1	The Role of Knowledge and Understanding in Fostering Physical Literacy
2	Lorraine Cale ^{1*} & Jo Harris ¹
3	
4	¹ School of Sport, Exercise and Health Sciences, Loughborough University, UK
5	
6	*Corresponding Author Email: <u>l.a.cale@lboro.ac.uk</u>
7	
8	Abstract
9	This paper explores the role of knowledge and understanding in fostering physical literacy
10	which is considered fundamental to successful participation in physical activity and to valuing
11	and taking responsibility for engaging in physical activities for life. Firstly, it highlights the
12	place and importance of knowledge and understanding within the broad concept, cognitive
13	domain, and attributes of physical literacy. The type, scope, and progression of knowledge
14	and understanding deemed necessary to foster physical literacy are then explored with
15	attention paid to knowledge of health within the school context in particular. To conclude, the
16	paper outlines selected pedagogical approaches and practical strategies for developing and
17	monitoring such knowledge and understanding.
18	
19	Keywords: physical literacy, health, physical education, learning, progression
20	

```
21
```

The Role of Knowledge and Understanding in Fostering Physical Literacy

22 Given physical literacy is concerned with lifelong participation in physical activity (Liedl, 2013; Whitehead, 2013) and valuing and taking responsibility for engagement in 23 24 physical activities for life (Whitehead, 2010a), then arguably fundamental to achieving this is having the required knowledge and understanding of movement and health in terms of how to 25 move, and of why, how, where, and with whom to engage in lifelong physical activity. This 26 paper therefore contributes to the literature in this regard by exploring the role of knowledge 27 and understanding in fostering physical literacy. Firstly, it highlights the place and importance 28 29 of knowledge and understanding in physical literacy and it then explores the type and scope of knowledge and understanding deemed necessary to foster the concept. Consideration is given 30 31 to the health knowledge young people should acquire as they progress on their physical 32 literacy journeys through primary and secondary school in particular. The paper concludes by outlining some pedagogical approaches and practical strategies for developing such 33 34 knowledge and understanding.

35

Place and Importance of Knowledge and Understanding in Physical Literacy

Recognition of physical literacy as a holistic concept which goes beyond physical and 36 fundamental movement skills and encompasses knowledge and understanding is now widely 37 acknowledged in the literature (Almond & Myers, 2017; Edwards, Bryant, Keegan, Morgan, 38 & Jones, 2017; Ennis, 2015; Liedl, 2013; Lundvall, 2015; Whitehead, 2010a). Knowledge 39 40 and understanding features explicitly within the International Physical Literacy Association's (IPLA, 2017) most recent definition of physical literacy which describes the concept as "the 41 motivation, confidence, physical competence, knowledge and understanding to value and take 42 responsibility for engagement in physical activities for life." Indeed, Ennis (2015) argues that 43 "knowledge is at the heart of physical literacy" (p. 119) with it providing the foundation for 44 knowing what to do and how and when to perform. Meanwhile, Lundvall (2015) warns that 45

46 without attention to embodied knowledge, "part of the literacy ambition will be lost" and young people "may not master the keys to lifelong learning through movement" (p. 117). 47 Knowledge and understanding is considered to be a core element within the cognitive 48 49 domain as well as one of the key attributes of physical literacy (Edwards et al., 2017; Whitehead, 2010a). Following a systematic review of the physical literacy literature, 50 51 Edwards et al. (2017) identified three core categories within the cognitive domain: (a) 52 knowledge and understanding of activities; (b) knowledge and understanding of healthy and 53 active lifestyles; and (c) the value to take responsibility for physical activity. With respect to 54 knowledge and understanding of activities, a literate sports person (or exerciser) would be knowledgeable about sports/exercise rules, traditions, and values (Kirk, 2013), and in terms of 55 knowledge and understanding of healthy and active lifestyles, they would have a sound 56 57 awareness of the value of participating in a physically active lifestyle (Whitehead, 2013). 58 More specifically, and in terms of knowledge and understanding as an attribute, "acquiring knowledge in relation to movement and health" is one of the six attributes of 59 60 physical literacy identified by Whitehead (2010a). She explains how individuals making progress on their physical literacy journey will: 61 ... have the ability to identify and articulate the essential qualities that influence the 62 effectiveness of their own movement performance, and have an understanding of the 63 principles of embodied health with respect to basic aspects such as exercise, sleep and 64 65 nutrition. (p. 14) The relationship between the attribute of knowledge and understanding and other 66 attributes of physical literacy is furthermore important to recognize. Indeed, knowledge and 67

understanding is arguably fundamental to achieving the other attributes and the overall concept. For example, having physical competency alone, or any one attribute for that matter, 69

is clearly insufficient to ensure lifelong engagement in physical activity. Knowledge and 70

68

understanding can be enriched by all aspects of participation and characteristically develops
as the attributes of motivation, confidence, physical competence, and fluent interactions grow
(Whitehead, 2010b). In turn, knowledge and understanding can positively influence these
other attributes in that it will support the appreciation of developing physical competence and
the perception of different environments (Whitehead, 2010b) and can enhance motivation and
confidence to participate.

Given the above, it is perhaps not surprising that knowledge and understanding is
either explicitly or implicitly embedded within the physical education curricula in most
countries. To illustrate this, details of the relevant requirements within the National
Curriculum in England are summarised later.

81

Type and Scope of Knowledge and Understanding in Physical Literacy

Just as physical literacy is a holistic concept, physical literacy knowledge and understanding should equally be seen holistically. As already noted, knowledge and understanding within the cognitive domain and as an attribute have different components, with two constituents to the latter. The first is concerned with grasping the essential principles of movement and performance and the other with health and fitness (Whitehead, 2010b). Whitehead argues that if lifelong involvement in physical activity is to be achieved then it is clearly important for individuals to take some responsibility for both.

The first constituent expects individuals who are making progress on their physical literacy journey to appreciate the basic components of movement and be able to evaluate their own performance and that of others, using appropriate vocabulary and observing movement (Whitehead, 2010b). With regards the constituent of health and fitness, Whitehead claims it is essential that individuals adopt an objective view of themselves in deciding how best to manage aspects of life suggesting "it would be unacceptable for the concept to omit the care, attention and respect individuals should show to their embodied dimension" (p. 66).

96 Such knowledge and understanding understandably then typically features within the physical education curricula in schools. In England, for example, and with respect to 97 knowledge of movement, successive versions of the National Curriculum for Physical 98 99 Education include the aspects of developing knowledge and understanding of ways to promote improvement through evaluation of one's own and others' performances and taking 100 101 steps or making suggestions for improvement. Indeed, these elements feature explicitly in the current National Curriculum (Department of Education, 2013a, 2013b) for pupils from 7 years 102 103 of age upwards. The programmes of study state that for 7-11 year olds (key stage 2), pupils 104 "should develop an understanding of how to improve in different physical activities and sports and learn how to evaluate and recognise their own success," and be taught to "compare their 105 106 performances with previous ones and demonstrate improvement to achieve their personal 107 best" (2013a, p. 2). For 11-14 year olds (key stage 3), pupils "should understand what makes a performance effective and how to apply these principles to their own and others' work," and 108 be taught to "develop their technique and improve their performance...," as well as "analyse 109 110 their performances compared to previous ones and demonstrate improvement to achieve their personal best" (2013b, p. 2). For 14-16 year olds (key stage 4), pupils should similarly be 111 taught to "develop their technique and improve their performance (in other sports or other 112 physical activities)," plus "evaluate their performances compared to previous ones and 113 demonstrate improvement across a range of physical activities to achieve their personal best" 114 115 (2013b, p. 3).

As noted by Whitehead (2010b), the above clearly involve firstly being able to
diagnose what is making a movement or movement pattern more or less effective and then
understanding how to improve and develop it. This should encompass experiences within a
wide range of activity settings and by involving participants in observation, analysis,
description, and evaluation (Whitehead, 2010a, 2010b).

121 With regards to knowledge of health, and again drawing on the National Curriculum 122 in England, ensuring that all pupils "are physically active for sustained periods of time" (Department of Education, 2013a, 2013b, p. 1) and "lead healthy, active lives" (p. 1) represent 123 124 two of the main aims of the subject across the age range. Interestingly though, and despite these aims, reference to knowledge and understanding in relation to health in the programmes 125 126 of study is somewhat limited and more implicit. For example, pupils aged 11-14 years (key stage 3) should "develop the confidence and interest to get involved in exercise, sports, and 127 128 activities out of school" and in later life and "understand and apply the long-term benefits of 129 physical activity" (2013b, p. 2), whilst 14-16 year olds (key stage 4) should "get involved in a range of activities that develops personal fitness and promotes an active, healthy lifestyle" 130 131 (2013b, p. 3).

To achieve the above aims and notably to lead a healthy active life, a sound and broad knowledge and understanding in the area is clearly required. Further, it is contended that this needs to extend beyond the rather limited knowledge and understanding requirements implied in the National Curriculum and the "basic aspects" of exercise, sleep, and nutrition identified by Whitehead (2010a, p. 14). At the same time, it is fully accepted that physical literacy knowledge and understanding does not demand a grasp of technical biomechanical and medical scientific concepts (Whitehead, 2007, 2010b).

On this issue, Armour and Harris (2013) claim that much of the international physical education community is unclear about the precise nature of appropriate health knowledge to be covered in the subject. Given the different views expressed in the literature, this claim would seem to be founded suggesting a need to identify the health knowledge and experiences required to be able to successfully engage in physical activities for life. For this reason, alongside well reported concerns over physical education teachers' limited health knowledge and their delivery of health in the curriculum generally (Alfrey, Cale, & Webb,

146 2012; Cale & Harris, 2013; Castelli & Williams, 2007; Fardy, Azzollini, & Herman, 2004; 147 Harris, 2010; Harris & Leggett, 2015; Hastie, 2017; Keating et al., 2009; Kulinna, McCaughtry, Martin, Cothran, & Faust, 2008; McKenzie, 2007; Puhse et al., 2011; Trost, 148 149 2006), the main focus of the discussion from hereon will centre on knowledge relating to health. In 2000, and in recognition of the above, a working group comprising representatives 150 151 of national physical education, sport, and health organisations in England was formed in an attempt to achieve consensus on health-related learning within the subject, a key output of 152 153 which was the publication of national guidance including health-related outcomes for 154 children aged 5 to 16 years (Harris, 2000). These outcomes are detailed fully elsewhere (see 155 Harris, 2000; Harris & Cale, 2018) and include a number of cognitive (knowledge and 156 understanding), as well as affective and behavioural outcomes. To illustrate the scope in 157 learning they are presented in four categories: safety issues, exercise effects, health benefits, and activity promotion, representing the key areas of learning considered necessary to engage 158 159 in lifelong physical activity. In summary, for individuals to successfully engage in physical 160 activity for life, it is important that they know and understand (a) how to take part in physical activity safely and effectively (safety issues), (b) the body's response to participating in 161 physical activity (exercise effects), (c) the reasons for participating in physical activity 162 (health benefits), and (d) what physical activity to take part in, where and how (activity 163 164 promotion).

In addition, and in recognition of physical literacy as a journey through which
individuals develop throughout their lifespan from cradle to grave (Edwards et al., 2017),
gradually acquiring wider and deeper knowledge and understanding (Whitehead, 2010b), the
learning outcomes (Harris, 2000; Harris & Cale, 2018) are presented by age group or key
stage (KS): 5-7 years (KS1), 7-11 years (KS2), 11-14 years (KS3), and 14-16 years (KS4).
These represent the middle stages of Whitehead's (2013) age-related stages which individual

171 journeys pass through and which span from preschool through to the older adult years. Thus, 172 whilst it is acknowledged that individuals develop at different rates in light of their different abilities, contexts (social cultural and geographical), and experiences, the outcomes broadly 173 174 illustrate how individuals' learning about health is expected to progress. Example knowledge and understanding outcomes for each of the age ranges and for each category are shown 175 176 below. Although these were initially produced to support teachers in developing pupils' knowledge and understanding, they can and should equally be reinforced by parents and 177 178 others, as appropriate. Learning outcomes associated with each age group are presented in 179 Table 1. Table 1 is adapted from the initial work of Harris (2000).

180

Place Table 1 Here

With respect to the above knowledge, research has revealed that the more instrumental 181 182 outcomes, for example, those relating to safety issues (e.g., safe practice and warming up and cooling down) and to exercise effects (i.e., the short term effects of exercise on the body) are 183 184 more frequently addressed by physical education teachers than those associated with health 185 benefits and activity promotion (Harris, 2010). Yet, it is evidently the latter outcomes which are mostly closely linked to valuing and engaging in physical activities for life. Alfrey and 186 Gard (2014) similarly acknowledge how the profession is depicted as clearly focussed on the 187 dualistic and instrumental understandings of health and the body, and consequently how in 188 turn this leads to many teachers focussing on and applying the same narrow instrumental 189 190 outcomes in their delivery. The need for a broader approach which pays more attention to 191 health and activity promoting outcomes is therefore recommended (Harris, 2000; Harris & Cale, 2018) and it seems is needed if physical literacy is to be truly fostered. In addition, 192 193 recent calls have been made for approaches which adopt a socially-critical perspective to health knowledge and information (Burrows, Wright, & McCormack, 2009; Haerens, Kirk, 194 Cardon, & De Bourdeaudhuij, 2011). Example knowledge and understanding outcomes 195

related to health benefits and activity promotion illustrating how they progress with schoolage are shown in Table 2.

198 199

Place Table 2 Here

Fostering Knowledge and Understanding in Physical Literacy

According to Almond (2010, p. 124), "physical literacy and its associated characteristics (or attributes) have no value unless they can be applied to and influence common practice." In fostering knowledge and understanding of physical literacy, the content and its delivery are clearly key and need to be appropriate to ensure that all individuals have the opportunity to acquire knowledge and understanding both of movement and of health, and of the relationship between physical activity and health (Murdoch & Whitehead, 2010).

In developing knowledge and understanding, there are some general principles which 207 should be subscribed to. Physical literacy is, by definition, concerned with the physical and 208 209 as such the concept and attributes should be developed within and through the physical, and 210 through a range of activities, with knowledge and understanding of movement and health 211 being no exception in this regard. Developing the former through the physical is common and 212 clearly common sense, but evidence suggests this is not always the case for the latter. Despite it being found to be relatively ineffective (Cale & Harris, 2006), classroom-based delivery of 213 214 health-related theoretical concepts and information in schools is often reported (Cale, 2017; 215 Cale & Harris, 2006). A further limitation with classroom-based delivery is that it is sedentary, thereby detracting from potential active time, and with the focus tending to be 216 217 restricted to information transmission rather than developing knowledge via a combination of understanding, experiencing, decision making and evaluating (Cale, 2017; Cale & Harris, 218 219 2013). On the other hand, learning about health through active participation in purposeful 220 physical activity is not only consistent with the physical context of the subject and with 221 messages relating health benefits to frequent physical activity, but it helps to increase activity

levels and contribute to young people's overall physical activity (Harris, 2000; Harris & Cale,
2018). As highlighted later, and if taught effectively, it also potentially allows both
knowledge and understanding of movement and of health to be developed simultaneously,
whilst developing other core attributes of physical literacy as well.

Other principles which are fundamental to developing knowledge and understanding, 226 227 and arguably to all good teaching, are the inclusion and empowerment of all pupils, and their subsequent shift with enhanced knowledge and understanding from dependence on the 228 229 teacher to independence. In considering approaches to physical literacy development, 230 Almond and Myers (2017) argue we need to consider the gradual process of emerging empowerment, independence, and agency as central to how we nurture young people's 231 232 learning paths. The provision of positive, relevant, meaningful, and rewarding physical 233 activity learning experiences is central to facilitating this process and fostering empowered and independent individuals capable of making informed lifestyle choices. On this, Elbourn 234 235 and James (2013) identify three key elements important to the empowerment of young people 236 with respect to healthy active lifestyles: (a) appropriate content, (b) appropriate context, and 237 (c) effective pedagogy. Appropriate content is that which is deemed to be safe, progressive, relevant, well informed, inclusive, and fun, whilst appropriate context relates to the range of 238 activities through which learning can be promoted such as a variety of games, dance, 239 gymnastic, or fitness or exercise activities. Effective pedagogy is that which, amongst other 240 241 things, is "personalised, enabling, and collaborative, and which facilitates informed decision 242 making and uses active learning strategies" (Elbourn & James, 2013, p. 2).

Different organisational approaches to developing knowledge and understanding of health are available which have been the subject of much debate and critique over the years (Cale & Harris, 2005, 2009, 2013; Murdoch & Whitehead, 2010). Health-related learning outcomes can be taught within the curriculum, within and beyond physical education. If

247 within physical education, learning can be permeated through the core traditional activities such as athletics, dance, games, gymnastics, outdoor education and swimming, taught 248 249 discretely in separate health-related units of work, or delivered via a combination of these 250 approaches. There are merits as well as drawbacks with each. To summarise, the strengths of a permeation approach are that health knowledge and understanding can be seen as related 251 252 and integral to all physical education experiences and thus pupils learn that all physical activities can contribute towards health, thus endorsing the close relationship between health 253 254 issues and participation (Harris, 2000; Murdoch & Whitehead, 2010). Via a permeated 255 approach, a skilled teacher may also be able to effectively develop both aspects of physical 256 literacy knowledge and understanding, that is, of movement and of health. However, a key 257 limitation levelled at this approach is that integrating the health-related learning through the 258 teaching of the core traditional activities may result in it becoming lost or marginalised and it taking second place to other learning such as skill development or tactical understanding 259 260 (Cale & Harris 2005; Harris & Cale, 2018). The discrete approach avoids this issue and 261 ensures health is not overlooked, but a drawback in teaching it in isolation through separate units may imply that it does not relate closely to other learning and elements of physical 262 education, physical literacy, and other curriculum subjects (Harris & Cale, 2018; Murdoch & 263 Whitehead, 2010). On balance, a combined approach is advocated in that it builds on the 264 strengths of each, helps to reinforce and ensure the consistency and coherence of learning, 265 266 and provides a realistic opportunity to more adequately address the required knowledge base 267 (Cale & Harris, 2009). It also allows links to be made to other physical education and physical activity experiences and health behaviours and subjects (Cale & Harris, 2005, 2009). 268 269 For example, it is recommended that links are made with learning in related subjects such as personal, social and health education science (PSHE), and food technology, plus with extra-270 curricular and/or community activity experiences where appropriate. Furthermore, 271

information and advice about such opportunities can be communicated to pupils as well as
their families in a variety of ways (e.g., via newsletters, visual displays, parent email, parent
consultations, assemblies, school web site; Harris & Cale, 2018). This is in fact akin to a
whole school approach to health which is growing in popularity and increasingly being
advocated within and beyond the United Kingdom (All-Party Commission on Physical
Activity, 2014; Blanchard, Shilton, & Bull, 2013; Cale, Harris, & Duncombe, 2016;
McMullen, Ní Chróinín, Tammelin, Pogorzelska, & van der Mars, 2015).

279 Concerns over the delivery of health were alluded to earlier. Indeed, alongside a lack 280 of clarity about the nature of appropriate health knowledge to cover, it is suggested teachers also lack appropriate PE-for-health pedagogies (Armour & Harris, 2013; i.e., strategies for 281 282 delivering health). Consequently, a number of researchers have called for more and 283 alternative methods, strategies, or models to effectively teach health-related knowledge (Armour & Harris, 2013; Haerens et al., 2011; Hastie, Chen, & Guarino, 2017; Hodges, 284 285 Kulinna, Lee, & Kwon, 2017). Indeed, critical of prevailing approaches, Armour and Harris 286 (2013) argue there has been surprisingly little new knowledge on health pedagogies that could support teachers in re-contextualizing health knowledge to meet the diverse learning 287 288 needs of pupils and therefore call for a renewed focus on developing PE-for-health pedagogies. 289

In recognition of this, there have been some recent encouraging pedagogical developments which are considered to have potential, two notable ones of which are outlined below and include the Health-Based Physical Education Model (HBPE; Haerens et al., 2011) and the Physically Active Lifestyle (PAL) Principles (Harris, Cale, Casey, Tyne, & Samaria, 2016). These have typically built on and been informed by the lessons learnt from previous health-related approaches originating primarily from the United States and Australia (Haerens et al., 2011). In addition, other relevant developments which have shown promise recently include Knowledge in Action Lesson Segments (Hodges et al., 2017) and the Project-Based
Learning Model (Hastie, Chen, & Guarino, 2017).

The HBPE model is considered to be highly compatible with the aims of physical 299 300 literacy, having as its central theme "pupils valuing a physically active life, so that they learn to value and practice appropriate physical activities that enhance health and wellbeing for the 301 302 rest of their lives" (Haerens et al., 2011, p. 321). Since 2011, the model has undergone an extensive period and comprehensive process of development with teachers, teacher educators, 303 304 and pupils resulting in some positive outcomes for teachers and pupils (Bowler, Sammon, 305 Casey, Haerens, & Kirk, 2012; Bowler et al., 2015). The model draws on self-determination theory, the social ecological model, and theories of behaviour change and identifies four 306 307 goals for HBPE including the characteristics of habitual, motivated, informed, and critical 308 movers. The affective domain is prominent in planning for learning emphasising the importance of valuing a physically active life as a sustainable long-term process, knowledge 309 310 as a significant component, and of focussing beyond the individual to the wider community. 311 In this respect, and whilst intended to be used flexibly to inform learning outcomes and the delivery of health knowledge and content, the model proposes that: (a) pupils' psychological 312 needs for autonomy, competence, and relatedness should be prioritised; (b) teachers should 313 promote physical activity within and beyond lessons, maximising lesson opportunities and 314 interacting with parents and community bodies; (c) lessons should include physical activity 315 316 learning opportunities, such as current guidelines, age-related statistics, local opportunities, and safe/effective practice; and (d) pupils should understand physical activity barriers, 317 potential strategies to overcome these and become movement activists for their peers/family 318 319 (Bowler et al., 2012).

Another pedagogical approach to promoting knowledge and understanding of healthis the adoption of PAL Principles (Harris et al., 2016). These principles emanated from a

322 small-scale action-based study with teachers and trainee teachers which aimed to develop and 323 trial a principle-based approach to promoting active lifestyles which could inform policies, 324 delivery, and resources suitable for use by teachers and schools (Cale, Harris, & Hooper, 325 2017). Informed by the literature and underpinned by social cognitive theory and the social ecological model, participants were involved in developing, trialling, evaluating, and 326 327 agreeing on a number of whole school and physical education-specific PAL principles, some of which explicitly focus on the development of knowledge and understanding in this area. 328 329 Key considerations in the design and implementation of the principles were in ensuring their 330 flexibility, simplicity, accessibility, and sustainability. Thus, there are no rigid rules and no prescriptive or structured programme for teachers to follow in incorporating them and 331 332 minimal training and no or few resources are needed to do so. The findings from the study 333 were encouraging revealing changes in teachers' pedagogies to increase activity levels and 334 positive responses from pupils (Cale et al., 2017). 335 Examples of whole school PAL principles which require and involve the development 336 of appropriate knowledge and understanding include (Harris et al., 2016): Include the physical activity for health guidelines for children in the teaching of 337 • 338 PSHE (alongside other health guidelines) as well as in physical education. • Discuss the promotion of active lifestyles, including marketing the 'one hour a day' 339 340 physical activity guideline, with all staff, governors, pupils and parents/carers. Promote active travel to school (cycling, walking, scooting)... (p. 52) 341 • 342 Likewise, relevant examples of physical education PAL principles include (Harris et al., 343 2016): Teach pupils about the broad range of benefits (physical, psychological and social) of 344 • a healthy, active lifestyle, including the role of physical activity in healthy weight 345 346 management.

Include assessment of learning and progress in active ways (e.g. show me...;
demonstrate...; shadow...).

- Routinely inform pupils where they can be active within 3-5 miles of the school
 radius (in every unit of work and via the school's intranet/library).
- Teach pupils how active they should be, involve them in monitoring their activity
 levels so they become aware of how active they are, and inform them of multiple
 ways of increasing their activity levels.
- Identify low active pupils and offer them (and their parents/carers)

355 support/guidance/information and targeted/bespoke activity sessions. (p. 52)

In developing knowledge and understanding, not only is identifying appropriate 356 knowledge and approaches for delivering it important, but so too is monitoring the 357 358 acquisition of this knowledge to establish the progress being made. Knowledge and 359 understanding of health can be assessed via written, verbal, and active responses to focussed 360 questions and tasks as well as via teacher observation (Cale & Harris, 2009). Peer- and self-361 assessment of health-related learning are also very appropriate as they directly involve pupils in making judgements and decisions about their own and others' learning (Harris & Cale, 362 363 2018). Furthermore, just as knowledge should be developed through the physical it is 364 recommended that, whenever possible, assessment of knowledge should be through the physical for the same reasons. Active assessment methods represent one of the physical 365 366 education PAL principles and can involve physical responses to focussed questions and 367 practical tasks and activities which require demonstration and application of knowledge and understanding. Various assessment methods, taken and/or modified from elsewhere (e.g., 368 Cale & Harris, 2009; Harris & Cale, 2018) are presented below. Whilst these assessments 369 370 can be applied to different ages and abilities, it is anticipated that they be adapted, as appropriate, and that the nature and depth of expected response will similarly be different. 371

372 Focused questions/activities (pupil-teacher or pupils-pupil) include: (a) Show me and name 373 which muscles are working hard when you run/jump/throw; (b) Why is it important to stretch 374 muscles after you have worked them hard?; (c) How much (and what type of) activity should 375 young people do?; (d) Explain to a partner why physical activity is good for your health; and (e) What are some of the main reasons why young people are not active? Practical tasks 376 377 include: (a) Show me a stretch for the muscles in.... the back of your leg/hamstring/calf, the front of your thigh/quadriceps, chest/pectorals, etc.; (b) Perform an exercise which will 378 379 strengthen vour.... tummy/stomach/abdominal muscles, leg/thigh muscles/quadriceps, 380 arms/triceps, etc.; (c) With a partner, plan and perform a warm up which includes mobilising and pulse raising activities followed by stretches of the main muscles; (d) Observe another 381 group's cool-down for sprinting and decide how effective it is (in reducing heart and 382 383 breathing rates and stretching out the main muscles that were worked hard); and (e) Prepare some advice for a member of your family who wishes to become more active. Identify and 384 include 10 top tips/pieces of information you think will help them to take part safely and 385 386 achieve their goal (of enjoying a physically active lifestyle).

387

Conclusion

Fundamental to physical literacy and to participating, valuing, and taking 388 responsibility for engaging in physical activities for life is knowledge and understanding of 389 movement and health, which is either explicitly or implicitly embedded within the physical 390 391 education curricula in most countries. To foster the above, and notably to lead a healthy 392 active life, a sound, broad, and holistic knowledge and understanding is clearly required. With reference to health specifically, and in an attempt to achieve consensus on and illustrate 393 394 the scope in health-related learning, health-related outcomes for children have been published 395 covering four key categories: safety issues, exercise effects, health benefits, and activity promotion. The latter outcomes relating to health and promoting activity are, however, 396

mostly closely linked to valuing and engaging in physical activities for life, and the need to
pay more attention to these is therefore recommended and indeed deemed necessary if
physical literacy is to be truly fostered.

400 In fostering knowledge and understanding in physical literacy, the content and its delivery are clearly key and there are some general principles which should be subscribed to. 401 402 These include: learning through the physical, and through a range of activities; the inclusion and empowerment of all pupils; and the shift from dependence on the teacher to 403 404 independence. Different organisational approaches to developing knowledge and 405 understanding of health are also available which warrant consideration, each of which has 406 strengths and limitations. Within physical education, for example, learning can be permeated through core traditional activities, taught discretely in separate health-related units of work, or 407 via a combination of these approaches. On balance, a combined approach is advocated. 408 Following concerns over the delivery of health, there have been calls for more and 409 alternative approaches to effectively teach health-related knowledge and for a renewed focus 410 on developing PE-for-health pedagogies. Encouragingly, there have been some recent 411 412 pedagogical developments which are considered to have potential in this regard, two notable ones of which include the HBPE Model and the PAL Principles. Finally, not only is 413 414 identifying appropriate knowledge and approaches for delivering health important, but so too 415 is monitoring the acquisition of this knowledge to establish the progress being made. This

416 can be done in various ways and it is recommended that, where possible, assessment should

417 be through the physical (i.e., active, and via a range of practical strategies and methods).

418

419	References
420	Alfrey, L., Cale, L., & Webb, L. (2012). Physical education teachers' continuing professional
421	development in health-related exercise. Physical Education and Sport Pedagogy, 17,
422	477-491.
423	Alfrey, L., & Gard, M. (2014). A crack where the light gets in: a study of health and physical
424	education teachers' perspectives on fitness testing as a context for learning about
425	health. Asia-Pacific Journal of Health, Sport and Physical Education, 5(1), 3-18.
426	Almond, L. (2010). Physical literacy and the older adult population. In M. Whitehead (Ed.),
427	Physical literacy: Throughout the lifecourse (pp. 116-129). London, UK: Routledge.
428	Almond, L., & Myers, L. (2017). Physical literacy and the primacy of movement. Physical
429	Education Matters, 12(1), 19-21.
430	All-Party Commission on Physical Activity. (2014). Tackling physical inactivity - A
431	coordinated approach. Retrieved from http://activitycommission.com/
432	Armour K.M., & Harris, J. (2013). Making the case for developing new PE-for-health
433	pedagogies. Quest, 65, 201-219.
434	Blanchard C., Shilton, T., & Bull, F. (2013). Global Advocacy for Physical Activity (GAPA):
435	Global leadership towards a raised profile. Global Health Promotion, 20, 113-121.
436	Bowler, M., Sammon, P., Casey, A., Haerens, L., & Kirk, D. (2012, September). Validating
437	the health-based physical education pedagogical model: Defining teacher and student
438	benchmarks. Paper presented at the British Educational Research Association Annual
439	Conference, University of Manchester, UK.
440	Bowler, M., Sammon, P., Kirk, D., Haerens, L., Cale, L., & Casey, A. (2015, July).
441	Developing a 'prototype' health-based physical education pedagogical model. Paper
442	presented at the International Association for Physical Education in Higher Education
443	Annual Conference, Universidad Europea, Madrid, Spain.

Burrows, L., Wright, J., & McCormack, J. (2009). Dosing up on food and physical activity:
New Zealand children's ideas about 'health.' *Health Education Journal*, 68, 157-169.

446 Cale, L. (2017). Teaching about Healthy Active Lifestyles. In C.D. Ennis (Ed.), *Routledge*

447 *handbook of physical education pedagogies* (pp. 399-411). Oxon, UK: Routledge.

- Cale, L., & Harris, J. (Eds.). (2005). *Exercise and young people. Issues, implications and initiatives.* Basingstoke, UK: Palgrave Macmillan.
- 450 Cale, L., & Harris, J. (2006). School based physical activity interventions Effectiveness,
- 451 trends, issues, implications and recommendations for practice. *Sport, Education and*452 *Society*, *11*, 401-420.
- 453 Cale, L., & Harris, J. (2009). *Getting the buggers fit (2nd ed.)*. London, UK: Continuum.
- Cale, L., & Harris, J. (2013). Physical education and health: Considerations and issues. In S.
 Capel & M. Whitehead (Eds.), *Debates in physical education* (pp. 74-88). Oxon, UK:
 Routledge.
- 457 Cale, L., Harris, J., & Duncombe, R. (2016). Promoting physical activity in secondary
 458 schools. Growing expectations: Same old issues. *European Physical Education*459 *Review*, 22, 526-544.
- 460 Cale, L., Harris. J., & Hooper, O. (2017, January). *The Promoting Active Lifestyles project*.
- 461 Paper presented at the 30th Australian Council for Health, Physical Education and
- 462 Recreation (ACHPER) International Conference, University of Canberra, Australia.
- 463 Castelli, D., & Williams, L. (2007). Health-related fitness and physical education teachers'
 464 content knowledge. *Journal of Teaching in Physical Education*, 26, 3-19.
- 465 Department for Education. (2013a). *Programmes of study for physical education Key stages*
- 466 *1 and 2*. Retrieved from <u>https://www.gov.uk/government/publications/national-</u>
- 467 <u>curriculum-in-england-physical-education-programmes-of-study</u>

- 468 Department for Education. (2013b). *Programmes of study for physical education Key stages*
- *3 and 4*. Retrieved from <u>https://www.gov.uk/government/publications/national-</u>
 curriculum-in-england-physical-education-programmes-of-study
- 471 Edwards, L.C., Bryant, A.S., Keegan, R.J., Morgan, K., & Jones, A.M. (2017). Definitions,
- 472 foundations and associations of physical literacy: A systematic review. *Sports*
- 473 *Medicine*, 47, 113-126.
- Elbourn, J., & James, A. (2013). *Fitness room activities for secondary schools. A guide to promoting effective learning about healthy active lifestyles.* Leeds, UK: Coachwise.
- 476 Ennis, C.D. (2015). Knowledge, transfer and innovation in physical literacy curricula.

477 *Journal of Sport and Health Science*, *4*, 119-124.

- Fardy, P.S., Azzollini, A., & Herman, A. (2004). Health-based physical education in urban
 high schools: The PATH program. *Journal of Teaching in Physical Education*, *23*,
 359-371.
- Haerens, L., Kirk, D., Cardon, G., & De Bourdeaudhuij, I. (2011). Toward the development
 of a pedagogical model for health-based physical education. *Quest*, *63*, 321-338.
- 483 Harris, J. (2000). *Health-related exercise in the national curriculum*. Leeds, UK: Human
 484 Kinetics.
- Harris, J. (2010). Health-related physical education. In R. Bailey (Ed.), *Physical education for learning: A guide for secondary schools* (pp. 26-36). London, UK: Continuum.
- 487 Harris, J., & Cale, L. (2018). *Promoting active lifestyles in schools*. Leeds, UK: Human
 488 Kinetics.
- Harris, J., Cale, L., Casey, A., Tyne, A., & Samaria, B. (2016). Promoting active lifestyles in
 schools. The PAL project. *Physical Education Matters*, *11*(3), 52-53.

- 491 Harris, J., & Leggett, G. (2015). Influences on the expression of health within physical
- 492 education curricula in secondary schools in England and Wales. *Sport Education and*493 *Society*, 20, 908-923.
- 494 Hastie, P. (2017). Revisiting the National Physical Education Content Standards: What do we
- really know about our achievement of the physically educated/literate person? *Journal of Teaching in Physical Education*, *36*, 3-19.
- Hastie, P.A., Chen, S., & Guarino, A.J. (2017). Health-related fitness knowledge development
 though project-based learning. *Journal of Teaching in Physical Education*, *36*, 119-125.
- Hodges, M., Kulinna, P.M., Lee, C., & Kwon, J.Y. (2017). Professional development and teacher
- perceptions of experiences teaching health-related fitness knowledge. *Journal of Teaching in Physical Education*, *36*, 32-39.
- 502 International Physical Literacy Association (IPLA). (2017). Retrieved from
- 503 https://www.physical-literacy.org.uk/
- 504 Keating, X.D. Harrison, L., Chen, L., Xiang, P., Lambdin, D., Dauenhauer, ... Pinero, J.C.
- 505 (2009). An analysis of research on student health-related fitness knowledge in K-16
- 506 physical education programs. *Journal of Teaching in Physical Education*, 28, 333-349.
- 507 Kirk, D. (2013). Educational value and models-based practice in physical education. *Educational* 508 *Philosophy Theory*, 45, 973–986.
- 509 Kulinna, P.H., McCaughtry, N., Martin, J.J., Cothran, D., & Faust, R. (2008). The influence of
- 510 professional development on teachers' psychosocial perceptions of teaching a health-
- 511 related physical education curriculum. *Journal of Teaching in Physical Educ*ation, 27, 292-
- 512 307.
- Liedl, R. (2013). A holistic approach to supporting physical literacy. *Physical and Health*
- 514 *Education Journal*, 79(2), 19.

- Lundvall, S. (2015). Physical literacy in the field of physical education A challenge and a
 possibility. *Journal of Sport and Health Sciences*, *4*, 113-118.
- 517 McKenzie, T.L. (2007). The preparation of physical educators: A public health perspective.
 518 *Quest*, 59, 346-357.
- McMullen, J., Ní Chróinín, D., Tammelin, T., Pogorzelska, M., & van der Mars, H. (2015).
 International approaches to whole-of-school physical activity promotion. *Quest*, 67, 384-399.
- 522 Murdoch, E., & Whitehead, M. (2010). Physical literacy, fostering the attributes and
- 523 curriculum planning. In M. Whitehead (Ed.), *Physical literacy: Throughout the*524 *lifecourse* (pp. 175-188). London, UK: Routledge.
- 525 Puhse, U., Barker, D., Brettschneider, W.D., Feldmeth, A.K., Gerlach, E., McCuaig, L., ...
- 526 Gerber, M. (2011). International approaches to health-oriented physical education:
- 527 Local health debates and differing conceptions of health. *International Journal of*528 *Physical Education*, *3*, 2-15.
- 529 Trost, S. (2006). Public health and physical education. In D. Kirk, D. Macdonald, & M.
- 530 O'Sullivan (Eds.), *The handbook of physical education* (pp. 63-187). London, UK:
 531 Sage.
- 532 Whitehead, M. (2007). Physical literacy: Philosophical considerations in relation to
- developing a sense of self, universality and propositional knowledge. *Sport, Ethics and Philosophy*, *1*, 281-298.
- Whitehead, M. (2010a). The concept of physical literacy. In M. Whitehead (Ed.), *Physical literacy: Throughout the lifecourse* (pp. 10-20). London, UK: Routledge.
- 537 Whitehead, M. (2010b). Physical literacy, the sense of self, relationships with others and the
- place of knowledge and understanding in the concept. In M. Whitehead (Ed.), *Physical*
- 539 *literacy: Throughout the lifecourse* (pp. 56-67). London, UK: Routledge.

- 540 Whitehead, M. (2013). The value of physical literacy. *ICSSPE Journal of Sport Science and*
- 541 *Physical Education*, 65, 42-43.

Table 1				
Learning Outcomes Associated with National Curriclulum Key Stages				
Pupils	who are 5-7 years can:			
•	explain that activity starts with a gentle warm up and finishes with a calming cool			
	down (safety issues)			
•	recognise and describe the effects of exercise, including changes to: breathing (e.g.			
	becomes faster and deeper), heart rate (e.g. heart pumps more quickly), temperature			
	(e.g. feel hotter), appearance (e.g. look hotter), feelings (e.g. feeling good, more			
	energetic, tired) (exercise effects)			
•	explain that regular activity improves health by making you feel good (e.g. happy,			
	pleased, content) and helping body parts (e.g. bones and muscles) to grow, develop			
	and work well (health benefits)			
•	identify when, where and how they can be active at school (in and out of lessons)			
	(activity promotion).			
Pupils	who are 7-11 years can:			
•	explain the need for safety rules and practices (e.g. adopting good posture, changing			
	clothes and having a wash after energetic activity, wearing suitable footwear,			
	following rules, safe lifting) (safety issues)			
•	explain and feel the short-term effects of exercise (e.g. breathing increases in order to			
	provide more oxygen to the working muscles, the heart rate increases to pump more			
	oxygen to the working muscles, body temperature increases because working muscles			
	produce energy as heat) (exercise effects)			
•	explain that exercise strengthens bones and muscles (including the heart) and helps to			
	keep joints flexible (health benefits)			

567	•	identify when, where and how they can be active in school and outside and explain
568		that individuals have different feelings about the types and amounts of activity that
569		they choose to do (activity promotion).
570	Pupils	who are 11-14 years can:
571	•	explain the value of preparing for and recovering from activity and the possible
572		consequences of not doing so, and the purpose of each component of a warm up and
573		cool down (i.e. mobility exercises, whole body activities, static stretches) for general
574		activity and for a specific activity (safety issues)
575	•	explain a range of short-term effects of exercise on the cardiovascular system (e.g.
576		changes in: breathing and heart rate, temperature, appearance, feelings, recovery rate)
577		and musculo-skeletal system (e.g. increases in muscular strength and endurance and
578		flexibility, improved muscle tone and posture, enhanced functional capacity) (exercise
579		effects)
580	•	explain a range of long-term benefits of exercise on physical health (e.g. reduced risk
581		of chronic disease (e.g. heart disease), reduced risk of bone disease (e.g.
582		osteoporosis), reduced risk of some health conditions (e.g. obesity, back pain),
583		improved management of some health conditions (e.g. asthma, diabetes, arthritis)
584		(health benefits)
585	•	know ways of incorporating exercise into their lifestyles (e.g. walking or cycling to
586		school or to meet friends, helping around the home/garden) (activity promotion).
587	Pupils	who are 14-16 years can:
588	•	recognise and manage risk and apply safe exercise principles and procedures (e.g. not
589		exercising when unwell or injured, avoiding prolonged high impact exercise,
590		administering first aid including resuscitation techniques, avoiding excessive
591		exercise) (safety issues)

592	•	explain that frequent and appropriate activity enhances the physical, social and
593		psychological well-being of all individuals including the young and old, able-bodied
594		and disabled, and those with health conditions (e.g. asthma, depression) and chronic
595		disease (e.g. arthritis) (health benefits)
596	•	explain that training programmes develop both health-related components
597		(cardiovascular fitness, muscular strength and endurance, flexibility, body
598		composition, composure, decision-making) and skill-related components of physical
599		and mental fitness (agility, balance, co-ordination, power, reaction time, speed,
600		concentration, determination) (exercise effects)
601	•	explain factors affecting participation and constraints to being active and explore how
602		to overcome the latter in order to gain access to and sustain involvement in activity
603		(activity promotion). (Taken and adapted from Harris, 2000).
604		
605		

606 Table 2

607 Example Knowledge and Understanding Outcomes Related to Health Benefits and Activity

608 *Promotion*

Learning	5-7 Year Olds	7-11 Year Olds	11-14 Year Olds	14-16 Year Olds
Outcome				
Health	explain that	explain that	explain a range of	explain that frequent
Benefits	regular activity	activity	long-term benefits	and appropriate
	improves	strengthens	of activity on	activity enhances the
	health by:	bones and	physical health:	physical, social and
	-making you	muscles	-reduced risk of	psychological well-
	feel good (e.g.	(including the	chronic disease	being of all
	happy pleased,	heart) and helps	(e.g. heart disease)	individuals including
	content)	to keep joints	-reduced risk of	the young and old,
	-helping body	flexible	bone disease (e.g.	able-bodied and
	parts (e.g.		osteoporosis)	disabled, and those
	bones and	explain that	-reduced risk of	with health conditions
	muscles) to	activity can help	some health	(e.g. asthma,
	grow, develop	you to feel good	conditions (e.g.	depression) and
	and work well	about yourself	obesity, back	chronic disease (e.g.
		and can be fun	pain)	arthritis)
		and sociable	-improved	
			management of	explain that activity
		explain that	some health	can help to manage
		regular activity	conditions (e.g.	stress and contribute
		permits daily	asthma, diabetes,	to a happy, healthy
		activities to be	arthritis)	and balanced lifestyle
		performed more		
		easily	explain that	appreciate the risks
			activity can	associated with a
		explain that	enhance mental	sedentary lifestyle
		being active	health and social	and with excessive
		helps to	and psychological	behaviour (e.g. eating
		maintain a	well-being (e.g.	disorders and over-

	healthy body	enjoying being	exercising)
	weight	with friends;	
		increased self-	identify how each
		esteem; decreased	activity area (e.g.
		anxiety) and that	gymnastics,
		an appropriate	swimming) can
		balance between	contribute to specific
		work, leisure and	components of health-
		activity promotes	related fitness (e.g.
		good health	gymnastics develops
			muscular
		explain that	strength/endurance
		increasing activity	and flexibility)
		levels and eating a	
		balanced diet can	
		help to maintain a	
		healthy body	
		weight (energy	
		balance equation)	
		but the body needs	
		a minimum daily	
		energy intake to	
		function properly,	
		and strict dieting	
		and excessive	
		exercising can	
		damage one's	
		health	
		explain how each	
		activity area (e.g.	
		athletics, dance,	
		games) can	

			contribute to	
			physical health	
			and to social and	
			psychological	
			well-being (e.g.	
			can improve	
			stamina, assist	
			weight	
			management, be	
			enjoyable)	
Activity	identify when,	identify when,	know ways of	explain and
Promotion	where and how	where and how	incorporating	demonstrate a
	they can be	they can be	activity into their	practical
	active at school	active in school	lifestyles (e.g.	understanding of the
	(in and out of	and outside	walking or cycling	key principles of
	lessons)		to school or to	activity programming
		explain that	meet friends;	and training,
		individuals have	helping around the	including:
		different	home/garden)	-progression
		feelings about		-overload
		the types and	know how to	-specificity
		amounts of	go about getting	-balance, moderation
		activity that they	involved in	and variety
		choose to do	activities	-maintenance
				-reversibility
				-cost benefit ratio
				explain factors
				affecting participation
				and constraints to
				being active and
				explore how to
				overcome the latter in

		order to gain access to
		and sustain
		involvement in
		activity