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### **Abstract**

4 Assessment of physical literacy poses a dilemma of what instrument to use. There is  
5 currently no guide regarding the suitability of common assessment approaches. The purpose  
6 of this brief communication is to provide a user's guide for selecting physical literacy  
7 assessment instruments appropriate for use in school physical education and sport settings.  
8 While recommendations regarding specific instruments are not provided, the guide offers  
9 information about key attributes and considerations for the use. A decision flow chart has  
10 been developed to assist teachers and affiliated school practitioners to select appropriate  
11 methods of assessing physical literacy. School PE and sport scenarios are presented to  
12 illustrate this process. It is important that practitioners are empowered to select the most  
13 appropriate instrument/s to suit their needs.

14

15

### **Introduction**

16 There is growing international interest in the concept of physical literacy because of the  
17 claimed benefits to physical (Gately, 2010; Tremblay, 2012; Tremblay & Lloyd, 2010),  
18 behavioral, psychological, and social outcomes for young people (Edwards, Bryant, Keegan,  
19 Morgan, & Jones, 2017). Assessment of physical literacy is now becoming important to  
20 address (Tremblay & Lloyd, 2010), but to date, this has proven difficult because numerous  
21 agencies have sought to define the construct of physical literacy in different ways (Dudley,  
22 Cairney, Wainwright, Kriellaars, & Mitchell, 2017; Shearer et al., 2018). A recent review by  
23 Edwards et al. (2017) recommended that researchers declare their philosophical approach  
24 and their definition of physical literacy before adopting any measurement approach. The  
25 purpose of this paper is to provide physical educators a guide to assessing physical literacy  
26 using the Australian Sports' Commission's approach to defining physical literacy (Keegan,

27 Barnett, & Dudley, 2017). As such we first briefly cover the Australian definition of physical  
28 literacy, developed in 2016-2017.

### 29 **Australian Definition of Physical Literacy**

30 A detailed articulation of the Delphi research project undertaken in this process can be  
31 found in this special issue (Keegan et al., 2019). In this process, four defining statements  
32 were proposed, as follows: *Core* - Physical literacy is lifelong holistic learning acquired and  
33 applied in movement and physical activity contexts; *Composition* - It reflects ongoing  
34 changes integrating physical, psychological, cognitive, and social capabilities; *Importance* - It  
35 is vital in helping us lead healthy and fulfilling lives through movement and physical activity;  
36 and *Aspiration* - A physically literate person is able to draw on their integrated physical,  
37 psychological, cognitive, and social capacities to support health promoting and fulfilling  
38 movement and physical activity, relative to their situation and context, throughout the  
39 lifespan. As such, this approach implies that the concepts of learning and movement,  
40 lifespan, and holistic perspective are the critical attributes (Arends & Kilcher, 2010).

41 The defining statements led to the need to assess the physical, psychological, cognitive  
42 and social learning domains. Within the same Delphi study (Keegan et al., 2019), these  
43 broad learning domains were operationalized into measurable and discrete elements, drawing  
44 a metaphor from the way that chemical elements can combine to form more complex  
45 compounds and mixtures. To support this model, we required a learning taxonomy that was  
46 capable of application across all four learning domains (and elements). The authors  
47 identified the Structure of Observed Learning Outcomes (SOLO) taxonomy (Biggs & Collis,  
48 1982) as highly relevant and it was adopted by the expert panel as it had already shown  
49 efficacy in the assessment of learning within physical education (PE) (Dudley, Goodyear, &  
50 Baxter, 2016). Put simply, the SOLO taxonomy classifies learning progression complexities  
51 regardless of context. At first, an individual learns one aspect of any given task  
52 (unistructural), then several aspects but unrelated (multistructural). Next, students learn how

53 to integrate them into a whole (relational), and finally they learn to generalize that whole to  
54 as yet untaught applications (extended abstract; Biggs & Collis, 1982). Thirty-two elements  
55 of physical literacy were identified by the ASC project (Keegan et al., 2017) that could be  
56 explained in terms of SOLO progressions, under each of the four discrete learning domains  
57 (see Figure 1).

58 **\*\*INSERT FIGURE 1: Model of physical literacy construction\*\***

### 59 **Deciding on an Assessment Approach to Physical Literacy**

60 A recent systematic review documented that, in every existing assessment approach to  
61 the measurement of physical literacy, decisions had been made to prioritize the measurement  
62 of certain elements according to the purpose of the assessments, and the areas of physical  
63 literacy which were of most interest to the user (Edwards et al., 2018). Green, Roberts,  
64 Sheehan, and Keegan (2018) highlighted the challenging nature of the task to produce one  
65 form of monitoring that clearly meets all elements of the physical literacy concept.  
66 Considered separately, many of the elements within each domain of the ASC model are well-  
67 documented in terms of measurement options (Keegan et al., 2017). It is beyond the scope of  
68 this brief report to review all of the potential assessments that could align with each domain  
69 of physical literacy. Essentially, there are many suitable options for measuring the learning  
70 domains and combinations of elements of physical literacy. Nevertheless, when deciding  
71 which assessment method to use, and why, teachers and researchers are offered little  
72 guidance on which assessments to use, and how (or whether) they can be reconciled against  
73 physical literacy.

74 In the remaining part of this paper, we present a decision-making guide for the  
75 assessment of physical literacy (in this case, using the Australian definition) specific to the  
76 context of school physical education (PE). The intention is to outline key considerations that  
77 will help when deciding what assessment approach to use. Similarly, previous guides to  
78 assessment of physical activity (Dollman et al., 2009) and sedentary behavior (Hardy et al.,

79 2013) in children and young people were not to provide recommendations of specific  
80 instruments to use when assessing physical activity and/or sedentary behavior, but rather to  
81 guide users to select the most appropriate method for their intended purpose. We note that  
82 almost all assessment and measurement techniques used by practitioners can be viewed  
83 simultaneously as reflecting important elements of physical literacy, while also not  
84 adequately capturing the entirety of the concept. Rather than dismissing all existing measures  
85 in response to the latter concern, our proposed approach encourages PE teachers to reflect on,  
86 position, and evaluate their measurement approaches, in relation to physical literacy. Rather  
87 than asking, ‘does this measure adequately quantify physical literacy’, we ask: ‘how can each  
88 measurement approach be reconciled with, and useful within, a physical literacy approach?’.

89         Having a measure of physical literacy that is viewed as reliable, valid, and trustworthy  
90 for any specific population is clearly important. Nevertheless, even if the measure is based  
91 on the best available scientific reliability and validity evidence, there are always further  
92 considerations that can and should be made. Such further considerations, according to  
93 Dollman et al. (2009) and Hardy et al. (2013), include aspects such as the purpose of the  
94 data collection and the age of the population in question. As such, there is no ‘perfect’  
95 measure, but rather the most reliable (i.e., consistent) and valid (i.e.,  
96 interpretable/understandable) measure that circumstances and resources allow.

97         In the subsequent section, we provide three scenarios that are relevant to the context  
98 of PE. Tremblay and Lloyd (2010, p. 26) have advocated the:

99         ...comprehensive and objective measurement of physical literacy as a means to  
100         elevate the importance of physical education, increase the robustness of physical  
101         education assessment, improve monitoring and evaluation of physical education  
102         curricula, and provide important surveillance evidence needed to assist with resource  
103         allocation by decision-makers.

104           Indeed, PE may be considered as an important means of developing physical literacy.  
105   The main purpose of the three example scenarios is to illustrate a decision-making process,  
106   therefore what we have provided in these sections should not be considered exhaustive, but  
107   rather a starting point for those interested in the content area. Each example scenario is  
108   structured with nine decision-making steps. These steps were developed from those in  
109   previous guides (Dollman et al., 2009; Hardy et al., 2013), but adapted to the Australian  
110   definition of physical literacy.

### 111   **Scenario 1**

112           *A secondary school PE teacher has identified motivation issues within the*  
113   *basketball unit of instruction.*

114   Motivation, in terms of the scenario presented, can be seen as an integration of the  
115   psychological and cognitive dimensions. The psychological domain relates to moods,  
116   feelings, and attitudes. The cognitive domain covers conscious and unconscious knowledge  
117   and understanding, including problem-solving and decision-making, awareness of rules and  
118   tactics, appreciation of healthy and active lifestyles, and processing of feedback and  
119   reflection. The nine steps provided below are reflected in Figure 2.

120           **Step 1.** Identify the *elements of importance* under the psychological (i.e., motivation)  
121   and cognitive (i.e., purpose and reasoning) domains.

122           **Step 2.** Identify the teacher's *interest* in this scenario. For example, the teacher may  
123   highlight *engagement and effort during training* as being of particular concern based on  
124   her/his observations of some of the student's effort and compliance with instructions.

125           **Step 3.** Identify the *context* for this scenario, which in this case is *flat land-based*.

126           **Step 4.** Identify the *purpose*. In this scenario, the teacher is concerned with some  
127   students in class who appear to have lost their motivation for training. Thus, it can be  
128   considered as an individual/clinical/school/class assessment.

129           **Step 5.** Identify the *target age/developmental group* of the class, which in this case is  
130 adolescent.

131           **Step 6.** Identify the *SOLO level* of interest. In this scenario, we are interested in  
132 moving the students from multi-structural to relational, or perhaps the extended abstract  
133 category.

134           **Step 7.** Identify the most suitable *method* (measurement/assessment) available. For  
135 example, motivation cannot be directly measured, but must be either inferred from behavior  
136 or evaluated using questionnaires, surveys, or interviews, each of which can be subdivided  
137 into quantitative (e.g., rating scales, psychometric validation) or qualitative approaches  
138 (descriptions of behavior, feelings, attitudes, and thoughts through observational analyses).  
139 In this case, we may have a reflective, less authoritarian, teacher who is interested in the  
140 students' perceptions. The teacher then must consider whether the students should write in a  
141 diary or log, be interviewed one-on-one, or complete a questionnaire. A diary or log may be  
142 more appropriate if the teacher wants to gain a general idea of motivation over time. If there  
143 is access to a research group and resources, a written survey option might be appropriate.  
144 The Sport Motivation Scale (SMS; Pelletier et al., 1995) was validated in athletes with a  
145 mean age of 18. The scale is based on Self-determination Theory (Deci & Ryan, 1985) and  
146 assesses contextual intrinsic and extrinsic motivation as well as amotivation in relation to  
147 sport. This is an important distinction when it comes to assessing motivation. For example,  
148 more extrinsic motivation may be a bad thing, so when it comes to motivation more is not  
149 necessarily better. Such a questionnaire would fit with the interest of the teacher in relation  
150 to a specific task or activity within the understanding that motivation can differ towards  
151 different activities/pursuits, however, the scoring and interpretation of the responses may still  
152 require careful interpretation.

153           **Step 8.** Consider that the *number* of the participants (class) is feasible with the  
154 method chosen.

155           **Step 9.** Consider the *cost*. In this case, a survey for a class of students is feasible and  
156 affordable, and if scoring were to be problematic, then a guided interview/conversation may  
157 be more appropriate. A revised version of the SMS (Mallett et al., 2007), which includes an  
158 additional measure of extrinsic motivation (integrated regulation), has been tested and  
159 validated in Australian adolescent athletes, so this may also prove useful.

160   \*\*INSERT FIGURE 2 here\*\*

161   **Scenario 2**

162           *Teachers have noticed that younger primary school girls (5-8 years) are not confident*  
163 *to join in ball skill activities. The teacher wants to understand more about the physical*  
164 *self-concept of the girls.*

165           An individual’s physical self-concept is made up of their self-reflection regarding their  
166 appearance, fitness, strength, and perceived competence (Fox & Corbin, 1989). As such,  
167 both the psychological and physical domains could be relevant. The psychological domain  
168 relates to moods, feelings, and attitudes and the physical domain relates to physical  
169 competence, motor skills, health- and skill-related fitness, technique, and psychomotor skills  
170 (see Keegan et al., 2019). This scenario therefore provides an example of how in certain  
171 circumstances it is possible to join these elements to create a new ‘compound.’ The nine steps  
172 provided below are reflected in Figure 3.

173           **Step 1.** Identify the *elements of importance* under the broader domains of  
174 psychological and physical. The teachers are interested in students’ perceived competence.  
175 There is no element of called ‘perceived competence’ so here we must build the construct  
176 that we are looking for from the elements in the Australian model (see Figure 1). To achieve  
177 this, we could combine the element ‘confidence’ under the psychological domain with the  
178 element ‘object manipulation’ under the physical domain to represent the compound called  
179 ‘competence in object manipulation.’



180           **Step 2.** Identify the teacher’s *interest* in this scenario. The teachers are interested in  
181 how competent students think they are in catching and throwing.

182           **Step 3.** Identify the *context*, which in this case is *flat land-based*.

183           **Step 4.** Identify the *purpose* of the assessment. For this example, the teacher is  
184 interested in whether the girls improve their perceptions of object manipulation competence.  
185 Thus, it can be considered for the purpose of understanding a small group of learners during a  
186 lesson.

187           **Step 5.** Identify the *target age/developmental group* for this scenario, which is primary  
188 aged school children.

189           **Step 6.** Identify the *SOLO level* that is suitable for this scenario. In this case,  
190 understanding which of the girls are at the unistructural level, versus those who are not, is  
191 important.

192           **Step 7.** Identify the *method* (measurement/assessment) that is most suitable. As it is  
193 not possible to assess self-perception objectively, the ‘subjective’ box is highlighted. The  
194 next decision is to consider whether the girls should use a diary or log, be interviewed one-  
195 on-one, or complete a survey. Considering the age of the children and the likely literacy level  
196 (Harter & Pike, 1984) the teacher highlights ‘interview’ and then ‘pictorial.’

197           **Step 8.** Consider that the *number of participants* is feasible with the method chosen.  
198 In this case, brief interviews with approximately half of the class of children would appear to  
199 be an acceptable time commitment.

200           **Step 9.** Consider the *cost*. For this scenario, the cost is higher than in the previous  
201 scenario, as time to interview the primary-aged children needs to be considered as opposed to  
202 a method where the children complete their own survey. These questions encourage us to  
203 reconsider our earlier decisions, but for this example, the chosen methods are feasible. This  
204 leads us to a potential pictorial instrument (Barnett et al., 2016), which measures object  
205 control perception.

206 **Scenario 3**

207 *A high school physical education teacher wants students to develop a greater game*  
208 *understanding specific to an invasion game (cognitive domain).* Invasion sports such as  
209 basketball, netball, soccer, handball, and water polo are those where the main objective is to  
210 maintain possession in order to specifically penetrate an opposition's territory and score  
211 (Bunker & Thorpe, 1982). In this third scenario, now that the process has already been  
212 presented twice, no figure is provided, nor are separate step headings presented. The learning  
213 domain in this scenario is mainly cognitive but as the teacher will be looking for visible  
214 manifestations of the students' ability to apply tactical cognitive skills in conjunction with  
215 their physical skills, the physical learning domain is relevant as well.

216 The *elements* of importance are tactics (cognitive domain), and flat land-based  
217 movement and object manipulation (both part of the physical domain). When combined into  
218 a compound representation, we are looking to characterize: (a) tactics-movement (e.g.,  
219 finding space, losing defenders, or marking attackers); (b) tactics-object manipulation (e.g.,  
220 moving the ball into space, changing the focus of attack, or containing an opposition's  
221 attack); (c) movement-manipulation (e.g., running with the ball or kicking/throwing the ball  
222 while moving); and (d) the combination of all three (e.g., using movement of the self and the  
223 ball to manipulate the opposing defense, or reacting to the opposition's play with a view to  
224 preventing them from scoring and winning the ball back). The teacher's *interest* in this  
225 movement compound within tactics is the student's ability to read the play and make  
226 decisions. The *context* of the measurement/assessment is *land-based* and the *purpose* is at  
227 the class level. The age/developmental group is high school, and SOLO level is acquisition  
228 and accumulation (see Keegan et al., 2017).

229 The *method* of assessment will be objective and require the teacher to use direct  
230 observation measures of each student's performance (or a sample of students within a class)  
231 in relation to the complexity of the invasion game providing the context. Given the focus is

232 on the execution of tactical decision-making and not just the performance outcome,  
233 prescribed criteria need to be enacted in order to capture the evidence associated with intent  
234 of the decisions the students are making. The *number of participants* is not large, average PE  
235 class size. Direct observation can be considered higher in *cost* than a survey measure due to  
236 the time involvement, but still feasible for a PE teacher.

237 Based on these three scenarios, it is clear that there is not an ‘ideal’ approach to  
238 measurement, but rather the instructors are empowered to make informed decisions regarding  
239 how to assess physical literacy, and how this assessment might fit into the broader  
240 conceptualization of the concept. In these examples we assume that the teachers’ own  
241 assessment requirements are more central and meaningful to them than attempting to  
242 faithfully measure a complex construct, yet by detailing how their local and highly specific  
243 assessment is, in fact, readily reconciled with physical literacy, then their assessment can  
244 become contextualised, aligned, and more meaningful in the long-term.

#### 245 **Limitations of this assessment approach**

246 There are assumptions within the Australian definition of physical literacy that might  
247 make it challenging for this assessment approach to be used for other definitions. For  
248 example, the ASC approach attempted to distinguish between the learning potential (held by  
249 everyone) versus the aspiration to become self-regulating and flourish through physical  
250 literacy (Keegan et al., 2019). Notably, the Australian framework was novel in invoking the  
251 SOLO taxonomy to structure assessment, and the metaphor with elements and compounds to  
252 represent diverse movements and attributes. Edwards et al. (2018) discussed broad  
253 approaches (idealist and pragmatic) to understanding the concept of physical literacy, which  
254 typically affect the assessment approach adopted. From the idealist perspective, physical  
255 literacy is holistic (i.e., consisting of interconnecting parts that only make sense as a whole),  
256 and therefore the domains of physical literacy should, ideally, not be isolated (Jurbala, 2015).  
257 As measurement often entails being able to reduce concepts, measuring the domains of

258 physical literacy separately would be inconsistent with the holistic viewpoint. In contrast, a  
259 pragmatic approach maintains that it is important to have measures that link to best practice  
260 and evidence. We suggest these two approaches do not need to be mutually exclusive. While  
261 acknowledging the holistic nature of physical literacy, we recognize that we may not assess  
262 physical literacy in its entirety through measurement of its component elements, and our  
263 guidelines encourage teachers to also recognise this constraint. Nonetheless, in so doing we  
264 can at least assess the elements, which contribute significantly to physical literacy; the more  
265 of these elements in any operational approach to assessment, the more complete the resulting  
266 characterization of physical literacy.

### 267 **Conclusion**

268 Those who are interested in assessing physical literacy need a process to select the  
269 methods that best fit their intention, needs, and resources. We have provided a nine-step  
270 approach to stimulate thinking about decision making around assessing physical literacy  
271 using the Australian definition of physical literacy. In using the Australian definition of  
272 physical literacy, we have constructed a measurement model based on measuring  
273 combinations of ‘elements,’ which means, to some readers, the approach we have offered  
274 permits users to overlook or ignore the holistic nature of physical literacy, as originally  
275 proposed. In contrast, however, we proposed this measurement approach - based on  
276 acknowledging a wide range of elements - as an option for resolving the apparent tension  
277 between idealist-and-pragmatist assessment approaches. Our approach encourages and  
278 supports users in considering and incorporating measures pertaining to all four domains:  
279 physical, psychological, cognitive, and social. Further, our approach makes it clear that if  
280 one chooses to measure an isolated aspect of physical literacy, then important aspects could  
281 be being missed, and thus, requires decision-makers to weigh up whether this compromise or  
282 loss is necessary/acceptable. To illustrate the process, we used scenarios applicable to  
283 teachers. The scenarios demonstrate that deciding on an assessment approach for physical

284 literacy is possible by working through the guided steps. What is essential to consider is the  
285 way that these measurement tools are implemented. Thus, the environment, the climate  
286 created, and the pedagogy used are future crucial considerations. It is apparent that the data  
287 gained by working through these scenarios could theoretically be used as formal assessment  
288 for reporting to PE curricular outcomes. It is important to acknowledge though, that our  
289 approach might be complex for PE teachers to easily use. If our approach was provided via a  
290 website resource with links to common assessments of the different elements of physical  
291 literacy, this might make the approach more feasible. Data analysis and synthesis may also  
292 be a challenge, but with new data analysis techniques perhaps it is possible to represent  
293 physical literacy in nodal ways (borrowing from social network analysis) which could show  
294 the growth in a population's physical literacy and the number of interrelated networks that  
295 form part of it. Various other modelling approaches exist outside of exclusively looking for  
296 linear factors/functions, and we would argue that these are more likely to be suitable for the  
297 quantitative and qualitative assessment of physical literacy as these modelling methods  
298 become more widespread and accepted within this field.

299         In many countries around the world, policy and assessment standards in health and PE  
300 seek to promote healthy, empowered and self-regulating children, more capable of living  
301 healthy and fulfilling lives. Implicitly, such policy documents guide against merely  
302 emphasising sporting skills and competitive success, but rather using PE and sport to foster  
303 healthy habits, skills, and beliefs ranging from safe equipment use to ethics and connection to  
304 community. Such aspirations are consistent with the 'aspiration' defining statement of  
305 physical literacy in the ASC's approach (Keegan et al., 2017). We contend that assessment  
306 of physical literacy is also important beyond school PE, and should be considered in the  
307 broader education, sporting, recreation, and health contexts. Appropriate evaluation of  
308 physical literacy will facilitate investigation into physical literacy levels, into whether  
309 cultures or subgroups in the population differ in their physical literacy levels, and most

310 importantly, if they do, what can be done to address inequities. This is an ambitious  
311 undertaking and raises new challenges such as how data can be collected, collated, and  
312 shared.

313 FIGURE 1: Model of physical literacy construction

314

315

316 FIGURE 2: Scenario 1 – Psychological and Cognitive

317



318 FIGURE 3: Scenario 2: Physical and Psychological

319

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