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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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Introduction

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

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

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

The concept of physical literacy within physical education

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

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

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

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

- The physically literate individual will interact with sensitivity and ease with others in group situations, appreciating the expressive quality of movement in her/himself and in 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 concepts such as exercise, sleep and nutrition.

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

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

----------Insert Table 2 about here----------

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

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

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

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

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

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

Methods

Leximancer text mining analysis software

Researchers have implemented the use of Computer Assisted Qualitative Data Analysis Software (CAQDAS) to systematically, efficiently and logically enhance the research and analysis processes for some time (Crofts and Bisman, 2010). Leximancer is one such CAQDAS that can be used to 'text mine' the content of substantial documents as a lexicographic tool that can visually display the selected information. Leximancer processes textual documents by determining the 'contextual collocations of words through 'term-occurrence information, such as co-occurrence, positions and frequencies of nouns and verbs' (Kamimaeda et al., 2007). The advantage of Leximancer is that it extracts a populated list from the text document that displays the weighted term classifications and connections between key words. From this list it creates concept maps that illustrate the level of connections between key words in the text being analysed (Crofts and Bisman, 2010). In other words, the software processes 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 (Crofts and Bisman, 2010). How the Leximancer software processes text documents into words, concepts and themes is demonstrated in Figure one.

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

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

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

Selection of the physical literacy-based literature

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

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

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

Content analysis

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

PL across the international PL literature.

Results

Text mining analysis across the international PL literature

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

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

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

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

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

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

Text mining analysis across the country-specific physical literacy literature

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

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

‘skills’ (skills and development) (Table 7).

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

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

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

Discussion

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

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

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

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

The fundamental role of PE teachers as ‘role models’ was also identified. It was associated with role modelling and developing youth through sport. The importance of developing ‘children’ 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

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

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

more explicit within the most commonly used United Kingdom definition.

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

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

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

Conclusions

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

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

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

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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, physically, 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.*