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What's in a concept? A Leximancer text mining analysis of physical literacy across the international literature

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1 **Introduction**

2 Until recently an Arnoldian philosophy of physical education (PE) was considered to be something
3 of a ‘touchstone’ “for theorising the form and content of physical education in relation to its
4 educational status in schools” (Kirk, 1988: 71). Arnold’s (1979) three conceptual dimensions for
5 PE - education in, through and about movement, provided a distinctiveness of purpose between PE
6 and other forms of physical activity provision by giving ‘voice’ to the educative dimensions of PE.
7 However, even with the Arnoldian explanation there remains evidence of confusion internationally
8 as to what constitutes PE (Green, 1998; Kirk, 1993, 2006, 2010; Penney, 1998; Pill, 2007; Swabey,
9 2006; Tinning, Kirk and Evans, 1993). Some have argued that narrower interpretations persist in PE
10 compared to the conceptualisation by Arnold (Clennett and Brooker, 2006; Kirk, 2010). The narrow
11 interpretations of PE have often been through curricular hegemony (Sprake and Walker, 2015) and
12 to support a traditional ‘physical education method’ based on directive instruction (Metzler, 2011)
13 and a tradition of sport techniques (Kirk, 2010).

14 PE has been described as contested ground (Pill, 2012), where the persistence of a
15 traditional PE method for pedagogical practice has contributed to the marginalisation of PE in
16 curriculum time (Kirk, 2010; Locke, 1992; Penney and Chandler, 2000). Stolz (2010: 1) described
17 this marginalisation as “a crisis of legitimisation within education.” From Stolz we might assume
18 that the challenge highlighted by MacDonald and Brooker (1997) to construct a PE that is
19 educationally defensible, rigorous, relevant and legitimate nearly two decades ago appears to be as
20 relevant now in many jurisdictions as it was then. We agree with Kirk (1996) and Penney and
21 Chandler (2000) that the business of schools is education and so it should be possible to justify PE
22 on educative purposes and student learning. Something that needs to be considered is whether the
23 introduction of physical literacy (PL) into this contested ground provides clarity to the purpose of
24 PE and its pedagogical practice in schools or whether it is another ‘player’ in the space adding
25 further conceptual and pedagogical confusion for practitioners as a concept essentially now in
26 competition with the Arnoldian propositions.

27 The philosophy of PL (Whitehead, 2001) has gained a sense of momentum in recent times,
28 to the point where advocates have a philosophy and justificatory argument and are now in search of
29 a supportive pedagogical argument (Kirk, 2013). This momentum exists despite PL initially being
30 neither an alternative to PE nor a PE pedagogical model, simply a potential outcome of PE (Sprake
31 and Walker, 2015). Nevertheless, PL has increasingly become part of the PE discourse (Lundvall,
32 2015), and Sprake and Walker (2015) suggested the PE-community has a responsibility to pay close
33 attention to the momentum being gained by the PL movement. However, definitional evolution,
34 differing operationalising of PL in policy and curriculum documents, and the substitution of PL
35 where PE was once used in documentation confuse the legitimacy of the concept. Common
36 consensus on the understanding of PL has been obstructed - meaning that PL has not been
37 universally accepted in PE curriculum documents (Macdonald and Enright, 2013). Therefore, the
38 aim of this paper was to uniquely report on a text mining analysis of concepts and contexts relating
39 to the use of PL across the international PL literature.

40

41 ***The concept of physical literacy within physical education***

42 Whitehead (2001: 131) presented a case for PL as part of the PE legitimisation debate by proposing
43 a “preliminary description of a physically literate individual.” The case for PL is not the first
44 conceptualisation solution for an educationally defensible PE. In (refer to Table 1), Whitehead
45 acknowledged similarities to conceptualisations proposed by others, including Arnold (1979).

46

47 -----Insert Table 1 about here-----

48

49 Whitehead’s (2001) proposition for a complete PE might be seen as a continuation of the
50 ideas proposed by the ‘New PE movement’ of the 1950s (Corbin, 2016). The New PE movement
51 was considered a way of educating through physical activity “with full regard to values in human
52 growth, development and behaviour” (Streit and McNeely, 1950: 134). Such ideas continued over

53 time to be conceptually clarified through the work of Arnold (1979), Kirk (1988) and others. The
54 challenge concerning the New PE movement was clarifying the contribution of PE to educating the
55 whole person. Whitehead (2004: 4) deviated and suggested “the goal in education would not be to
56 produce physically educated young people but to ensure that every pupil left compulsory education
57 having acquired literacy in respect of the motile aspects of their embodied dimension.” Whitehead
58 (2005) later proposed a definition of PL to accompany the description of a physically literate
59 individual (Table 2), and expanded the preliminary description to include:

60

- 61 • The physically literate individual will interact with sensitivity and ease with others in
62 group situations, appreciating the expressive quality of movement in her/himself and
63 in others; and
- 64 • In addition, the individual has the ability to identify and articulate the essential
65 qualities that influence the effectiveness of his/her own movement performance, and
66 has an understanding of the principles of embodied health, with respect to basic
67 concepts such as exercise, sleep and nutrition.

68

69 Whitehead (2005) also advocated for a move from the goal of PE as becoming physically
70 educated to enabling all to achieve PL, or to be physically literate. The further expansion of
71 meaning and utility of PL is noted in Whitehead’s (2007) definition and description (Table 3), as is
72 a move to progress a curriculum that would foster the development of PL. However, Whitehead
73 (2013: 32) asserted that you “DO NOT Teach physical literacy”, and PL is not a pedagogical
74 model, yet PL is a rationale for the value of physical activity. Together with definitional
75 remodeling, what we see from 2001-2013 is the evolution of PL from an educational philosophy to
76 a proposed outcome of PE identified by a series of associated attributes (Tables 1-4). Consequently,
77 perhaps where PL departs from PE is around the idea that PE has been associated with the
78 development of generic and specific competencies (Hardman, 2011) while PL has been associated

79 with motivation (Whitehead, 2010). However, we concur with Corbin (2016) who suggested the
80 definition demarcations between being physically literate and being physically educated are blurred.

81 -----Insert Table 2 about here-----
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83 -----Insert Table 3 about here-----
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86 -----Insert Table 4 about here-----
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92 The recent advance of PL may be associated with a desire in some jurisdictions to develop
93 the profile and standing of PE and use the opportunity of advancing PL to re-assert the key values
94 of PE as a subject, or to unify the PE discourse around a common understanding (Hayden-Davies,
95 2008; Roetert and MacDonald, 2015). However, the confounder to developing the profile and
96 standing of PE has been the (re?) defining of PL in policy and curriculum documents to create more
97 of a smorgasbord of ideas. For example, definitions of PL include:

- 98
- 99 • The development of fundamental movement skills and fundamental sport skills that permit a
100 child to move confidently and with control, in a wide range of physical activity, rhythmic
101 (dance) and sport situations (Higgs et al., 2008);
 - 102 • The development of agility, balance, coordination, and skill across a wide range of activities
103 (UK Sport, 2002);
 - 104 • Those who move with competence in a wide variety of physical activities that benefit the
105 development of the whole person (Mandigo, Farancis, Lodewyk and Lopez, 2009);
 - 106 • The ability to use body management, locomotor and object control skills in a competent
107 manner, with the capacity to apply them confidently through play and practice settings
108 which may lead to sustained involvement in sport and physical recreation (Delaney and
109 Rainer, 2012); and

- 110 • Those who have the knowledge, skills and confidence to enjoy a lifetime of healthful
111 physical activity (Couturier, Chepko, and Holt/Hale, 2014).

112

113 Multiple definitions of PL have confused understanding of the concept (Lounsbery and
114 McKenzie, 2015) and led to it being excluded from the recent release of the Australian Curriculum
115 for Health and PE, although some merit was seen in the concept of PL as a general capability of the
116 curriculum (Macdonald and Enright, 2013). Further confounding the PL proposition is the absence
117 of empirical support for the theorising (Chen, 2015; Macdonald and Enright, 2013). The similarity
118 between definitions of PE and being physically educated and the replacement definition of PL that
119 has occurred in some jurisdictions has also added to the conceptual confusion. There has been
120 suggestions that the term PL has been placed upon practitioners with limited evidence of a need to
121 do so. An emphasis on PL has lead to the point of the PE discipline being described as a ‘profession
122 being distracted’ from the more important things it needs to focus on (Lounsbery and McKenzie,
123 2015). There are many assumptions about PL and its educative role in the literature (Lundvall,
124 2015) which has been complicated by the substitution of PE for PL (Corbin, 2016). In some policy
125 documents, the intention of PL has acted as a novel metaphor to capture attention and collaborative
126 action to promote the inherent value of physical activity (Jurbala, 2015).

127 It is clear that the idea of PL has proved attractive in education, sport and physical activity
128 fields, however, definitional blurring of PL is evident and some have been critical of how it is being
129 applied (Lounsbery and McKenzie, 2015). It is not the intent of this paper to evaluate the relative
130 merits of PL or pass judgement on the utility of the concept, although previous reports on the utility
131 of the concept are discussed. This study fills an important gap in the literature by showing the
132 multiplicity of conceptions and themes from the PL literature, raising the question of whether the
133 substitution of PE in policy documents for PL actually changes anything for the pragmatics of the
134 PE practitioner. The study uniquely utilises the Leximancer text mining software as an innovative
135 method for the researchers to analyse this evolving, emerging and contentious concept within the

136 discipline of PE. The study also determines if strongly related terms and concepts with PL match
137 various definitions of PL and conceptual areas of consideration for such definitions.

138

139 **Methods**

140 *Leximancer text mining analysis software*

141 Researchers have implemented the use of Computer Assisted Qualitative Data Analysis Software
142 (CAQDAS) to systematically, efficiently and logically enhance the research and analysis processes
143 for some time (Crofts and Bisman, 2010). Leximancer is one such CAQDAS that can be used to
144 ‘text mine’ the content of substantial documents as a lexicographic tool that can visually display the
145 selected information. Leximancer processes textual documents by determining the ‘contextual
146 collocations of words through ‘term-occurrence information, such as co-occurrence, positions and
147 frequencies of nouns and verbs’ (Kamimaeda et al., 2007). The advantage of Leximancer is that it
148 extracts a populated list from the text document that displays the weighted term classifications and
149 connections between key words. From this list it creates concept maps that illustrate the level of
150 connections between key words in the text being analysed (Crofts and Bisman, 2010). In other
151 words, the software processes the level of relationship between concepts and the rate at which
152 concepts and the significantly related terms appear close to each other within the text (Crofts and
153 Bisman, 2010). How the Leximancer software processes text documents into words, concepts and
154 themes is demonstrated in Figure one.

155

156

157 -----Insert Figure 1 about here-----

158

159 To date, Leximancer has been mainly used for research purposes within the fields of
160 accounting, business and general education (Beamish et al., 2006; Fisher and Miller, 2008;
161 Grimbeek et al., 2004, 2005; Rooney et al., 2006;). Despite Leximancer providing a mechanism for
162 viewing textual data with a different visual lens, there has been an absence of international literature

163 using this software to explore important concepts and terminology in the field of PE. Although the
164 statistical counts and connections of Leximancer can hint towards a quantitative data analysis
165 approach, in this study Leximancer was used to provide a means for the researchers to identify
166 related concepts and themes, including themes which might otherwise have been missed or
167 overlooked through manual data analysis processes. Themes identified via the software can then be
168 interpreted further by researchers to discover meaning from the textual analysis.

169

170 *Selection of the physical literacy-based literature*

171 Within the international PE literature there is a gap in applying content analysis to studies
172 examining a particular concept or construct, especially a highly contentious and emerging concept
173 in the field of PE such as ‘physical literacy’. To investigate the use of the terminology ‘physical
174 literacy’, the researchers conducted a content analysis of peer reviewed journal articles, conference
175 proceedings and research reports published over a 15-year period, 2001 to (April) 2016. The
176 inclusion criteria for the literature were: (1) peer reviewed journal articles, peer reviewed
177 conference papers or research summaries (e.g. government reports) specifically on PL as a concept;
178 (2) the concept PL was included in the title; (3) the research was in the field of school PE (not sport
179 coaching); (4) PL was a dominant focus or theme throughout the paper; (5) the research was
180 published after 2001 (PL was proposed in 2001 as part of the PE legitimisation debate) (see Table
181 5). Peer reviewed literature and government reports were prioritised for inclusion within the
182 analysis to ensure that the documents undergoing the text mining followed the highest level of
183 academic scholarship and format (Ridley, 2012).

184 The search method involved a scan of academic paper repositories. The scan started with a
185 Google Scholar search with the entry of ‘physical literacy research’. Where a paper was linked back
186 to a database – for example, Proquest, the database was explored for papers using the same search
187 entry before returning to Google Scholar. The search methods resulted in a sample of 49 papers
188 (from journal articles, conference papers, government reports and one journal special edition on PL)

189 for the analysis (Table 5). The distribution of papers was wide ranging across international contexts,
190 including the United States (26.53%), Canada (28.57%), United Kingdom (22.45%) and other
191 countries (22.45%; including from Australia, Sweden, Nigeria, Ireland, Switzerland, Turkey,
192 Multiple and Portugal) (Table 5). The distribution of the papers across the years 2001-2016 was:
193 2001-2010 (24.5%), 2011-2013 (26.5%) and 2014-2016 (49%). If the original portable document
194 format (pdf) was not in a digital format with searchable text, the pdf document images were
195 converted by optical character recognition software into a digital format readable by the text mining
196 software.

197

198 ***Content analysis***

199 The Leximancer software was applied to develop theme and concept lists from the collated
200 document of PL papers. Themes and concepts were automated from the Leximancer text mining
201 software according to the level of relationship between concepts and the rate at which concepts and
202 the significantly related terms from the documents appear close to each other within the text. The
203 process is described as spatial and relational analysis which is conducted to determine the relevance
204 of the semantic networks (Crofts and Bisman, 2010). This was followed by the researchers
205 identifying the clusters of major concepts, themes and contexts related to the PL by the visual
206 representation of cognitive mapping (Crofts & Bisman, 2010). Similar versions of the words
207 identified (often plural and non-plural versions of words) from the software were manually merged
208 into singular preliminary concepts such as (i) schools, and (ii) school. The context of words is for
209 determining meaning (Denzin and Lincoln, 2005) and the content analysis undertaken by the
210 researchers thus focused on drawing meaning and interpretation from the text mining analysis. The
211 results from the initial text mining analysis were checked manually by the researchers to confirm
212 the themes, concepts and associations within the original literature. This ensured that the
213 researchers further immersed themselves in the data and accurately interpreted the data that was
214 collated to enrich the research process of analysing the concepts and contexts relating to the use of

215 PL across the international PL literature.

216

217 **Results**

218 *Text mining analysis across the international PL literature*

219 From the overall text mining analysis across the international PL literature, the 30 concepts with the
220 strongest relevance ranged in textual association from seven% to 100%. Given that the research is
221 concerned with the concept of PL, it was no surprise that the concepts of ‘physical’ (100%
222 relevance; 6794 mentions), ‘literacy’ (100% relevance; 6635 mentions) and especially ‘physical
223 literacy’ (91% relevance; 6191 mentions) were the concepts identified overall as the most relevant
224 across the literature.

225

226 -----Insert Table 5 about here-----

227

228 When specifically examining PL across the 49 research papers, the concepts that were
229 revealed to be most connected to PL (excluding physical and literacy) were ‘education’ (87%
230 relevance to PL), ‘activity’ (72% relevance to PL), ‘fitness’ (72% relevance to PL), ‘health’ (71%
231 relevance to PL), ‘concept’ (70% relevance to PL), ‘competence’ (70% relevance to PL),
232 ‘understanding’ (69% relevance to PL), ‘role’ (69% relevance to PL), ‘curriculum’ (67% relevance
233 to PL) and ‘assessment’ (65% relevance to PL) (Table 6). From the PL analysis, the strong
234 relevance of the education concept was further investigated and revealed high level relational
235 connections with the concepts of ‘curriculum’, ‘teachers’ and ‘approach’. The ‘activity’ concept
236 was also identified as relating most strongly to fitness, competence, motivation, sport and physical
237 literacy concepts.

238

239 -----Insert Table 6 about here-----

240

241 To assist the analysis, automated themes from the text mining relating to PL are visually
242 represented by circles and the greater the frequency of specific concepts within a theme results in a
243 greater sized circle (Figure 2). The overall automated themes across the literature (and the concepts
244 within each of the automated themes) included ‘physical’ (physical literacy, education, activity,
245 people, motivation and school curriculum concepts), ‘physically’ (life, knowledge, social and
246 potential concepts), ‘skills’ (fundamental, movement, motor and performance concepts), ‘children’
247 (learning, children, approach and support concepts), ‘teachers’ (teachers, youth, sport, research,
248 model) and ‘development’ (role, assessment and development) (Figure 2). Smaller level
249 association themes included ‘use’ (concepts such as games, play), ‘individual’ (environment,
250 ability), ‘practice’ (work, practice and play), ‘body’ (control, body, performance), ‘study’ (study)
251 and ‘world’ (self and others) (Figure 2).

252

253 -----Insert Figure 2 about here-----

254

255 ***Text mining analysis across the country-specific physical literacy literature***

256 When examining the country-specific PL themes, the top five automated themes generated from the
257 Canadian PL literature included ‘physical’ (concepts such as physical, literacy, physical literacy,
258 activity, education, research, classroom and teachers), ‘students’ (concepts such as students,
259 physically, physically literate, experiences, practice and participants), ‘knowledge’ (knowledge,
260 understanding, competence, model, life and individual), ‘development’ (development, children,
261 movement and motor) and ‘skills’ (skills and activities) (Table 7).

262 The text mining analysis of the United Kingdom PL literature revealed the top five
263 automated themes of ‘physical’ (automated concepts of physical, physical literacy, activity,
264 education, children, development, skills and understanding), ‘children’ (children, development,
265 skills, young, sport, health and people), ‘knowledge’ (teachers, learning, school, PE, students,
266 curriculum and time), ‘development’ (movement, life, develop, individual, experience and role) and

267 'skills' (skills and development) (Table 7).

268 The top five themes revealed from the automated analysis of the United States literature
269 included 'physical' (automated concepts of physical, physical literacy, literacy, education, activity,
270 school, sport and & health), 'students' (students, learning, teachers, skills, practice), 'PE' (PE,
271 physically, physically literate and knowledge), 'skills' (skills and development) and 'concept'
272 (children, movement, activities, model and opportunities) (Table 7).

273 From the literature across the other countries such as Australia, Nigeria, Switzerland and
274 Sweden, the top five automated themes generated included 'physical' (automated concepts of
275 physical, physical literacy, literacy, activity, education and development), 'movement' (movement,
276 skills, learning, children, motor, skill & fundamental), 'sport' (sport, physically literate, physically,
277 activities, PA, study and research), 'young' (young, people and sports) and 'students' (students)
278 (Table 7).

279

280 -----Insert Table 7 about here-----

281

282 **Discussion**

283 The text mining analysis of all the literature revealed that when specifically examining the PL
284 proposal, the concepts that were revealed to be most connected to PL (excluding physical and
285 literacy) were education, activity, fitness, health, concept, competence, understanding, role,
286 curriculum and assessment. Such findings when relating to the definitions of PL and PE can provide
287 further information into whether there is merit to replace PE with PL in policy documentation and
288 delves deeper into emerging themes and concepts from the international PL literature.

289 The definition of PL (Table 3) as "motivation, confidence, physical competence,
290 understanding and knowledge to maintain physical activity at an individually appropriate level,
291 throughout life" (Whitehead, 2007: 282) has some similarities with what the Leximancer analysis
292 revealed as closely connected concepts - 'activity', 'competence', 'knowledge' and 'understanding'.

293 Although 'education' isn't described within the PL definition, the major educative purpose of
294 teachers is to design and enact contexts that deliver knowledge and understanding to students
295 (Furlong, Gilman and Huebner, 2009; Hyndman and Pill, 2016). From the text mining analysis
296 across the PL literature, other concepts strongly connected to the PL concept (yet absent from the
297 definition) included 'fitness', 'health', 'concept', 'role', 'curriculum' and 'assessment'. Perhaps in
298 order to develop motivation and confidence for individuals to be physically active and competent,
299 the educative concepts of 'curriculum' and 'assessment' could be included within the definition.
300 Without curriculum and assessment, levels of understanding, competence and knowledge will be
301 unable to be gauged appropriately. This ties in to existing criticisms in the literature that because PL
302 is not a competence it is difficult to assess, particularly in jurisdictions using common descriptions
303 of student outcomes or student achievement standards. Despite the increased emergence of indirect
304 methods for students to meet PE curriculum objectives (Hyndman, Mahony, Smith, Te Ava and
305 Nutton, 2016), there was an absence of connection between PL with concepts related to recess, after
306 school and specific physical activity facilities. Such a finding suggests that PL is viewed as a
307 concept that should be facilitated by teachers.

308 Despite PL being known as a 'lifespan' and 'motivation' concept from Whitehead's (2007)
309 widely used definition, the concept of life and motivation were much further down the list in level
310 of relevance. 'Life' was absent from the top 10 concepts connected with the PL concept from the
311 literature. The closely connected concept of 'health' could also be considered within the definition
312 as a widely established outcome of children engaging in physical activity at an appropriate level
313 throughout life (WHO, 2014). Themes identified from the text mining also included 'skills' and
314 'development' which are closely related to competence, which is a concept associated with
315 traditional understandings of PE as centrally concerned with developing movement competence.

316 The fundamental role of PE teachers as 'role models' was also identified. It was associated
317 with role modelling and developing youth through sport. The importance of developing 'children'
318 was noted as a theme, and emphasises this age group as assumed to be needing to be equipped with

319 the necessary physical skills to maintain physical activity engagement across the lifespan. The
320 strong level association between PL and the concept of ‘importance’ also exemplifies that the
321 authors of the papers included in the analysis view PL as a vital idea within the discipline of PE.

322 An emerging contentious issue around PL is whether substitution of PE for PL is necessary
323 for the pragmatics of the PE practitioner (Lounsbery and Mckenzie, 2015). When examining the
324 terms used for the definition of PE in 1986 by the National Association for Sport and Physical
325 Education (NASPE) (2004) include a physically ‘educated’ individual: (i) performs a variety of
326 physical activities, (ii) is physically fit, (iii) participates regularly in physical activity, (iv) knows
327 the implications and benefits from involvement in physical activities and; (v) values physical
328 activity and its contributions to a healthful lifestyle (NASPE, 2004). Key concepts that emerged
329 from the Leximancer analysis were similar to the NASPE (2004) PE definition that included
330 activity, health (i.e. ‘contributions to a healthy lifestyle’) and fitness (i.e. ‘physically fit’). Other
331 concepts from the top 30 connections to PL that are relevant to the definition included life (i.e.
332 ‘lifestyle’) and knowledge (‘know’). The concept ‘motivation’ can also be related to the definition
333 of PE as a catalyst to participate in physical activity regularly.

334 An emphasis on education or on the physical can lead to a different type of PE (Whitehead,
335 2001). Education in movement has long been the observed and lived reality of PE, whilst education
336 through movement reflects the educative dimension of PE (Whitehead, 2004). The figures and
337 tables within the paper demonstrate that PL is strongly associated with physical domains of
338 learning, yet there is a surprising absence of cognitive, social and emotional domains of learning
339 that are possible from PE. Such findings can relate to a way of educating through physical activity
340 with a core focus on valuing human growth, development and behaviour (Streit and McNeely,
341 1950). The influence of such ideas has continued to develop for decades (Arnold, 1979; Kirk, 1988)
342 and could be a key reason less concepts and themes were related to cognitive, social and emotional
343 domains from the text mining analysis.

344 The strong level association of ‘understanding’ with PL could be linked to ‘knowledge’

345 within the definition (i.e. 'knows the implications'). As reported previously (Lounsbery and
346 Mckenzie, 2016) and identified within this study, there are many overlaps between the concepts
347 associated with PL and PE (Lounsbery and Mckenzie, 2016). Interestingly, the most relevant
348 concept connected to PL was 'education', the very term that is commonly being replaced by
349 'literacy'. With PL based around motivation (Whitehead, 2010), confidence, competence and
350 physical activity throughout life, perhaps the main difference with PE is that 'education' is based
351 around the delivery of curricular content by utilising different pedagogy to develop the curriculum
352 intentions for students described in curriculum frameworks (for example, the Australian Curriculum
353 HPE, International Baccalaureate Physical Education, etc.). The substitution of PE in policy
354 documents for PL can therefore have little significance for the pragmatics of the PE practitioner in
355 many jurisdictions (Lounsbery and Mckenzie, 2015). To this end, there may be something in Sprake
356 and Walker's (2015) assertion that PL is neither an alternative to PE nor a PE pedagogical model,
357 simply a potential outcome of PE that has become an increasing part of the PE discourse. This is not
358 unlike Enright and MacDonald's suggestion that PL could be considered a general capability
359 emerging from a quality PE program. However, whether one uses the discourse of PL or PE, the
360 fact that PL is not taught suggests there is little difference to the content and pedagogical
361 orientations to practitioners delivering quality PE.

362 In the United States, PL has been referred to as a vital objective to increase children's
363 physical activity to improve population health. The Society of Health and Physical Educators
364 (SHAPE) America has been an early supporter of PL, including PL as part of the national standards
365 with a goal of developing 'physically literate individuals who have the knowledge, skills and
366 confidence to enjoy a lifetime of healthful physical activity' (SHAPE America, 2016). The top five
367 themes from the text mining analysis of the United States PL literature included 'physical',
368 'students', 'PE', 'skills' and 'concept'. In order to achieve goals of PL, sport and activity programs
369 are important to be developed within schools in order to develop children's health. Therefore, there
370 is little surprise the concepts of education, activity, school, sport and health are positioned within

371 the most relevant theme of 'physical' from the United States PL literature (100% theme relevance).
372 As the goal within the discipline of PE in the United States is to develop physically literate
373 individuals (SHAPE America, 2016), the concepts of physically literate and knowledge are to be
374 expected within the theme of 'PE'. The theme of 'students' consisted of concepts such as learning,
375 skills and practice which are facilitated by teachers (also a concept within the theme). The themes
376 of 'skills' and 'concept' were based around skills, development, movement, activities, modelling
377 and opportunities which are important areas to be developed to reach PL goals. Although PL is a
378 goal within United States PE, the core operation of schools is to 'educate' (Furlong, Gilman &
379 Huebner, 2009) and there does not appear to be a distinct need to use the term 'literacy' to reach
380 similar objectives of a physically educated individual (Lounsbery and Mckenzie, 2015; Penney and
381 Chandler, 2000). The educative purposes to develop learning, skills, practice and movement via
382 teaching appear to be just as relevant.

383 The United Kingdom is the source of the most widely used definition of PL. As noted
384 earlier, Whitehead's (2007) definition encompasses terms such as motivation, competence,
385 confidence, knowledge, understanding, movement with the goal of establishing lifelong
386 participation in physical activity. Similar to the United States text mining results, 'physical' was
387 again the most prominent theme revealed that included concepts of PL, activity, education, children,
388 development, skills and understanding. Children were also a major theme identified from the United
389 Kingdom PL literature with core concepts around development, skills, young, sport, health and
390 people. Research suggests that childhood is the foundation period for young people to establish
391 physical activity habits that can track across the lifespan and prevent the onset of disease (WHO,
392 2014). With children noted in the United Kingdom definition of PL, the importance of this age
393 group is reinforced with such relevance to PL. As 'knowledge' is part of the PL definition it is not
394 surprising that it was also a major theme from the UK literature. Yet within the theme of
395 knowledge, key educative concepts including teachers, learning, school, curriculum and PE were
396 identified. This suggests that such teaching and instructional aspects could be considered and made

397 more explicit within the most commonly used United Kingdom definition.

398 Within Canada, PL is a widely established initiative and is described as the foundation for
399 Canada's national health and sporting objectives. Canada's goals are age-specific with the aim of
400 ensuring each child is physically literate before reaching adolescence (Mandigo, 2009). Canada's
401 primary definition of PL has been described as "moving with competence and confidence in a wide
402 variety of physical activities in multiple environments that benefit the healthy development of the
403 whole person" (Mandigo et al., 2015: 5). The Canadian definition has similar terms to the primary
404 definition of PL used in the United Kingdom, yet has greater emphasis on 'variety' and the 'whole'
405 person. With an emphasis on variety, Canadian PE systems ensure there is a diverse system for
406 children to develop PL through recreation venues, sporting facilities and schools via holistic
407 delivery (ensuring multiple dimensions of health are addressed) (Mandigo et al., 2015). Similar to
408 the results of the other countries, it was revealed that the main themes from the text mining of the
409 Canadian PL literature were 'physical', 'students', 'knowledge', 'development' and 'skills'. The
410 main finding that emerged from the text mining was that within the major theme of 'physical',
411 concepts such as research, classroom and teachers were identified as being connected. This reflects
412 recent literature (Tremblay and Lloyd, 2010) that suggests that PL is much more of a core focus
413 within the Canadian education system.

414 Within other countries there is less consensus on a PL definition and no definition of PL has
415 been established in countries such as The Netherlands and Venezuela (Mandigo et al., 2015). Due
416 to the multiplicity of defining PL and related concepts, reference to PL has been left out of the
417 Australian HPE curriculum and there is a greater emphasis on health literacy within Australian
418 education (Macdonald and Enright, 2013). In an Australian context, PL has started to be defined as
419 "a concept capturing the ability to move effectively; the desire to move; the perceptual abilities that
420 support effective movement; the confidence and assurance to attempt movement challenges; and the
421 subsequent ability to interact effectively with their environment and other people" (Keegan,
422 Keegan, Daley, Ordway and Edwards, 2013: 1). Whereas in New Zealand, PL has been defined as

423 “fundamental skills such as running, jumping and throwing” (Almond, 2013: 37). Despite less
424 solidarity with the PL definition in other countries external to the United States, United Kingdom
425 and Canada, the text mining results were relatively similar. Themes such as ‘physical’, ‘movement’,
426 ‘sport’, ‘young’ and ‘students’ all possessed similar concepts to PL focused countries. Interestingly,
427 within the theme of ‘sport’ the concepts of study and research were identified which suggests that
428 this is a context in which PL could be further examined in these other countries.

429

430 **Conclusions**

431 As PL is described as a goal of PE programs in some countries, further understanding needs to be
432 generated as to how PL objectives can be aligned to achievement standards described in curriculum
433 documents. The figures and tables within the paper demonstrate that PL is strongly associated with
434 physical domains of learning, yet there is a surprising absence of cognitive, social and emotional
435 domains of learning that are possible from PE. This study fills an important gap in the literature by
436 displaying that while multiplicity of conceptions and themes attributed to PL exist in the literature,
437 PL in international studies appears to be conceptualised via a traditional understanding of PE. This
438 is emphasised by the relative silence in PL literature of the cognitive and affective domains of
439 learning. The study uniquely employed the application of Leximancer text mining software to
440 analyse this evolving, emerging and contentious concept. Further research is needed to explore
441 other key concepts within the field of PE by utilising text mining analysis. Future research could
442 explore how key pedagogical or curricular concepts and themes have evolved. Policy and
443 curriculum documents within the field of PE can also be analysed to explore the prevalence of key
444 concepts and themes, and to ensure certain topics haven’t been overlooked or overused.

445 There are many assumptions about PL and its educative role in the literature being
446 complicated by the substitution of PE for PL and the definitional blurring of the concept across
447 international contexts. The findings from the international text mining analysis revealed that the
448 concept of PL was used in connection with the concepts; education, activity, fitness, health,

449 competence, understanding, roles, curriculum and assessment. Interestingly, the concept with the
450 most relevance connected to PL was ‘education’, the very term that is commonly being replaced by
451 ‘literacy’. A number of concepts were identified from the text mining analysis that were not
452 explicitly mentioned within the definitions of PL; including educational components such as
453 curriculum, teaching and assessment. As definitions and concepts are constantly evolving, the
454 findings from the present study across 49 international papers suggest that the concept of PL can
455 create further conceptual and pedagogical confusion to the purpose of PE. There is a need for a
456 common PL definition and pedagogical clarity for PE practitioners. Presently, the concept of PL has
457 served as an oratorical function to draw attention to the field of PE. Yet PL seems to do little to
458 address conceptual, pedagogical and curriculum concerns to ensure a PE discipline possesses a
459 clear educative proposition.

460

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This individual moves with poise, economy and confidence in a wide variety of physically challenging situations. Furthermore, the individual is perceptive in 'reading' all aspects of the physical environment, anticipating movement needs or possibilities and responding appropriately to these, with intelligence and imagination.

Table 1. Whitehead's (2001: 131) preliminary description of physical literacy.

“Physical literacy can be described as the ability and motivation to capitalise on our motile potential to make a significant contribution to the quality of life. As humans we all exhibit this potential, however its specific expression will be particular to the culture in which we live and the motile capacities with which we are endowed.”

Table 2. Whitehead’s (2005: 5) definition of physical literacy.

Table 3. Whitehead's (2007: 282) definition and description of physical literacy.

Definition:

“Motivation, confidence, physical competence, understanding and knowledge to maintain physical activity at an individually appropriate level, throughout life.”

Description:

- *Physical literacy can be described as the ability and motivation to capitalise on our motile potential to make a significant contribution to the quality of life. As humans we all exhibit this potential; however, its specific expression will be particular to the culture in which we live and the motile capacities with which we are endowed;*
- *An individual who is physically literate moves with poise, economy and confidence in a wide variety of physically challenging situations. Furthermore, the individual is perceptive in ‘reading’ all aspects of the physical environment, anticipating movement needs or possibilities and responding appropriately to these, with intelligence and imagination;*
- *A physically literate individual has a well-established sense of self as embodied in the world. This, together with an articulate interaction with the environment, engenders positive self-esteem and self-confidence. Furthermore, sensitivity to and awareness of our embodied capacities leads to fluent self-expression through non-verbal communication, and to perceptive and empathetic interaction with others; and*
- *In addition, the individual has the ability to identify and articulate the essential qualities that influence the effectiveness of his/her own movement performance, and has an understanding of the principles of embodied health, with respect to basic aspects such as exercise, sleep and nutrition.*

Table 4. Whitehead's (2013: 29) definition and attributes of physical literacy.

Definition:

“A disposition to capitalize on our human embodied capability, wherein the individual has the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for maintaining purposeful physical pursuits/activities throughout the lifecourse.”

Attributes:

- *The motivation and confidence to capitalise on innate movement/physical potential to make a significant contribution to the quality of life. All humans exhibit this potential, however its specific expression depends on individual endowment in relation to all capabilities, significantly movement potential, and is particular to the cultural context;*
- *Movement with poise, economy and confidence in a wide variety of physically challenging situations;*
- *Sensitive perception in ‘reading’ all aspects of the physical environment, anticipating movement needs or possibilities and responding appropriately to these, with intelligence and imagination;*
- *A well-established sense of self as embodied in the world. This together with an articulate interaction with the environment, engenders positive self-esteem and self-confidence;*
- *Sensitivity to and awareness of embodied capability, leading to fluent self-expression through non-verbal communication and to perceptive and empathetic interaction with others; and*
- *The ability to identify and articulate the essential qualities that influence the effectiveness of movement performance, and an understanding of the principles of embodied health, with respect to fundamental aspects such as exercise, sleep and nutrition.*

Table 5. The international physical literacy literature according to topic, format, country and year.

Study	Title/Topic	Type	Location
Whitehead (2001)	The concept of physical literacy	Peer reviewed journal article	United Kingdom
Daggett (2001)	Physical education and physical literacy	Peer reviewed journal article	United Kingdom
Haydn-Davies (2005)	How does the concept of physical literacy affect what is and might be the practice	Peer reviewed journal article	United Kingdom
Mancuso (2006)	Bodies in the classroom: Integrating physical literacy	Discussion research paper, peer reviewed journal article	United States
Whitehead (2007)	Physical literacy: Philosophical considerations in relation to developing a sense of self, universality and propositional knowledge	Peer reviewed journal article	United Kingdom
Mandigo (2007)	Physical literacy concept paper. Ages 0-12 years old	Government report	Canada
Delaney (2008)	Improving physical literacy	Government report	United Kingdom (Northern Ireland)
Mandigo (2009)	Physical literacy for educators	Peer reviewed journal article	Canada
Sheehan and Kats (2010)	Using interactive fitness and exergames to develop physical literacy	Peer reviewed journal article	Canada
Daggett (2010)	Physical education and literacy — The odd couple or a match made in heaven?	Peer reviewed journal article	United Kingdom
Tremblay and Lloyd (2010)	Physical literacy measurement- The missing piece	Peer reviewed journal article	Canada
Higgs (2010)	Physical literacy- two approaches, one concept	Peer reviewed journal article	Canada
Hardman (2011)	Physical education, movement and physical literacy in the 21st century: Pupils' competencies, attitudes and behaviours	Peer reviewed conference paper (review)	United Kingdom

Table 5 (Continued)

Study	Title/Topic	Type	Location
Stanec and Murray-Orr (2011)	Elementary generalists' perceptions of integrating physical literacy into their classrooms and collaborating with physical education specialists	Peer reviewed journal article	Canada
Coates (2011)	Physically fit or physically literate? How children with special educational needs understand physical education	Peer reviewed journal article	United Kingdom
Delaney and Rainer (2012)	Physical activity and physical literacy	Discussion research conference paper	United Kingdom
Alagul, Gursel and Keske (2012)	Dance unit with Physical Literacy	Peer reviewed journal article	Turkey
Ragoonaden, Cherkowski and Berg (2012)	New directions in daily physical activity: integral education, yoga and physical literacy	Peer reviewed journal article	Canada
Corlett and Mandigo (2013)	A day in the life: teaching physical literacy	Discussion research paper, peer reviewed journal article	Canada
McCaffery and Singleton (2013)	Why are we doing this anyway? Physical literacy, monism, and perceived physical competence for Ontario's elementary students	Peer reviewed journal article	Canada
Barrett and Winters (2013)	Dancing towards physical literacy from stage right to stage left	Peer reviewed journal article	Canada
Patriksson and Persson (2013)	Physical literacy among inactive Swedish young people	Research thesis	Sweden
McKean (2013)	Physical literacy in children—the underpinning movement competencies?	Peer reviewed journal article	Australia
Macdonald and Enright (2013)	Physical literacy and the Australian health and physical education curriculum	Peer reviewed journal article	Australia
ICSSPE Bulletin on 'Physical Literacy' (2013)*	Physical literacy*	Journal special issue*	United Kingdom
Roetert and Jefferies (2014)	Embracing physical literacy	Peer reviewed journal article	United States

Table 5 (continued)

Study	Title/Topic	Type	Location
Ejedafiru (2014)	Harnessing information and physical literacy's skills for physical fitness of special children in Nigeria	Peer reviewed journal article	Nigeria
Castelli, Centeio, Beighle, Carson and Nicksic (2014)	Physical literacy and comprehensive school physical activity programs	Peer reviewed journal article	United States
Giblin, Collins and Button (2014)	Physical literacy: importance, assessment and future directions	Peer reviewed journal article	Switzerland
Ladda (2014)	Physical literacy is a social justice issue!	Peer reviewed journal article	United States
Almond (2014)	Serious flaws in an FMS interpretation of physical literacy	Conference paper	United Kingdom
Dudley (2015)	A conceptual model of observed physical literacy	Discussion Research Paper, Peer Reviewed Journal Article	Australia
Castelli, Barcelona and Bryant (2015)	Contextualising physical literacy in the school environment: the challenges	Peer Reviewed Journal Article	United States
Chen (2015)	Operationalising physical literacy for learners: embodying the motivation to move	Peer Reviewed Journal Article (Review)	United States
Mandigo, Francis and Lodewyk (2015)	Physical literacy: a global environment scan	Government Report	Multiple Countries (Canada, United Kingdom, Australia, New Zealand, Netherlands, Venezuela, United States)
Ennis (2015)	Knowledge, transfer, and innovation in physical literacy curricula	Peer Reviewed Journal Article	United States
Hatie and Wallhead (2015)	Operationalising physical literacy through sport education	Peer Reviewed Journal Article	United States
Lundvall (2015)	Physical literacy in the field of physical education. A challenge and a possibility	Peer Reviewed Journal Article	Sweden

Table 5 (continued)

Study	Title/Topic	Type	Location
O'Brien, Belton and Issartel (2015)	Promoting physical literacy in Irish adolescent youth: The youth-physical activity towards health (Y-PATH) Intervention	Peer Reviewed Journal Article	Ireland
Silverman and Mercier (2015)	Teaching for physical literacy: implications to instructional design and PETE	Peer Reviewed Journal Article (Review)	United States
Sun (2015)	Operationalising physical literacy: the potential of active video games	Peer Reviewed Journal Article	United States
Longmuir, Boyer, Lloyd, Yang, Boiarskaia, Zhu and Tremblay (2015)	The Canadian assessment of physical literacy: methods for children in grades 4 to 6 (8 to 12 years)	Peer Reviewed Journal Article	Canada
Mateus, Santos, Vaz, Gomes and Leite (2015)	The effect of a physical literacy and differential learning program in motor, technical and tactical basketball skills	Peer Reviewed Journal Article	Portugal
Roetart and McDonald (2015)	Unpacking the physical literacy concept for K-12 physical education: what should we expect the learner to master?	Peer Reviewed Journal Article	United States
Jurbala (2015)	What is physical literacy, really?	Peer Reviewed Journal Article	Canada
Lounsbery and McKenzie (2015)	Physically literate and physically educated: A rose by another name?	Peer Reviewed Journal Article	United States
Corbin (2016)	Implications of physical literacy for research and practice: A commentary	Peer Reviewed Journal Article	United States
Longmuir and Tremblay (2016)	Top 10 research questions related to physical literacy	Peer Reviewed Journal Article	Canada
George, Rohr and Byrne (2016)	Impact of Nintendo Wii games on physical literacy in children: motor skills, physical fitness, activity behaviours, and knowledge	Peer Reviewed Journal Article	Canada

* The journal special edition from United Kingdom authors were counted as the one document.

Concept	Absolute count	Relative count (%)
Physical	6150	91
Literacy	5966	90
Education	1515	87
Activity	2105	72
Fitness	270	72
Health	491	71
Concept	400	70
Competence	331	70
Understanding	392	69
Role	187	69
Curriculum	253	67
Assessment	187	65
Provide	253	65
Motivation	187	64
Important	201	64
Life	383	64
Active	285	62
Need	307	61
Potential	345	61
Knowledge	271	61
Support	182	61
People	403	61
School	204	60
Social	305	60
Young	993	60
Approach	220	58
Development	348	58
Teachers	197	58
Model	1272	58
Human	694	58

Table 6. The closest conceptual connections with the ‘physical literacy’ concept across the international literature.

Table 7. A comparison of themes and concepts from the text mining analysis across countries.

Canada (N= 14 papers)			United Kingdom (N= 11 papers)			United States (N=13 papers)			Other countries (N= 11 papers)		
Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme
Physical	100	Physical, literacy, physical literacy, activity, education, research, classroom, teachers	Physical	100	Physical, physical literacy, activity, literacy, education, children, development, skills, understanding	Physical	100	Physical, physical literacy, literacy, education, activity, school, sport, health	Physical	100	Physical, physical literacy, literacy, activity, education, development
Students	21	Students, physically, physically literate, experiences, practice, participants	Children	28	Children, development, skills, young, sport, health, people	Students	20	Students, learning, teachers, skills, practice	Movement	26	Movement, skills, learning, children, motor, skill, fundamental
Knowledge	20	Knowledge, understanding, competence, model life, individual	Teachers	20	Teachers, learning, school, PE, students, curriculum, time	PE	18	PE, physically, physically literate, knowledge	Sport	22	Sport, physically literate, activities, PA, study, research
Development	20	Development, children, movement, motor	Movement	15	Movement, life, develop, individual, experience, role	Skills	13	Skills, development	Young	11	young, people, sports
Skills	18	Skills, activities	Concept	6	Concept	Children	12	Children, movement, activities, model	Students	7	Students

Table 7 (continued)

Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme	Theme*	Connection to the PL literature (%)	Automated concepts within theme
Important	10	Important, games, age, sport, CAPL	Embodied	5	Embodied	Active	10	Active, provide, fitness	Time	6	Time
Games	6	Games	Research	4	Research	Schools	7	Schools	Use	2	Use
Age	6	Age	Motor	4	Motor	Standards	4	Standards	Example	1	Example
Sport	5	Sport	Study	2	Study	Research	4	Research	Youth	1	Youth
CAPL	5	CAPL	Content	1	Content	Social	1	Social	-	-	-

* Themes and concepts are automated from the Leximancer text mining software according to the level of relationship between concepts and the rate at which concepts and the significantly related terms appear close to each other within the text.