "I determine at all times the activity they should practice"), 5 items to assess cognitive teaching theory (e.g., "I make them look for and evaluate different answers and solutions to the tasks I set"), 6 items to assess the constructivist methodology (e.g., "I give participation to the learners so that they can decide what they want to learn") and 3 items to assess letting them do during the classes (e.g., "I spend time intervening at the beginning and end of the class distributing the material for them to play with"). The response format used is Likert-type with a 5-point response range from 1 (strongly disagree) to 5 (strongly agree). Reliability analysis showed how the items belonging to these variables were reliable for constructivist (.78), cognitive (.83), behaviourist (.74) and laissez-faire (.70) teaching theory.

Teacher self-efficacy. In order to assess teaching self-efficacy, was used an adapted version of the Teachers' Sense of Efficacy Scale by Tschannen-Moran and Woolfolk (2001) with permission obtained from the authors to use these tool. The 12 items of this scale measure perceived teacher self-efficacy in three dimensions: a) perceived efficacy in optimising one's own instruction (4 items); b) perceived efficacy in classroom management (4 items) and c) efficacy in involving learners in learning (4 items). The reliability of the total scale was .92, while by dimensions it was .81, .86 and .81, respectively.

Table 1. Descriptive statistics and correlation analysis of all variables.

	<i>M</i>	<i>DT</i>	1	2	3	4	5	6	7	8	9	10
1. Way of teaching (MAC)	3.16	.48	-	.60**	.60**	.17**	.23**	.21**	.10**	-.01	.18**	-.03
2. Game (MAC)	3.12	.53	-	-	.67**	.20**	.22**	.22**	.25**	-.08*	.30**	.07
3. Interpersonal style (MAC)	3.21	.47	-	-	-	.22**	.23**	.22**	.25**	-.04	.27**	-.00
4. Commitment (Self-efficacy)	8.01	.98	-	-	-	-	.77**	.75**	.29**	.19**	.40**	.13**
5. Teaching (Self-efficacy)	7.92	1.04	-	-	-	-	-	.75**	.27**	.22**	.43**	.12**
6. Management (Self-efficacy)	7.87	1.00	-	-	-	-	-	-	.18**	.22**	.34**	.12**
7. Constructivist (Teaching theory)	3.62	.77	-	-	-	-	-	-	-	.18**	.67**	.57**
8. Behaviourist (Teaching theory)	3.79	.69	-	-	-	-	-	-	-	-	.30**	.37**
9. Cognitivist (Teaching theory)	4.02	.69	-	-	-	-	-	-	-	-	-	.42**
10. Laissez-faire (Teaching theory)	3.11	.94	-	-	-	-	-	-	-	-	-	-

Procedures

The present research has the approval of University Ethics Committee with the reference DCD.JMM.01.22, as well as all the scales used have obtained the respective permissions from their original authors. In order to carry out the data collection, different aquatic centres were contacted to request their collaboration in the study. The research team subsequently administered the questionnaire, in the three idioms translated, all in an online format, which was answered voluntarily and anonymously. The researchers were also available to answer any questions that arose during the process of completing the questionnaire. The questionnaire took between 15-20 minutes to complete.

Data analysis

Descriptive statistics (means and standard deviations) and bivariate correlations were calculated for all the variables under study. Cronbach's alpha coefficient was used to determine the internal consistency of each of the dimensions. Also, the predictive power of the teaching theories on Comprehensive Aquatic Method (MAC) was tested by means of a stepwise multiple linear regression analysis. A significance level of $p < .05$ was used for the statistics obtained in the different analyses, which were carried out using the R Project for statics computing (R Core Team, 2023).

Results

Descriptive statistics and correlations of all variables

The most valued variable in the MAC was the autonomy-supportive teaching style, followed by the teaching style and play. In relation to teaching self-efficacy, the most important dimension was instruction, followed by strategies for involving learners in learning and classroom management. Regarding teaching theories, cognitive theories were the most valued, followed by behavioural, constructivist and laissez-faire (Table 1). Correlation analysis revealed the existence of a positive and significant relationship between all the dimensions ($p < .01$), except between the game and behaviourist dimensions ($p < .01$), which was negative and significant. No significant correlations were found between the dimensions way of teaching and interpersonal style and behavioural theories and letting do, and between play and letting do ($p > .05$).

Linear regression analysis

A stepwise linear regression analysis was undertaken to find out how the different theories used predicted the MAC. According to the last step in the linear regression analysis, the different theories used predicted MAC with an explained variance of 12% (Table 2). The theories that positively predicted MAC were cognitive ($\beta = .29$, $p < .01$) and constructivist ($\beta = .13$, $p < .05$), while behaviourist ($\beta = -.12$, $p < .05$) and let-do ($\beta = -.14$, $p < .05$) theories predicted it negatively.

Table 2. Linear regression analysis of prediction of the MAC across teaching theories.

	<i>B</i>	<i>SEB</i>	<i>b</i>	<i>R</i> ²
Teaching theories	2.63	.12		.12**
Constructive	.07	.03	.13*	
Behaviourist	-.07	.02	-.12*	
Cognitive	.18	.03	.29**	
Laissez-faire	-.06	.02	-.14*	

* $p < .05$.

** $p < .01$.

Table 3. Linear regression analysis of prediction of teaching self-efficacy across different teaching theories and the MAC.

	<i>B</i>	<i>SEB</i>	<i>b</i>	<i>R</i> ²
	4.20	.32		.23**
Constructive theory	.01	.06	.01**	
Behavioural theory	.21	.05	.16	
Cognitive theory	.47	.06	.35**	
Laissez-faire theory	-.07	.04	-.07	
MAC	.38	.08	.18**	

* $p < .05$.

** $p < .01$.

A stepwise linear regression analysis was conducted to test which variables (teaching theories and MAC) best explained teaching self-efficacy. According to the last step in the linear regression analysis, cognitive ($\beta = .35, p < .01$), behavioural ($\beta = .16, p < .01$), and MAC ($\beta = .18, p < .01$) theories positively predicted teaching self-efficacy with a total explained variance of 23% (Table 3).

Discussion

Full confidence in one's own efficacy is needed in order to begin and sustain the effort to achieve success (Mone et al., 1995). Therefore, teacher self-efficacy may be essential for classroom success, as evidence (Miller et al., 2017) shows its relationship with teaching quality, learner achievement and job satisfaction (Toropova et al., 2021). Most of the studies that analyse the relationships between different theories and general self-efficacy have focused on learners and other contexts, so this research is a first approach to the study of these variables jointly on teachers in the aquatic education environment. With this in mind, the main objective of the study was to analyse the relationship between teaching theories, the MAC, and the teaching self-efficacy perceived by aquatic educators. In general terms, the results confirm our initial hypotheses, the MAC is more related to theories that actively involve learners and is positively predicted by cognitive and constructive theories. Furthermore, teacher self-efficacy is predicted by the theories that most actively involve the learner (constructive, cognitive and MAC). These references are in line with Guskey's (1988) study where the more effective teachers showed greater confidence and diversity of teaching strategies with creative and interesting pedagogical approaches in the classroom, contrary to the tendency of the less effective teachers to choose more traditional teaching theories. The assessment of the development of water competence in physical education curricula can be considered as an innovative pedagogical proposal that more effective teachers are more inclined to consider and which we believe will have a positive effect on the future water competence index of society in general. Achieving this will depend on the high degree of flexibility needed to generate and adapt to new scenarios, where both teachers and pupils benefit (Shahzad & Naureen, 2017; Pan, 2014). This is essential, recognising the importance of benefiting pupils and teachers in the development and promotion of a more active and consequently healthier lifestyle.

In our study, all teaching theories (constructivist, behavioural, cognitive, laissez-faire and MAC) have shown a positive relationship with the perception of self-efficacy in aquatic professionals. In general, science has identified that the use of more learner-centred theories generate a greater sense of teacher self-efficacy than the others, but with all of them it is possible to generate a sense of self-efficacy, although at different levels. Consequently, lower levels of self-efficacy are predictors of teacher burnout and stress (Dicke et al., 2014; Zhu et al., 2018) and lower learner achievement (Sharma et al., 2012). Although teachers do not perceive different teaching methodologies to be equally effective in all teaching situations (it depends on the task and context), it is the cognitive and constructivist theories that generate the most self-efficacy perceptions (Chao et al., 2017; Miller et al., 2017; Suprayogi et al., 2017). A constructivist view sees learning as a process of adapting and fitting into an ever-changing world and the aquatic environment, in its broadest expression, something is learned beyond what is practised in a pool or controlled environment. Interaction with the aquatic environment occurs through neuroception, perception, motor action and senses, so we build through the perception that the body gets from the experience (Light, 2008). In this sense and analysing the strong correlation of MAC with these theories focused on the learners (for their autonomy and transfer of competences) and their needs, it is possible to affirm that MAC, due to its proximity to cognitivist and constructivist theories, when used, teachers will feel more self-effective and well succeeded in their role of contributing to the development of water competences and promoting learners' intrinsic motivation for physical activity through water activities.

A dualistic view of the human being as mind and body (separation of self and action) is still common from a social point of view, and in this sense, following the approaches of behaviourist theories, the emphasis is still exclusively on the use of feedback and reward systems to alter and modify behaviour. But as Light (2008) points out, in a holistic view, the body and sensation are equally important in learning. So for lifelong use, the choice of the methodology to be used for better learning and retention will depend on the content to be covered, the age of the learner, their degree of autonomy and the effects expected.

There are several reasons that may explain the use of certain teaching theories, such as, for example, the development of motor skills and the improvement of sport-specific skills (Dudley et al. 2011; Hardman, 2008). There is often a tendency to use more behavioural teaching styles designed to help learners develop correct technique while providing maximum practice time (Chatoupis & Vagenas, 2017; Goldberger, 1984, 1992), but teaching motivation must go beyond the intention of developing motor competence in participants or teaching competitive sporting activities (Chatoupis, 2018). It is not only about influencing children and young people in a certain content or set of contents focused on how to do, but that this perception of teaching self-efficacy can extrapolate its scope to the development of personal and social skills (areas of to know and to be, individually and in groups), through active learning on the part of the learners, involved in an attractive way in the process (Ledertoug and Paarup, 2021).

We interpret that the use of behaviourist models leading to a perception of teacher self-efficacy may be due to: (a) the need for the aquatic educator to guarantee the safety of the learners, as the aquatic environment has a possible risk of drowning built into it; (b) by tradition, as they have historically learnt this in their sports training centres and have not had the possibility of learning about other more efficient models; (c) by the pattern followed by technical models centred on sporting skill, which emphasise knowing how to do and reproduce, where deciding or thinking is not a necessity.

In the light of the contributions of this study, it is important to emphasise the role played by teachers in the design of their classes. In general, teachers feel more effective when their theories involve active learning, making learners the protagonists of the process, giving them responsibility and autonomy, encouraging their creativity instead of meaningless memorisation, and teaching them to think in order to successfully solve the problems they face. But according to the study by [Lubans et al. \(2017\)](#) they are not reaching their potential and in order for the sessions to have a greater effect on the level of physical activity and physical literacy of young people it is essential to consider the quality of the tasks and for that it is important to design tasks with theories that actively involve the learner, in order to get the learner to focus more on mastery. This would be possible by giving more importance to aspects of self-improvement and learning, contributing to a perception of personal progress in a more effective way, feeling autonomous, competent and assuming a modifiable belief in their ability. These factors will allow them to overcome intrinsically motivated tasks, resulting in a positive psychological balance that can generate greater enjoyment and less boredom on the part of the learners, as the enjoyment experienced in classes can be an important variable for greater learning. Extending the traditional to do approach into to know and to be may be one of the possible and decisive strategies, since in order to learn the brain needs to be excited and validated as meaningful. In terms of interaction with the aquatic environment, the development of this kind of knowledge is fundamental to make transfers of knowledge from educational environments to real environments more probable. The role of aquatic education as an integral part of school physical education can clearly make a difference, as it would imply learning by professionals who are aware, committed and competent about their mission.

Despite the strengths of the study, there are a number of limitations to be taken into account when interpreting the results. Firstly, the teaching-learning theories are assessed from the point of view of the teacher and not the learners, which may not reflect the true methodology used. Secondly, being a correlational study, the results do not indicate the existence of a cause-effect relationship between the variables considered. In relation to future prospects, it would be interesting to analyse the effect of the different theories in an intervention and to check whether the relationship presented in this study is confirmed in practice. In addition, it could be relevant to establish experimental studies with different groups with different theories and to analyse the benefits or consequences of each of them. Given the potential of self-efficacy beliefs to both enhance and impair performance, future research on self-efficacy could assess associations within individuals by analysing high quality feedback or information related to task performance and the methodology that has been used to generate goal achievement.

The intention professional who teaches aquatic education, independent of the educational setting, is that their learners learn as much as possible regardless of the methodology they use. Their decisions are based on personal beliefs built up over time and influenced by some learning theories, which are rarely questioned ([Rink, 2001](#)). As the study by [Toropova et al. \(2021\)](#) indicates, this perception of self-efficacy varies with years of experience, being lower in less experienced professionals and declining in pre-retirement teachers.

This has been building cultural behaviours in the teaching methodology of the teacher in the aquatic context, which we can partly see reflected in this first study. In the search for true learning, evidence is needed in this regard, and it is challenging for trainees to implement more constructivist perspectives ([Rovegno, 1998](#)), as the starting point is to consciously question beliefs and relate them to the assumptions of learning ([Davis & Sumara, 2003](#)). It is necessary to understand learning theory and be aware of personal beliefs about the assumptions of what it means to be “‘water competent’” ([Fonseca-Pinto & Moreno-Murcia, 2023](#)). In this way, aquatic educators’ decisions should be adapted to the needs of the learner and the context.

Pedagogical implications

One of the main approaches to combat physical inactivity emphasises the need to improve the quality of activities, making them highly active and engaging ([Hills et al., 2015](#)). To encourage lifelong physical activity, counteracting current levels of inactivity, it is crucial to raise the levels of intrinsic motivation of practitioners. A multi-sectoral and multi-systemic approach is recommended, where both in-school and out-of-school programmes promote physical activity even outside the school environment ([Lubans et al., 2017](#)). However, in reality, the full potential of these programmes has not been fully realised. What are the possible contributions of this study?

Aware that there is still much to explore, given that the evidence is limited from both teacher and learner perspectives, and that there is a two-way relationship that should not be neglected, this study presents cross-cutting aspects to other

published studies, reinforcing the idea that these results can have direct implications for the teaching function, either in the field of school physical education, sports or extracurricular physical activities.

In this study, a relationship is observed between teaching theories and the level of self-efficacy perceived by the teacher. Cognitive and constructivist theories are the ones that best explain teacher self-efficacy. Although it is possible that teachers perceive themselves to be self-efficacious with all teaching theories, it is noteworthy that the values are higher when predominantly cognitivist and constructivist theories are chosen. There is a strong relationship between teacher self-efficacy, learner self-efficacy, learning outcomes, job satisfaction and retention in the teaching career, indicating that teachers who wish to feel more effective should predominantly opt for these practices. However, it is important to note that the choice of teaching methodology is influenced by context, timing and learner needs.

Higher teacher self-efficacy and the flexibility to manage the class with different theories and strategies allow for active student participation during the learning process, with positive effects on learner motivation and learning climate (Pan, 2014). We recommend that future studies assess levels of personal motivation, enjoyment of physical activity in general or in specific sports, the influence of learner motivation in the subject of physical education, and the teacher behaviours that most influence learners' intrinsic motivation to consider an active life by practising aquatic activities throughout life.

According to the MAC methodology, the most highly valued variable was the teaching style of supporting autonomy and play. These teaching strategies are directly related to cognitivist and constructivist theories, also associated with higher values of perceived teacher self-efficacy. In summary, if the teacher seeks a greater positive impact on their learners from an ecological and holistic perspective of pedagogy, and wishes to feel more self-effective, they should choose MAC as a methodology that is present and active in their teaching role.

There is no infallible method, but there is the ability to adjust theories to the circumstances. The MAC, as an example of a constructivist methodology, together with cognitivist and even, in some cases, behaviourist theories, can fulfil the function of the learning moment considering the learner as the protagonist. To achieve this, lessons should be oriented with an educational and competence development objective, considering equally important to know, to do, know and to be (Ledertoug and Paarup (2021), with an emphasis on aquatic activities due to the effect they can have on drowning prevention. It is crucial that the practitioner, whether in the context of school, sports or extracurricular activities, considers these indications because of the importance of decision-making and knowledge transfer to other settings. This transfer perspective also considers the lifelong practice of physical activity, which is essential to maintain high levels of personal water competence when aquatic activities are part of a more active lifestyle.

In addition to what is considered in this study and based on the evidence presented, we highlight that the perception of self-efficacy varies according to years of experience (Toropova et al., 2021). It is important to value specialised and highly complex continuous training to deepen knowledge about teaching and learning in the educational context (Catalano et al., 2020). The specificity of physical education, and in particular the protective role of water competence in drowning prevention, underlines the importance of this development in teachers' professional and personal development.

Given that teacher self-efficacy is key to both professional motivation and emotional self-regulation of teachers, high levels of self-efficacy will positively influence the reduction of the likelihood of burnout processes (Ortan et al., 2021), thus preserving the physical, emotional and mental health of the professional, and directly benefiting the learner and learning.

Conclusions

This study analysed the relationship between teaching methodologies, the Comprehensive Aquatic Method (MAC), and teaching self-efficacy, while also examining which type of teaching methodology (cognitive, constructivist, behaviourist, or laissez-faire) best predicts the use of the MAC. The findings suggest that teaching methodologies that actively engage learners positively influence the adoption of the MAC among aquatic educators.

Moreover, the results indicate that teacher self-efficacy is significantly associated with methodologies that prioritize active student involvement, particularly constructivist and cognitive approaches, as well as the MAC. These findings reinforce the importance of learner-centered methodologies in enhancing both the teaching process and the confidence of educators in aquatic settings.

Ethical approval and consent

This study is part of a doctoral thesis organised into three parts related to aquatic competence and teaching theories. Specifically, this study addresses the issue of teaching theories in aquatic activities and the perception of self-efficacy by

aquatic professionals. The University's Ethics Committee has had access to the study project as a whole, which has been approved by the Miguel Hernández Ethical Committee with the DCD.JMM.01.22 code on 6 of February of 2024. All the participants in this study are adults and before started to answer the survey provided a written informed consent by agreeing to participate saying yes to the first question and respond to the complete questionnaire.

Data availability

Underlying data

Fonseca-Pinto, R., & Moreno-Murcia, J.A. (2024b). *Teaching self-efficacy and teaching methods in the aquatic environment*. [Dataset]. Figshare. Online. <http://doi.org/10.6084/m9.figshare.27310473>

The project contains the following underlying data:

- Data.xlsx. (anonymised answers to questionnaires)

Data is available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

Extended data

Fonseca-Pinto, R., & Moreno-Murcia, J. A. (2024a). *(Survey) Teaching Methods in Aquatic Education*. [Dataset]. Figshare. Online. <https://doi.org/10.6084/m9.figshare.27316242.v1>

The project contains the following extended data:

- *Teaching methods in aquatic education* (survey questionnaire).

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Version 2

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Ana Rita Matias

University of Évora, Evora, Portugal

The authors answered the questions I mentioned satisfactorily. For this reason, I have no further comments to make

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Aquatic therapy; child development; learning development

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 18 December 2024

<https://doi.org/10.5256/f1000research.165114.r341215>

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Ana Rita Matias

University of Évora, Evora, Portugal

Dear Authors,
Thank you for submitting to the F1000Research such an interesting manuscript.
Generally, some concepts need to be clarified, and also some English parts should be reviewed.

After a careful reading, I have a few questions and suggestions, which I hope will help to improve your manuscript.

ABSTRACT

BACKGROUND

- I suggest rewriting the following paragraph: "In turn, teaching methodologies influence motor learning, as well as psychological, cognitive and social learning, with different impacts on human development and learning retention, levels of intrinsic motivation and continuity of practice in order to support a healthy lifestyle."
- Suggestion: Teaching methodologies influence learning, human development, motivation levels and, consequently, continuity of practice in favour of a healthy lifestyle.
- "... aquatic literacy is an integral part of physical literacy and the only possibility of being more able to interact with this environment.? – This sentence's meaning is unclear.
- At the end of this section, the two main objectives should be pointed out: 1. Assess the professionals' self-efficacy and 2) identify the methodology used by teachers who perceive themselves as most effective. These objectives should be aligned with the research questions on page 5 (5th paragraph).

METHODS

MAC abbreviation should be introduced the first time it is mentioned.

CONCLUSIONS

The abstract should be aligned with the background, methods, and conclusions.

INTRODUCTION

P.3 "Healthy variability in teaching" does not clearly explain the meaning of this concept. It probably could be replaced by "There are different approaches regarding the interaction between teacher and student..."

P.4

3rd paragraph

"athletes" - It is suggested to use the same word throughout the text: student, subjects, athletes...

6th paragraph

"...especially considering that many students would opt out of physical education if given the choice, with over 50% of 10th and 11th graders expressing disinterest in the current curriculum" - This sentence's meaning is partly unclear.

"...used by the teacher can help participants to achieve their present and subsequent achievements." – This sentence's meaning is partly unclear.

P.5

6th paragraph

This paragraph should be rewritten to keep the goal of this study simple.

MEASURES

The authors should mention in which county the questionnaires were administrated and whether they needed to be translated.

Teaching-Learning Methods Scale in Physical Education: The authors mention five dimensions but only present four.

DISCUSSION

It seems that all statistical procedures were correctly chosen.

FINAL REMARKS

Despite being an article with a pertinent theme for the field, it needs some improvement. Apart from the above-mentioned suggestions, I suggest removing the data relating to the application of the MAC instrument.

This study should focus on two objectives:

- 1) assessing teachers' perceived self-efficacy by applying the Teachers' Sense of Efficacy Scale and
- 2) identifying which methodology is used by teachers who perceive themselves to be more effective, using the TLMS-PE.

MAC's data should be integrated into a second article.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Aquatic therapy; child development; learning development

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 14 Feb 2025

Rita Pinto

Thank you for your valuable comments and references to adjust the document to improve clarity and value. We hope that we attend positively to all your questions. We present the answer respecting the order of your comments.

- Rewriting paragraphs

We have reviewed and modified the paragraph according to your recommendations. The revised text now reads as follows: "Teaching methodologies influence learning, human development, motivation levels, and consequently, the continuity of practice in favour of a healthy lifestyle."

We have taken your suggestion into account and have rewritten the paragraph as proposed. The text now reads as follows:

"Teaching methodologies influence learning, human development, motivation levels, and consequently, the continuity of practice in favour of a healthy lifestyle."

We have rewritten the sentence to clarify its meaning. The revised text now reads as follows: "Water literacy is an integral part of physical literacy and essential for interacting safely and effectively with the aquatic environment."

- The two main objectives should be pointed out: 1.

We have rewritten the text, adjusting the methods to make the objectives clearer. At the end of this section, we have explicitly highlighted the two main objectives:

To evaluate the self-efficacy of professionals.

To identify the methodology used by teachers perceived as more effective.

Additionally, we have reviewed these objectives to ensure they align with the research questions on page 5 (5th paragraph) to maintain coherence throughout the manuscript.

- MAC abbreviation should be introduced the first time it is mentioned.

Thank you for pointing that out. We have corrected the manuscript by introducing the abbreviation MAC the first time it is mentioned, as indicated.

- Introduction

P3 - Thank you for your suggestion. We have rewritten the paragraph as indicated.

P4 (3th and 6th paragraph)- Thank you for your suggestion. We have rewritten the paragraph as indicated.

P5 - We have rewritten the paragraph as indicated use as reference the objectives of the study mentioned on abstract.

- **Methods:** The authors should mention in which country the questionnaires were administrated and whether they needed to be translated

We have rewritten the Measures section to clarify that the three questionnaires used were adapted into a single one, so that participants cannot identify which content they are responding to. Additionally, we have specified that the translation was done into Spanish,

Portuguese, and Brazilian Portuguese.

We have also included information about the countries where the questionnaires were administered, ensuring that the translations were necessary to guarantee proper understanding by the participants.

Discussion

Thank you for your valuable comment. We understand the concern raised regarding the lack of clarity in the conceptual distinction between the Comprehensive Aquatic Method (MAC) and teaching methodologies in general, especially in relation to its comparison with constructivist methodologies.

We would like to clarify that, although the MAC is described as a constructivist approach, it is not solely a constructivist methodology in the strict sense. The MAC is an integrative approach that combines various learning theories, such as constructivism, cognitivism, and student-centered elements. While it is based on the constructivist principles that emphasize active participation and adaptation to the individual needs of students, the MAC also includes strategies and structures from other pedagogical approaches aimed at fostering more comprehensive learning tailored to the context of aquatic education.

This broader approach of the MAC could explain the observed results, which report that this methodology promotes greater self-efficacy in teachers compared to purely constructivist methodologies. By integrating a variety of strategies that go beyond what is traditionally associated with constructivism, such as structured support and learning organization, the MAC allows teachers to feel more confident and competent in their practice.

We have reviewed the manuscript and believe it is important to clarify this point. Rather than referring to the MAC solely as a "constructivist methodology," we propose describing it as an integrative pedagogical approach that uses various learning theories to create a more dynamic and effective teaching environment for both students and teachers.

Conclusions

The conclusions have been aligned with the background, methods, and research objectives.

Thank you for your suggestions and comments. We would like to clarify that, for us, it is essential to understand how the Comprehensive Aquatic Method (MAC) relates to teacher self-efficacy and the methodologies used in the educational field. The MAC is not only a pedagogical approach, but we also believe it directly influences teacher self-efficacy, making the inclusion of this instrument in the study relevant to analyse this relationship. While we recognize the importance of focusing on the two proposed objectives—evaluating perceived self-efficacy through the Teacher Sense of Efficacy Scale and identifying which methodology is used by the most effective teachers through the TLMS-PE we believe that the data related to the application of the MAC adds value to the study. This data provides a more comprehensive context on how methodologies influence teachers' self-efficacy perceptions, particularly how the MAC could enhance it in comparison to other methodologies.

Competing Interests: No competing interests were disclosed.

Reviewer Report 14 December 2024

<https://doi.org/10.5256/f1000research.165114.r341212>

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Carolina Burnay

Universidade de Lisboa, Lisbon, Lisbon, Portugal

The article investigates the relationship between teaching methodologies and self-efficacy in aquatic educators. Key findings include:

- Constructivist and cognitive approaches, which emphasize active student participation, are most effective in enhancing teacher self-efficacy.
- The Comprehensive Aquatic Method (MAC), rooted in constructivist approach, is also positively linked to teacher self-efficacy.
- Behaviorist approach and laissez-faire methodologies are less effective in building teacher self-efficacy.

Based on responses from 607 aquatic educators, the authors report that active, student-centered methodologies positively correlated with teacher self-efficacy, while passive approaches showed weaker associations.

The study advocates for adopting cognitive and constructivist teaching approaches, more specifically, the MAC methodology, in aquatic education to improve teacher confidence and encourage healthier, more active lifestyles among students.

However, some areas would benefit from further explanation or clarification.

1. The authors reference developmental and learning theories such as constructivism, cognitivism, and behaviorism, treating them as though they were teaching methodologies. Teaching methodologies, like the cited MAC, can be developed using strategies underpinned by these theories. However, it is important to note that constructivism, cognitivism, and behaviorism are theoretical frameworks, not methodologies. By conflating these theories with methodologies, the authors claim to be investigating which methodology promotes higher levels of self-efficacy in teachers. This distinction between theories and methodologies should be clarified to ensure accuracy and alignment with the study's objectives.

2. It is unclear which methodologies the authors are analyzing in relation to teachers' self-efficacy. In the Introduction (Teaching Methodologies) and Methodologies sections, the authors refer to:

- Reproductive methodology – teacher direct approach
- Productive/learner centered methodology – problem solving, underpinned by the constructivist theory

- Constructivist methodology - active participation, enabling students to solve problems with teacher support
- Laissez-faire - teacher only organizes equipment and manages time and space without engaging with students during activities

But in the last paragraph of Introduction and in the Results sessions, when stating the main goals of the study, the authors refer to:

- cognitive,
- constructivist,
- behaviourist
- laissez-faire

To improve clarity and consistency, it is crucial to explicitly define the variables under analysis and use the same terms consistently throughout the manuscript. This alignment will help avoid confusion and ensure the study's findings are clearly communicated.

3. While the Comprehensive Aquatic Method (MAC) is highlighted as effective, the manuscript provides limited quantitative comparisons between MAC and other methodologies. The authors describe the MAC as “a constructivist approach that centers on student interests and needs.” However, the results suggest that MAC methodology promotes higher self-efficacy in teachers than constructivist methodologies. This creates confusion regarding the definition and distinction of teaching methodologies, which requires clearer explanation and better conceptual alignment.

4. In the Methods/Measures section, the authors mention that three questionnaires were used, but only one is available online. Additionally, in the last sentence of the Procedures section, the authors refer to “the questionnaire,” making it unclear whether participants were asked to complete three separate questionnaires or a single questionnaire that combines questions from the three mentioned in the Methods/Measures section. This ambiguity needs clarification to ensure the methodology is fully understood.

Therefore, while the study provides valuable insights into the relationship between teaching methodologies and self-efficacy in aquatic education, addressing the identified issues of conceptual clarity, methodological consistency, and writing quality would significantly enhance the manuscript's overall impact and readability.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Child Motor Development.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 14 Feb 2025

Rita Pinto

We appreciate your comments and have reviewed the entire document to align it with your suggestions. We will present our response, respecting the order of the comments made. We hope to respond positively to all requests.

- In particular, we have revised the relevant sections to clarify the distinction between learning theories and teaching methodologies.

- Additionally, we have clarified that the study aims to analyze which teaching methodology, grounded in these theories, fosters higher levels of self-efficacy in teachers. This distinction is crucial to ensuring consistency with the research objectives.

- In particular, we have standardized the terminology used to describe the methodologies analyzed in relation to teacher self-efficacy, ensuring consistency across the Introduction, Methodology section, and Results. We have clarified the definition of each methodology under analysis and ensured the consistent use of terms throughout the manuscript. This helps to avoid potential confusion and enhances the clarity of the study's findings. We this adjustments to the manuscript we believe that we improved clarity and conceptual consistency in the definition and distinction of teaching methodologies. Thank you for your comments.

-We have revised the description of the Comprehensive Aquatic Method (MAC) to clarify its theoretical foundation and its relationship to constructivism. While MAC incorporates constructivist principles, it also integrates strategies from other approaches, which may explain why the results show higher teacher self-efficacy compared to purely constructivist methodologies.

Additionally, we have included a more detailed explanation of the differences between MAC and other methodologies, as well as a clearer analysis of the factors that might influence teacher self-efficacy levels. We have also strengthened the discussion on the need for further comparative studies that provide additional quantitative evidence.

- We appreciate your comment and have made the necessary modifications in the Methods/Measures section to clarify the identified ambiguity. We have rewritten the description of the measures used, explaining that, although three questionnaires were initially mentioned, they were adapted and combined into a single questionnaire. This clarification eliminates any confusion regarding whether participants completed three separate questionnaires or just one. Additionally, we have adjusted the final sentence of the Procedures section to accurately reflect that a single questionnaire was used, incorporating questions from the three original questionnaires.

- The Physical Education Teaching-Learning Methods Scale has four dimensions, not five as previously mentioned. We have corrected this inconsistency in the manuscript, and it now correctly describes that the scale consists of four dimensions.

Thank you very much.

Competing Interests: No competing interests were disclosed.

Reviewer Report 09 December 2024

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Qi Tian

Jingchu University of Technology, Jingmen City, China

The paper explores the relationship between teachers' self-efficacy and teaching methods through an extensive review of the literature. The conclusions drawn from the study are credible and provide valuable insights for enhancing both teachers' self-efficacy and their teaching practices. However, the article has two notable issues that need to be addressed:

firstly, **Insufficient Recent Literature:** The paper cites a limited amount of literature from the past five years, comprising only 17.2% (15 out of 87) of the total references. This raises concerns about the relevance of the supporting evidence to current teaching contexts.

Secondly, **Statistical Scoring Conversion:** The teacher self-efficacy scale differs from the other two scales in that it is not based on a 5-point scale. The article does not provide a clear explanation of how the scores from this scale were converted for statistical analysis, which could affect the reliability of the findings. To address these concerns, it is recommended that the authors update their references to include more recent studies, particularly from the last five years, to ensure the literature review reflects current trends and developments. Additionally, a detailed description of the methodology used for converting the teacher self-efficacy scores into a format compatible with statistical analysis should be included. These revisions will enhance the article's rigor and comprehensiveness.

Suggestion: With these improvements, the article can be revised and considered for approval.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Educational psychology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 14 Feb 2025

Rita Pinto

We appreciate your valuable comments on our article. We will present our response, respecting the order of the comments made. We hope to respond positively to all requests.

- New references from the last five years have been included: Luo et al., 2024; Hussain & Khan, 2022; Wettstein et al., 2021; Li, 2023; Salas-Rodríguez et al., 2021; Barni et al., 2019; Lauermann & ten Hagen, 2021.

- We would like to address your concern regarding the teacher self-efficacy scale and the conversion of its scores for statistical analysis. First, it is important to highlight that the teacher self-efficacy scale used in our study follows a methodological approach that has been widely validated in the literature, allowing for comparison with other scales even when they use a different metric. The decision to employ a different scale is based on the original structure of the instrument, whose validity and reliability have been demonstrated in previous studies.

We do not consider normalization or standardization of the data necessary, as comparisons

can be made directly without compromising the validity of the results. Differences in scale metrics do not affect the analysis, as comparisons focus on score trends rather than absolute values. This approach is widely accepted in studies of this nature and has been supported by methodological literature.

Thank you very much

Competing Interests: No competing interests were disclosed.

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