Guidelines for the Selection of Physical Literacy Measures in Physical Education in Australia

Abstract

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

Introduction

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

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

Australian Definition of Physical Literacy

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

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

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

INSERT FIGURE 1: Model of physical literacy construction

Deciding on an Assessment Approach to Physical Literacy

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

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

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

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

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

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

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

Scenario 1

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

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

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

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

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

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

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

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

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

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

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

INSERT FIGURE 2 here

Scenario 2

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

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

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

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

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

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

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

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

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

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

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

Scenario 3

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

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

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

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

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

Limitations of this assessment approach

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

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

Conclusion

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

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

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

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

313 FIGURE 1: Model of physical literacy construction

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316 FIGURE 2: Scenario 1 – Psychological and Cognitive
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318 FIGURE 3: Scenario 2: Physical and Psychological
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