

Validation process and use of the pictorial scale of perceived water competence (PSPWC): Past and future challenges

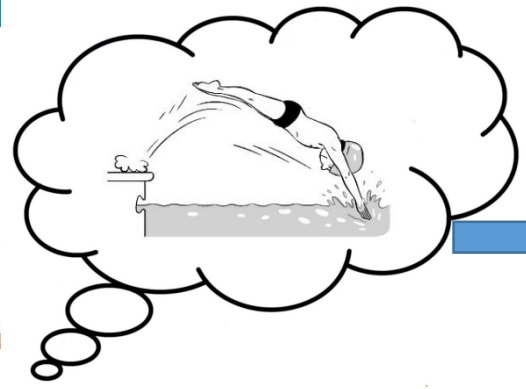
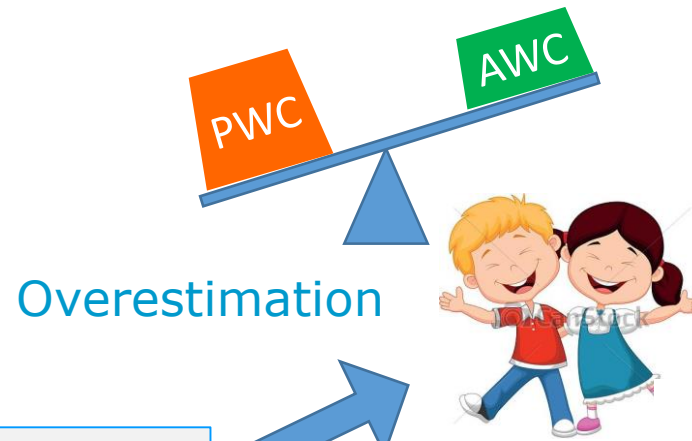
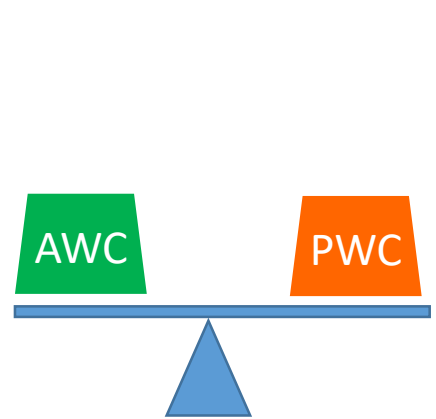
Boris Jidovtseff & Kristine De Martelaer



Introduction

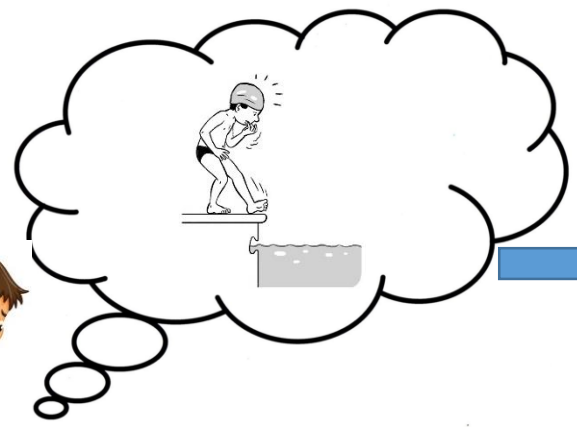


Measuring PWC and comparing with AWC

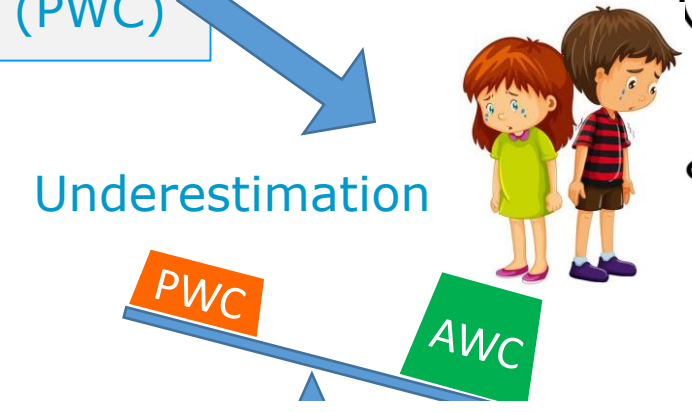


Risks of drowning

Actual water competence (AWC)
Versus
Perceived water competence (PWC)



Risks of demotivation



Importance of PC in motivation theory (Harter, 1984)



From Idea to product

Research group

- Lisa M. Barnett, Deakin University, Australia*
- Aldo M. Costa, Universidade da Beira Interior, Portugal.*
- Kristine De Martelaer, Vrije Universiteit Brussel, Belgium*
- Eva D'Hondt, Vrije Universiteit Brussel, Belgium*
- Kristy Howells, Canterbury Christ Church University, UK*
- Boris Jidovtseff, University of Liege, Belgium*
- Liliane D. S. Morgado, University of Liege, Belgium*
- Arja Sääkslahti, University of Jyväskylä, Finland*

Project started in Laramie (USA, AIESEP 2016)



Took form in Guadeloupe (FRA, AIESEP 2017)



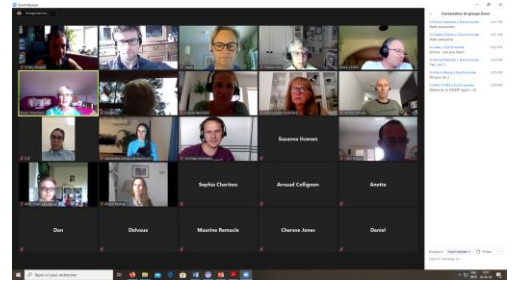
And continue to progress during and between conferences



IDEA



PRODUCT



Building the PSPWC

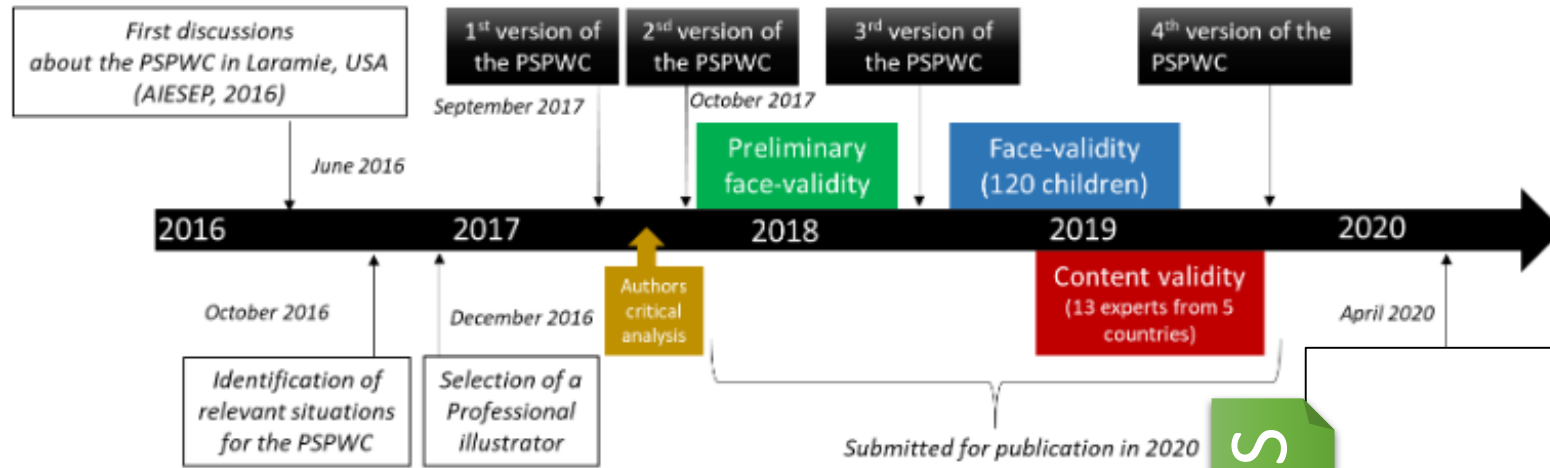
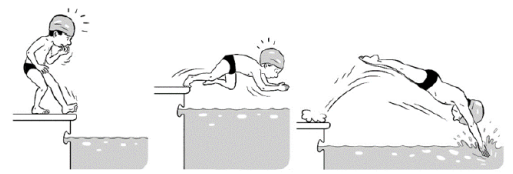


Figure 1 - Timeline and process of development and of validation of the PSPWC.


OPEN ACCESS

TESTING MANUAL

Pictorial Scale of Perceived Water Competence (PSPWC)



Research group



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- Kristine De Martelaer, Vrije Universiteit Brussel, Belgium
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- Lisa M. Barnett, Deakin University, Australia
- Aldo M. Costa, Universidade da Beira Interior, Portugal.
- Kristy Howells, Canterbury Christ Church University, United Kingdom
- Arja Sääkslahti, University of Jyväskylä, Finland
- Boris Jidovtseff, University of Liege, Belgium



The PSPWC

Situation 4 - Catching an object under water; (Aquatic fundamentals: I, WO, BC, V; depth of water: WHL)

- Presentation to the child: *"In this situation, the child tries to catch an object under water."*

Table 5 - Description of the three levels of progression of the situation 4.

Level	Description
1	The child tries to get the object with one hand in the direction of the object but face outside the water and feet on the ground.
2	The child catches an object in shoulder deep water, with the head under the water and feet on the ground.
3	The child catches an object in shoulder deep water, with the head under water and feet losing contact with the floor.



L1: Not Able

L2: In Progress

L3: Able

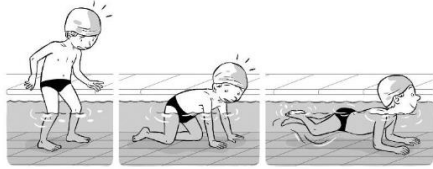


Aquatic fundamentals measured by the PSPWC

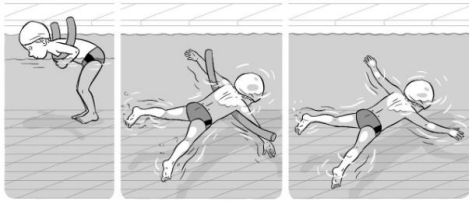
Table 1 - Aquatic fundamentals measured by the PSPWC

Aquatic skills		Depth of water	Aquatic fundamentals								
			Water entry (WENT)	Water exit (WEXI)	Immersion (I)	Water orientation (WO)	Buoyancy (B)	Gliding (G)	Propulsion (P)	Breath control (BC)	Vision (V)
Sk1	Lying down in a prone position using hands on the bottom to move forward (as a crocodile)	SW			X	X			X		
Sk2	Standing and submersion in the water	SW to WSL			X						
Sk3	Blowing bubbles under water	WHL			X					X	
Sk4	Catching an object under water	WHL			X	X				X	X
Sk5	Floating on the back (back star)	WHL or WSL				X	X				
Sk6	Floating on the front (front star)	WHL or WSL				X	X			X	
Sk7	Water entry by slide	WSL	X								
Sk8	Pushing from the wall and gliding under water	WHL or WSL				X	X	X		X	
Sk9	Leg propulsion on the back	WSL -DW					X	X	X		
Sk10	Leg propulsion on the front	WSL-DW					X	X	X	X	
Sk11	Water entry by jumping	DW	X								
Sk12	Water entry by diving	DW	X					X		X	
Sk13	Water exit by climbing out	DW		X							
Sk14	Vertically treading water	DW				X	X				
Sk15	Turning from the front to the back in an aligned position (i.e. longitudinal axis rotation)	DW				X	X		X		
Sk16	Changing direction while swimming on the front (i.e. transverse axis rotation)	DW				X	X		X		
Sk17	Turning from the back to the front (i.e. sagittal axis rotation).	DW				X	X		X		

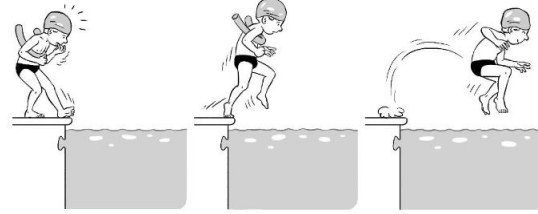
17 Skills of the PSPWC



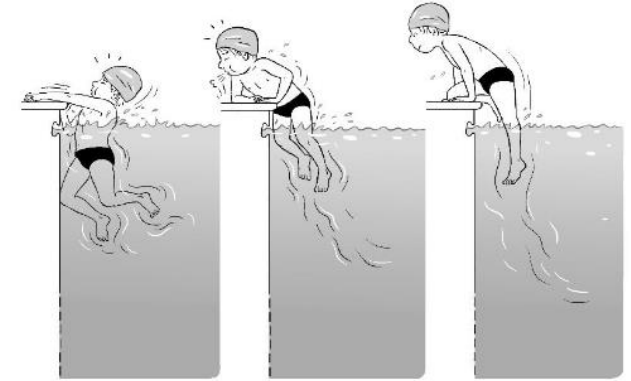
L1: Not Able L2: In Progress L3: Able



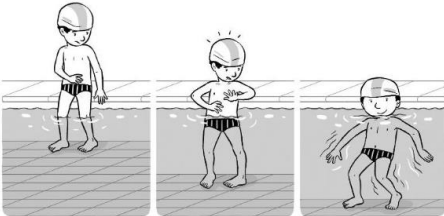
L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



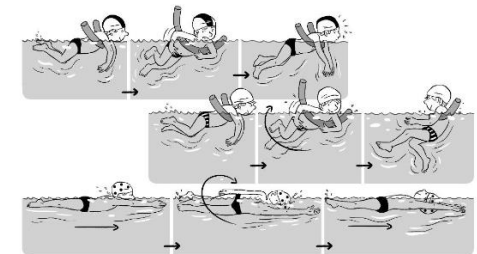
L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able
L2: In Progress
L3: Able



L1: Not Able L2: In Progress L3: Able



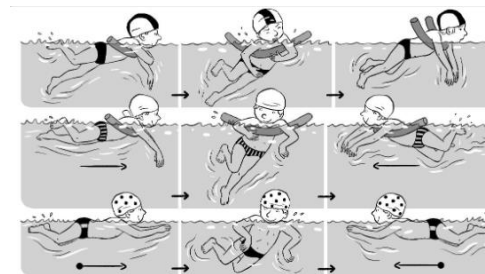
L1: Not Able L2: In Progress L3: Able



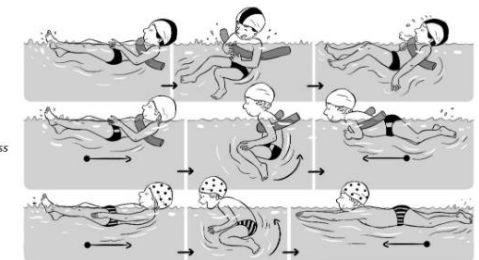
L1: Not Able L2: In Progress L3: Able



L1: Not Able L2: In Progress L3: Able



L1: Not Able
L2: In Progress
L3: Able



L1: Not Able
L2: In Progress
L3: Able



past research with PSPWC

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LONG RESEARCH ARTICLE

Health Promotion
Journal of Australia

WILEY

Utility of a scale to assess Australian children's perceptions of their swimming competence and factors associated with child and parent perception

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Editor: James Smith

Abstract
Issue Addressed: Drowning is a global public health issue. Aims were to assess: (a) face validity of the "Pictorial Scale of Perceived Water Competence (PSPWC)," (b) the association between child and parent perception of child swimming competence and (c) factors associated with perception of child swimming competence.
Methods: Child-parent dyads and swim instructors were recruited for a mixed method study. Children aged 4-8 years (n = 51) reported on: familiarity, progressions and their own swim competence in 17 swimming situations. Parents (n = 51) reported on child competence and swimming experience. Swim instructors (n = 15) were interviewed. Spearman's rank correlation was used to assess whether child and parent swim perception were associated. The Mann-Whitney U test, Wilcoxon signed-rank test or Kruskal-Wallis test were used to assess which factors were associated with child and/or parent report.
Results: Children reported high familiarity of scenarios and could sequence items. Swim instructors concluded the PSPWC depicted swim skills accurately. There was no association between child and parent perception of children's swimming ability. Swimming level was positively associated with child perception but not parent proxy report. Swimming lesson experience, child sex, country of birth and disadvantage were not associated with child perception or parent proxy report. Older children perceived higher swimming competence but parent report was not associated with child age.
Conclusions: Children have a better understanding of their swim competence than their parents do, suggesting parent education is needed.
So what? The PSPWC could be used by teachers (both swimming and classroom) to inform parents how their child estimates their swim competence. If use of this tool was incorporated into education practice this could assist in creating awareness, which can be the start of advocacy towards the creation of policy to assist in the provision of accessible swim education for all Australian children.

KEYWORDS
 child, drowning, perception, pictorial scale, swimming, water competence, water safety

Health Promot J Austral. 2020;00:1-30. | wileyonlinelibrary.com/journal/hpja | © 2020 Australian Health Promotion Association | 1

- ✓ Preliminary version of the PSPWC (V2, 2017)
- ✓ 51 children from 4 to 8 yrs (from swimming school)
- ✓ Good Face validity except for : - S3 (*blowing bubbles under water*)
 - S13 (*water exit climbing out*)
 - S16 (*transverse rotation*)
 -S17 (*Sagittal to rotation*)
- ✓ Acceptable internal consistency ($\alpha = .68$)
- ✓ Children PWC: Mdn score = 48 (from 37 to 51)
- ✓ Parents PWC: Mdn score = 49 (from 30 to 51)
- ✓ Children versus parents PWC: $r = 0.22, P = .120$
- ✓ PWC related to AWC
- ✓ Age effect : $P = .026$
- ✓ No gender effect: $p = .674$



De Pasquale et al, 2021

past research with PSPWC

Check for updates

Article

Differences between Young Children's Actual, Self-perceived and Parent-perceived Aquatic Skills

Perceptual and Motor Skills
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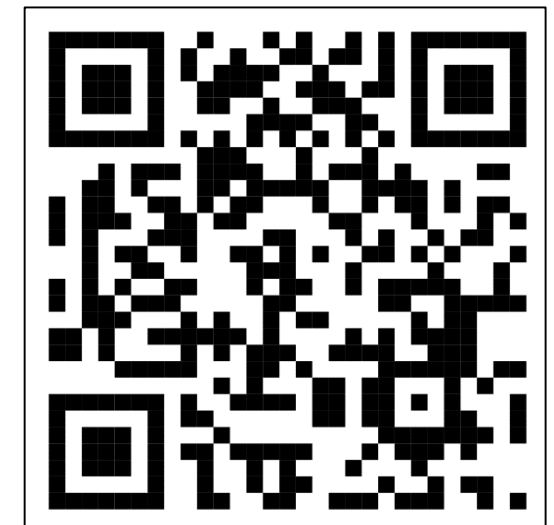
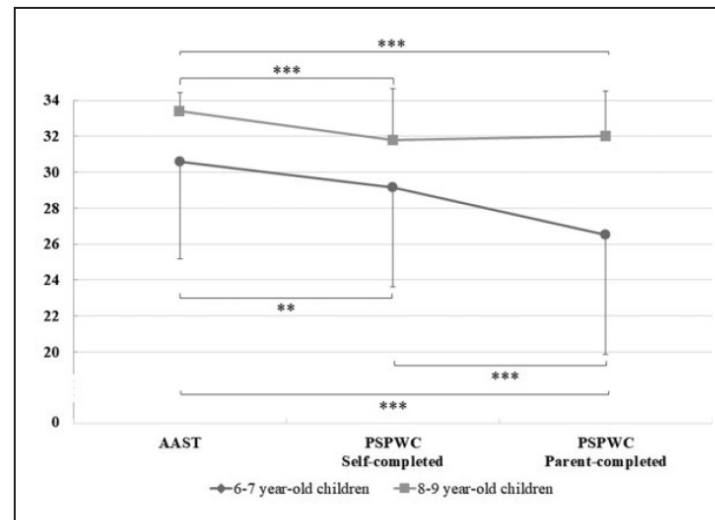
Eva D'Hondt¹, Lise Buelens¹,
Lisa M. Barnett², Kristy Howells³,
Arja Sääkslahti⁴, Aldo M. Costa⁵,
Boris Jidovtseff⁶, Lisa Mertens¹, and
Kristine De Martelaer¹

Abstract
As drowning is a leading cause of unintentional injury/death in children worldwide, perceptions of their actual aquatic skills are of critical importance. Children's self-perceptions may influence the risks they take, and parental perceptions may influence the degree of supervision deemed to be necessary for children in and around water. Accordingly, we examined the differences between young children's actual,

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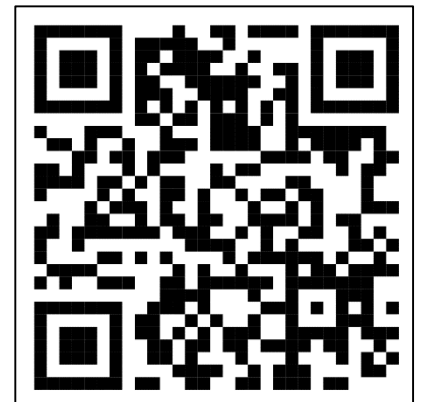
- ✓ 2nd version of the PSPWC (V2, 2017)
- ✓ 134 children from 6 to 9 yrs (from a swimming school) and 134 parents
- ✓ Actual Aquatic Skills Test' (AAST) fully aligned with PSPWC
- ✓ Good internal consistency : Children PSPWC : Cronbach's $\alpha = .871$
Parents PSPWC : Cronbach's $\alpha = .932$
Children AAST : Cronbach's $\alpha = .932$
- ✓ Scores on 34 (0-1-2pts/sk) and not 51 (1-2-3pts/sk)
- ✓ No gender effect
- ✓ Age effect on PSPWC and AAST 6-7yo < 8-9yo
- ✓ Underestimation of WC !!!





D'Hondt et al, 2021

past research with PSPWC

- ✓ 3rd version of the PSPWC (V3, 2018)
- ✓ 120 children from 5 to 8 yrs (from public school)
- ✓ Good Face validity except for : - S13 (*water exit climbing out*)
- ✓ Low familiarity with S1, S14, S15
- ✓ Age effect on Sequencing : 5yrs< 6yrs=7yrs=8yrs
- ✓ Good content validity : (13 experts from 5 countries) Av CVI : 0.87-0.95
- ✓ Lower CVI for : Sk7—Water entry by slide ; Sk16—Sagittal rotation
- ✓ Relevant experts comments on PSPWC :
 1. "water entry by slide not common in my country"
 2. "inclusion of emotions on the drawings could mislead children"
 3. "irrelevant use of floating devices in the intermediate level"
 4. "tool should be more associated with the positive pedagogy of success and it could be criticized the fact that Level1 was associated with a child's failure"



Morgado et al, 2023

Article

Face and Content Validity of the Pictorial Scale of Perceived Water Competence in Young Children

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Abstract An international group of experts have developed a pictorial tool to measure perceived water competence for children aged from 5 to 8 years old: the Pictorial Scale of Perceived Water Competence (PSPWC). The aim of the present study was to verify the validity of this tool. In the first part of the study, 120 children were interviewed to investigate face validity of the PSPWC to ensure that all pictorial items were understandable. In the second part of the study, 13 scientific and/or pedagogical international experts were invited to assess the tool's content validity via an online survey. Face validity results revealed that children were able to understand and sequence correctly the aquatic situations in 92% of the cases. The average Content Validity Index (CVI) of the PSPWC ranged from 0.88 to 0.95, showing acceptable content validity. Feedback from experts and children resulted in a major improvement of the "exit water" situation and minor improvements concerning some other items. Experts confirmed that the PSPWC was globally appropriate for different countries and cultures, except for the situation "water entry by slide" which was not considered usual practice in some countries. The PSPWC opens up to new fields of research; useful both for the prevention of drowning and for the support of children's aquatic education.

Keywords: aquatic skills; water safety; self-perception; tool; motor skills

1. Introduction

Perceived competence (PC) refers to one's beliefs about his or her ability to learn and execute specific skills. PC is a key factor in Harter's competence motivation theory [1]. According to this model, feeling competent is of great importance for motivation and can positively impact cognitive, affective, and behavioral outcomes. One's PC influences different motivational factors such as the choice to participate in an activity, the attitude and commitment within an activity or even the long-term interest in this particular activity [2,3].

Measuring PC has great scientific and pedagogical interest, especially during early childhood. As Harter [2] stated, children do not perceive themselves as competent in the same way when looking into different developmental areas. Therefore, determining PC in specific contexts and situations seems relevant, especially regarding the self-perception of water competence. Scientists have hypothesized that PC is a key factor in the relationship

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<https://www.mdpi.com/journal/children>



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past research with PSPWC

Article

The Inter-Rater and Intra-Rater Reliability of the Actual Aquatic Skills Test (AAST) for Assessing Young Children's Motor Competence in the Water

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Abstract: As children's actual aquatic skills are important for the prevention of drowning as well as their engagement in lifelong aquatic physical activity, researchers and practitioners should be able to assess this vital concept accurately and reliably. Therefore, this study aimed to investigate the inter-rater and intra-rater reliability of the Actual Aquatic Skills Test (AAST), consisting of 17 different test items for the assessment of young children's motor competence in the water. Six raters received a training and evaluation session on scoring the AAST, after which five of them assessed four test videos (of various children (n = 38) performing the test items) twice, with one to two weeks in between (i.e., test and re-test). Inter-rater and intra-rater reliability were determined per test video and for the different AAST test items across videos using Gwet's Agreement Coefficient 2 (Gwet's AC2). The Gwet's AC2 for inter-rater reliability at the test varied from 0.414 to 1.000, indicating a moderate to perfect agreement between raters. For intra-rater reliability, it ranged from 0.628 to 1.000, demonstrating a good to perfect agreement between test and re-test scoring. In conclusion, the AAST is a promising tool to reliably assess young children's actual aquatic skills in an indoor swimming pool.

Keywords: water competence; swimming; aquatic literacy; physical education; teacher; coach; assessment; pictorial scale

1. Introduction

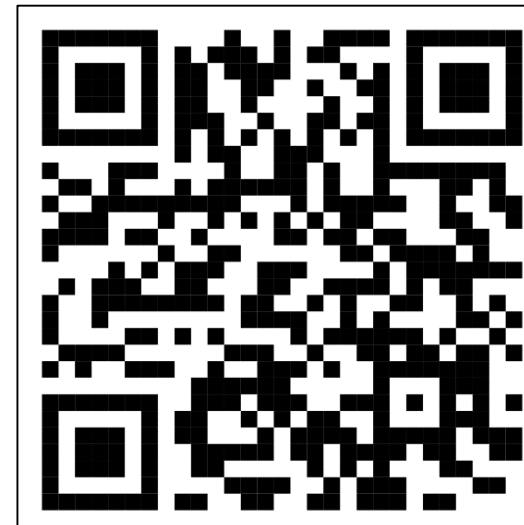
The concept of 'water competence' was first introduced and described by Langendorfer & Bruya (1995), focusing on fundamental motor skills in the water serving as the basis for further aquatic development [1]. Subsequently, Moran (2013) considered the concept of water competence from a drowning prevention perspective, defining it as "the sum of all personal aquatic movements that help prevent drowning, as well as the associated water safety knowledge, attitudes and behavior that facilitate safety in, on and around the water" [2]. More recently, Stallman et al. (2017) made the definition of the term water competence more tangible through their evidence-based proposal of 15 specific aquatic competencies, including physical, cognitive, as well as affective competencies [3]. In this paper, our focus will specifically be on the physical aspect within the concept of water competence, hereafter referred to as children's actual aquatic skills.

Drowning is the world's third leading cause of injury-related death, claiming more than 320,000 lives per year [4,5]. As to fatal and non-fatal drownings, young children are the most vulnerable age group, with one to four-year-olds and five to nine-year-olds

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- ✓ AAST based on PSPWC
- ✓ 5 trained raters
- ✓ 4 videos 17 sk of PSPWC/AAST test (38 children from 6 to 9 yrs)
- ✓ Moderate to perfect inter-rater reliability (Gwet's AC2: 0.414 to 1.00)
- ✓ 2 skills with moderate level of agreement :
 1. SK3 : Blowing bubbles under water (0.507)
 2. SK6 : Floating on the front (i.e., front star) (0.414)
- ✓ Good to perfect intra-rater reliability (Gwet's AC2: 0.628 to 1.00)



Mertens et al, 2022

past research with PSPWC

Check for updates

Original Manuscript

An Evaluation of the Reliability of the Pictorial Scale of Perceived Water Competence and Its Relationship With Actual Water Competence

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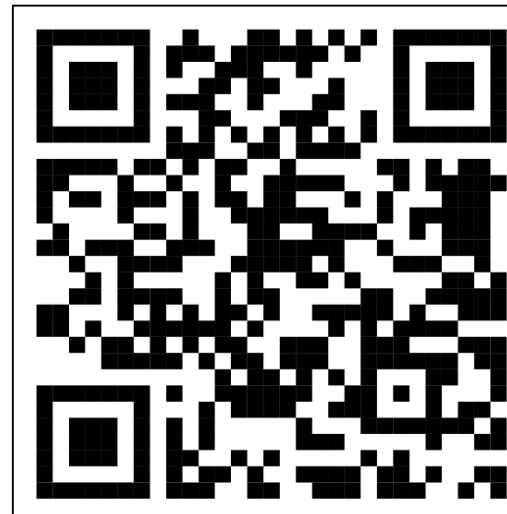
Boris Jidovtseff¹, **Liliane De Sousa Morgado¹**,
Arja Sääkslahti², **Kristy Howells³**, **Lisa M. Barnett⁴**,
Eva D'Hondt⁵, **Aldo M. Costa^{6,7}**, and
Kristine De Martelaer⁵

Abstract
In its recent development, the Pictorial Scale of Perceived Water Competence (PSPWC) showed good face and construct validity. However, additional reliability and validity research is needed, including test-retest reliability and a demonstration of the relationship between PSPWEC test scores and actual water competence. Toward that

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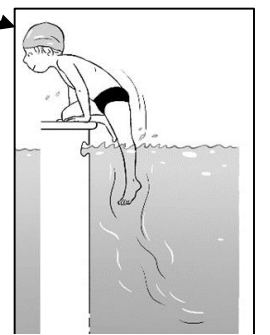
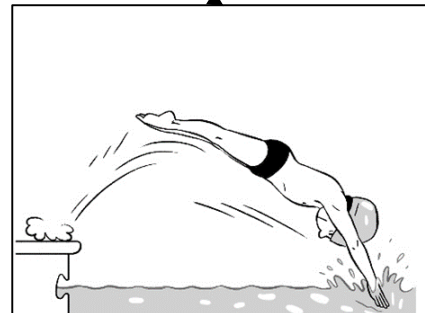
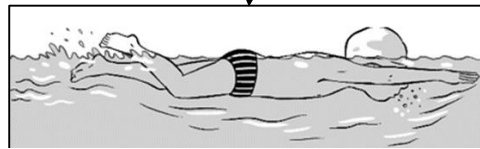
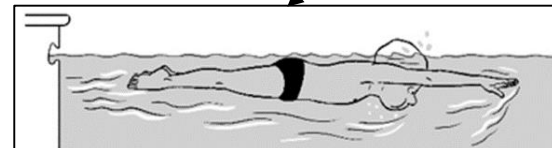
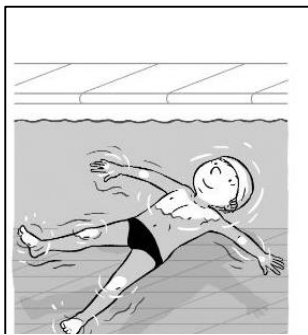
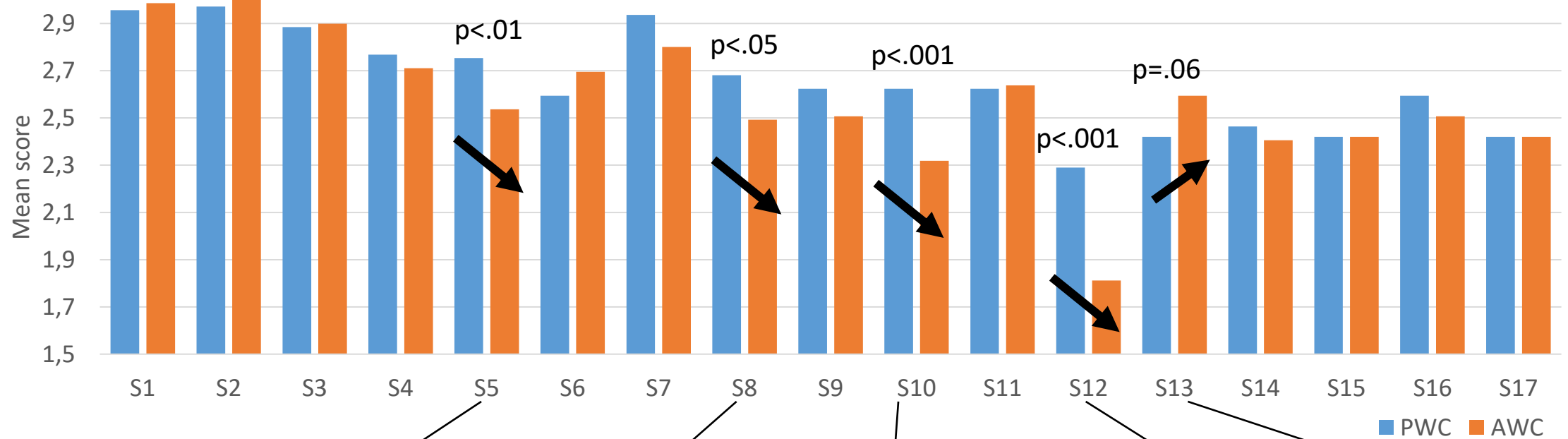
- ✓ 4th version of the PSPWC (V4, 2019)
- ✓ Test-retest reliability : 55 children from 5 to 8yrs (from public school)
- ✓ **Good test-retest reliability**
 - Total score ICC=0.81
 - Weighted kappa coefficients from 0.58 to 0.90 (**only moderate in SK1**)
 - **No learning effet** from pre test to post test and $r = .77$
- ✓ Relationship between PSPWC and AAST : 69 children from 5 to 8 yo
 - **Positive moderate relationship ($r = 0.64$; $p < .001$).**
 - Unsignificant overestimation of total WC (Wilcoxon test: +2.8%; $p = .08$)
 - Significant overestimation in Sk5, Sk10



Jidovtseff et al, 2024

past research with PSPWC

Situations comparison (PWC versus AWC)



past research with PSPWC



Barnett et al, 2023



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Validity evidence for the Pictorial Scale of Perceived Water Competence short form (PSPWC-4)

Lisa M. Barnett, Gavin Abbott, Natalie Lander, Boris Jidovtseff & Nicola D. Ridgers

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- ✓ Short version of the PSPWC (PSPWC-4)
- ✓ 4 selected situation with 4 levels scale
- ✓ 139 children from 4 to 12yrs (from swimming school)
- ✓ Excellent internal consistency : Cronbach's alpha of 0.89
- ✓ High correlation between PWC and AWC (r=0.71)
- ✓ Gender effect (p=0.05) : PWC Girls > PWC Boys
- ✓ Age effect (p<0.005)
- ✓ No ceiling effect

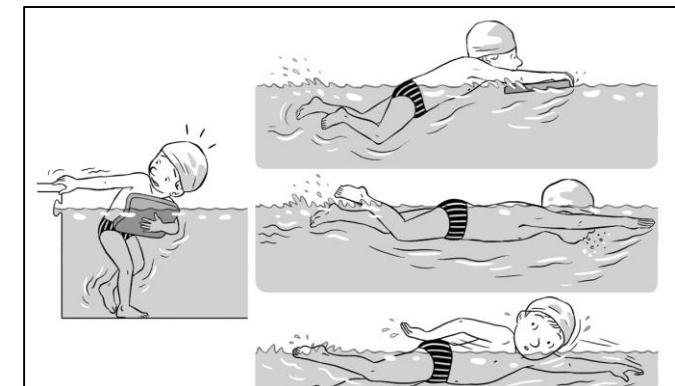
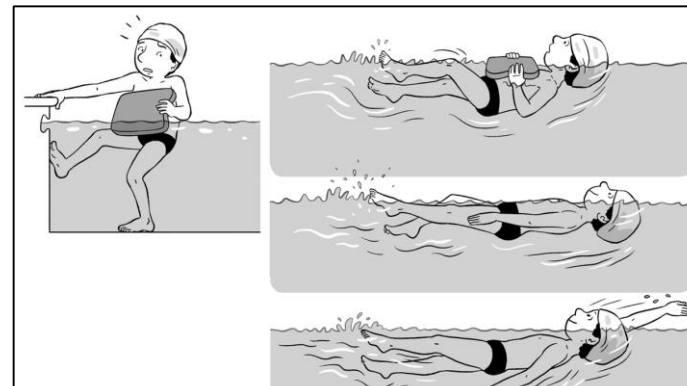
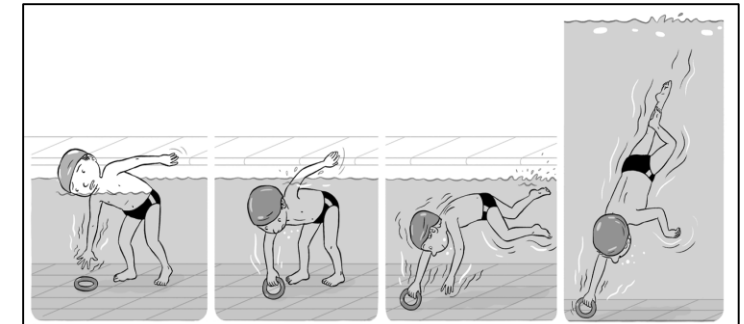
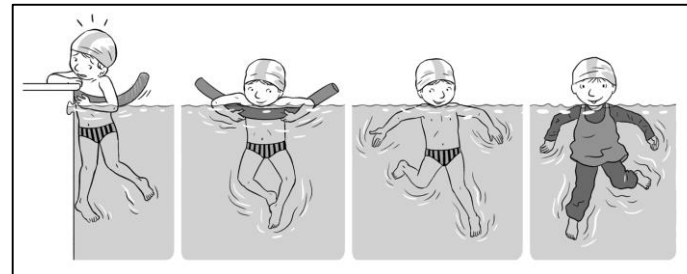


Table 4. Correlations between actual swim level at programme start and perceived skills.

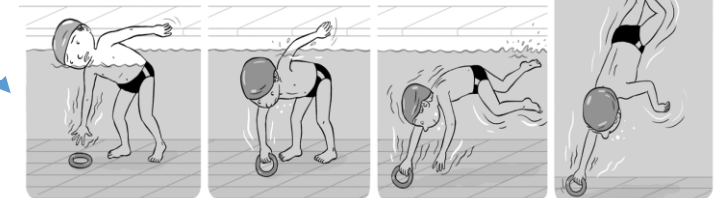
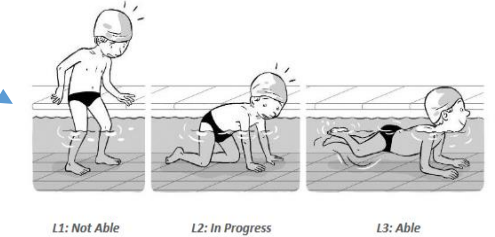
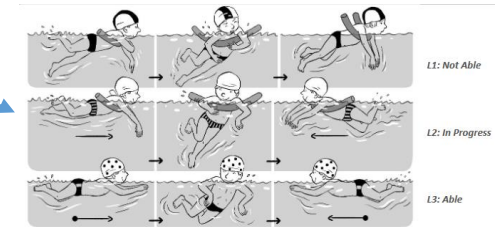
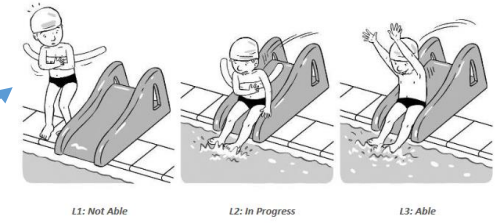
Items in the PSPWC-4	Larger sample	Boys	Girls
1. Retrieving object under deep water	0.57	0.42	0.69
2. Leg and arm propulsion on back	0.69	0.60	0.75
3. Leg and arm propulsion on front	0.60	0.43	0.74
4. Vertically treading water with clothes on	0.63	0.56	0.67
Perceived swimming competence sum score	0.71	0.57	0.81



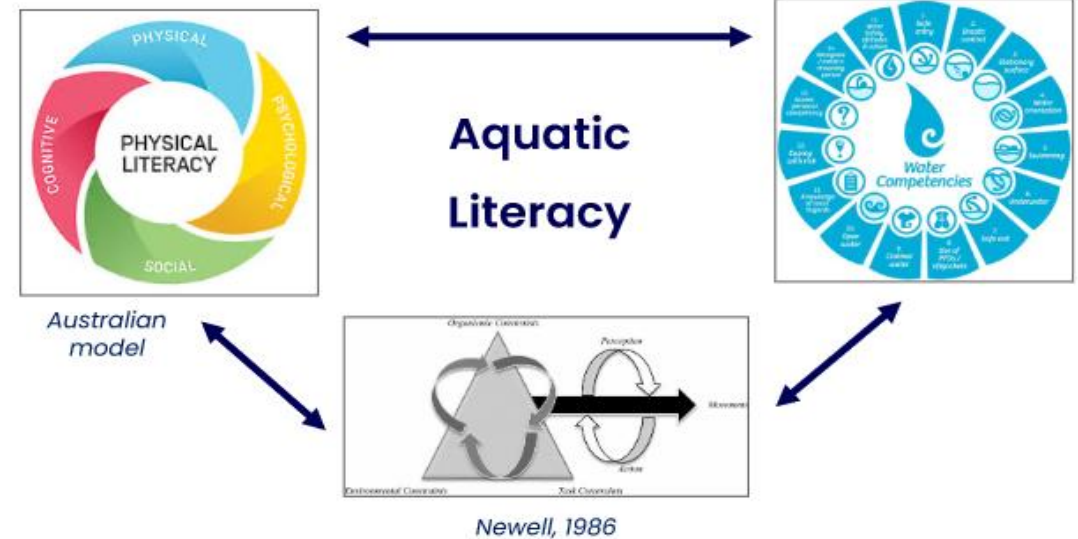
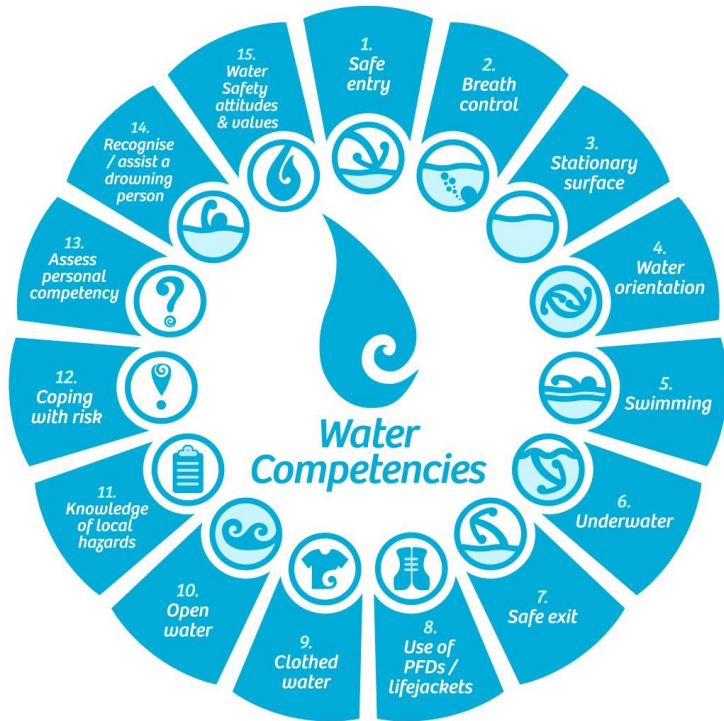


Consequences of these researches on the PSPWC

- ✓ Good internal consistency : Cronbach's $\alpha > 0.80$
- ✓ Face validity => Children from 5 to 9 yrs
- ✓ Good content validity except for Sk7 and Sk16
- ✓ Good test-retest reliability except Sk1
- ✓ Ceiling effect => develop 4 levels Scale ?
- ✓ Relevance of PWC –AWC comparisons
- ✓ Relevance of PSPWC with parents



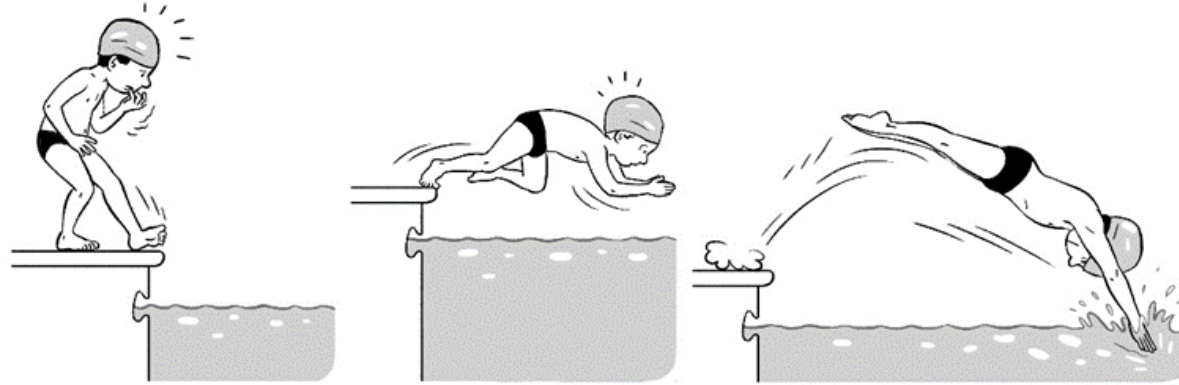
- ✓ Improve the PSPWC according to previous research
- ✓ Translation in different language and cross-cultural comparisons
- ✓ Integration of water competencies et aquatic literacy concept
- ✓ Determine key future developments of the tool & integration in research projects



Aquatic Literacy
Integrative concept

alfsc
aquatic literacy for all children





Thank you for your attention



Boris Jidovtseff & Kristine De Martelaer

