Australian Journal of Teacher Education

Volume 44 | Issue 6 Article 4

2019

Developing Children's Physical Literacy: How well prepared are prospective teachers?

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Abstract: While the known health impacts of sedentary lifestyles have focused attention on children's outdoor activity, the development of their physical literacy – the physiological, social, cultural, cognitive, expressive, and psychological dimensions of their physicality – is much less in focus.
Developing children's physical literacy is embedded in the Early Years Learning Framework and Primary curriculum: Health and Physical Education, and the performing arts subjects within The Arts. This study asks "How well prepared are pre-service teachers to implement a program that contributes to developing children's physical literacy?"
This mixed methods study includes an environmental scan of BEd courses at 12 Australian universities; and at one university, a content analysis of units, a review of 227 students' practicum records, and an online survey of 57 pre-service teachers.
The study finds that pre-service teachers are generally well-informed, committed and confident but have limited diagnostic and practical pedagogical skills to effectively develop children's physical literacy.

Background

In Australia there is a notable and general concern about sedentary lifestyles and the associated long-term health implications. Estimates put the cost of physical inactivity to the Australian economy at over $13billion annually, made up from healthcare costs, lost productivity and premature mortality (Keegan, R. J., Keegan, S. L., Daley, S., Ordway, C. & Edwards, A. (n.d.)). Consequently, there are many calls for children to be engaged in physical activity. This is usually constructed in terms of playing outside and playing sport. A cursory review of the research literature and grant funding confirms the cultural tendency to conflate activity and movement with sport and athleticism – and to value these within a health paradigm. Attention to developing physical literacy across a broad range of pursuits is not readily apparent, yet it is this concept that frames the educational goals of physical activity within the curriculum.

In the Australian Curriculum there are two learning areas where physical literacy is a focus: Health and Physical Education and The Arts, in the form of the performing arts subjects of dance, drama and music. There is a mandated curriculum in all Primary school years for both these learning areas. For years birth to age eight, the Early Years Learning Framework (EYLF), refers to physical wellbeing, which involves movement and play, as part of its outcome of developing children's sense of wellbeing. (Belonging, Being and Becoming: The Early Years Learning Framework for Australia, [EYLF], 2009).

While the term "physical literacy" is not explicitly used in these documents, the physical literacy paradigm underpins the reimagining of educational goals; explicitly reframes the Health and Physical Education curriculum; and implicates the performing arts curriculum.

"Literacy" in the contemporary context is understood to mean being knowledgeable and able to construct, represent and communicate meaning in a variety of contexts using the conventions and symbol systems of a particular field or subject (Dinham, 2017, p.27). Hence, terms like "maths literacy", "science literacy", "visual literacy" and "physical literacy" have entered the lexicon, with these types of literacies being seen as the *goals* of education.

Since physical literacy is a relatively new educational paradigm, and since it generally falls to generalist teachers in early childhood and primary to implement the whole curriculum, this research study was undertaken to examine how well pre-service early childhood and primary teachers were prepared, confident and capable of developing children's physical literacy in educational settings.

Physical Literacy

The term physical literacy, originally proposed by Margaret Whitehead (2001), has been in circulation for nearly two decades. Whitehead's conceptualisation initially focused on the individual's capacity to move with poise, economy and confidence in a wide variety of physically challenging situations, and to anticipate movement needs by perceptively 'reading' the physical environment. However, over the intervening years, the scholarly discourse has drawn attention to the sociological, psychological and cultural dimensions of physical literacy (Haydn-Davies, 2005; Penney & Chandler, 2000; Wright & Burrows, 2006). This led Whitehead herself to revise the original definition and to also incorporate Morrison's earlier categorization of movement as expressive, utilitarian and objective (cited in Wall & Murray, 1994).

Whitehead's expanded definition (2007, 2013) of a physically literate person has the following dimensions, as described in Mandigo, Francis, Lodewyk and Lopez (2012):

i. the ability to move with poise, grace, economy of movement, and confidence in a wide range of physically challenging situations;
ii. the ability to read the situation, predict and/or anticipate what is likely to happen next as the situation unfolds, and then be able to react through movement in an appropriate manner in a wide range of physically challenging situations;
iii. the knowledge, skills, attitude, and motivation to fully use their capacity and potential for movement;
iv. the physical skills based on the limits to their movement potential or their ability or physical disability that are appropriate to their local culture;
v. a well-established sense of their physical self: they feel 'at home' in their body, and comfortable with their physicality;
vi. a high level of self-confidence and self-esteem that comes from confidence in their body and its abilities.

Physical literacy is seen as an essential life skill for active participation in society (Roetert & Jeffries, 2014, p.39) and hence, has to be seen as a critical factor in developing the whole child in educational settings (Roetert & Couturier MacDonald, 2015, p.109).

Physical Literacy in the Curriculum Context

The momentum for physical literacy has come primarily from within the field of physical education (Delaney, Donnelly, News, & Haughey, 2008). Whitehead (2007) and others clarify that physical literacy is not the same as physical education and nor does it replace it. Instead physical literacy is the *goal* of the physical education curriculum. This goal provides a sound philosophical basis and unifying research and development platform for an inclusive physical education curriculum model aimed at developing each child's physicality and adoption of an active lifestyle over the lifespan.

The beliefs underpinning the goal of developing children's physical literacy in educational settings are that

(1) physical literacy does not develop of its own accord through everyday activity – much like language literacy or numeracy does not develop significantly without intentional and purposeful programs of education;
(2) the habits, practices and disposition for being physically literate are established in childhood;
(3) the benefits of being physically literate will continue to accrue throughout life and in a variety of contexts; and
(4) developing physical literacy promotes health and wellbeing.

In a global environmental scan Spengler (2014) identifies ten countries where the term physical literacy is used explicitly or implicitly, including the UK, Canada, China, some European and African countries, and the USA where physical literacy has been adopted for the latest iteration of the National Standards and Grade Level Outcomes for K-12 Physical Education (Society of Health and Physical Educators, 2014).

References to physical literacy in curriculum documents are made in the context of the physical education curriculum, where its role in maintaining health is consistently foregrounded. However, for embodied human beings living in a spatial environment, physical literacy is a fundamental capability that extends beyond the health paradigm and intersects all aspects of living, constructing meaning and functioning successfully in the world.

In the school curriculum, another major area where physical literacy is addressed is the performing arts through Dance, Drama and Music. In these subjects, the embodied exploration and expression of ideas and meaning-making - with particular attention to creative, imaginative, affective and expressive dimensions of the moving body - is given attention. In Dance, the body is the instrument of meaning-making - of exploration, expression and communication. In Drama, gesture, posture, expression, and positioning in space, and in relation to others, are integral. In Music, the voice is regarded as the first musical instrument and singing requires stamina, precision, and control of breath and articulator muscles. Playing other musical instruments requires fine motor control, timing and good hand-eye co-ordination.

Both physical education and the performing arts offer unique opportunities for children to develop their physical literacy through planned, purposeful and sequential learning experiences.

Physical Literacy in the Australian Educational Context

The term physical literacy is not explicitly used in the Australian Curriculum, though the Health and Physical Education (H&PE) curriculum is built on the concept; and reflects the recommendations in a report, *Getting Australia Moving: Establishing a Physically Literate and Active Nation* (Keegan, et al (n.d.), to shift the focus from sports activity alone

by recognising that "movement proficiency, motivation to move, and appreciation of the value of moving - is a more inclusive and holistic approach [to physical education]" (n.d., p.17). Within a wellbeing frame, the Introduction to the H&PE curriculum proclaims that "the acquisition of movement skills, concepts and strategies that enable students to participate in a range of physical activities confidently and competently" develops students' "knowledge, understanding and skills to support them to be resilient, to develop a strong sense of self, to build and maintain satisfying relationships, to make health-enhancing decisions in relation to their health and physical activity participation, and to develop health literacy competencies in order to enhance their own and others' health and wellbeing" (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2014).While this implies that physical literacy is the goal of the Australian Curriculum H&PE curriculum, the NSW Department of Education has been explicit in stating this and, as of 2017, has articulated a Physical Literacy Continuum (https://education.nsw.gov.au/teaching-and-learning/curriculum/key-learning-areas/pdhpe/physical-literacy/physical-literacy-continuum).

In the Australian Curriculum, the performing arts subjects of Dance, Drama and Music are positioned within The Arts Learning Area. (In the UK, Dance is part of the Physical Education curriculum). Again, physical literacy is not the expressed *goal* of performing arts education but attention to physical poise and the creative, cultural, cognitive and expressive aspects of an individual's physicality are an integral and vital part of education in the area. In the Dance curriculum for example, it states, "students use the body to communicate and express meaning through purposeful movement" (ACARA, 2014, The Arts, Structure). The curriculum documents advise that the program of learning involves children in

- developing body awareness with attention to different body parts, body zones and bases;
- utilising the dance elements of space, directions, time, dynamics and relationships to create movements;
- developing competence, body control and accuracy using fundamental movement and technical skills;
- exploring form, meaning and interpretation as they make and respond to dance;
- using expressive skills including projection and focus when performing dance for themselves and others.

These are all dimensions of physical literacy.

In the Early Years Learning Framework, the importance of physical literacy for functioning in the world is central to the ethos of whole child development through play-based learning. This is expressed as "attention to fine and gross motor skills provide children with the foundations for their growing independence and satisfaction in being able to do things for themselves" (EYLF, 2009, p. 30). Outcome three of the document goes on to explain that children's physical wellbeing and development is evidenced by their capacity to

- engage in increasingly complex sensory motor skills and movement patterns;
- combine gross and fine motor movement and balance to achieve increasingly complex patterns of activity including dance, creative movement and drama;
- use their sensory capabilities and dispositions with increasing integration, skill and purpose to explore and respond to their world;
- demonstrate spatial awareness and orient themselves, moving around and through their environments confidently and safely;
- manipulate equipment and manage tools with increasing competence and skill;
- respond through movement to traditional and contemporary music, dance and storytelling;

- show an increasing awareness of healthy lifestyles and good nutrition;
- show increasing independence and competence in personal hygiene, care and safety for themselves and others;
- show enthusiasm for participating in physical play and negotiate play spaces to ensure the safety and wellbeing of themselves and others (EYLF, 2009, p. 32).

All these qualities are foundational to the concept of physical literacy.

Research about physical literacy goals in the context of Australian education is limited due to the implicit rather than explicit endorsement of the paradigm, and the recency of its introduction as an educational goal. Instead, related studies are mostly found in the context of the H&PE curriculum area or young children's general physical activity.

Studies coalesce around the relationship between children's physical activity and health (Hills, Dengel, & Lubans, 2015); the degree to which Fundamental Movement Skills are acquired by children (Hardy, Reinten-Reynolds, Espinel, Zask, & Okely, 2012); and the quality of the enacted health and physical education curriculum (Trudeau & Shephard, 2008).

A persistent concern is the distinction between incidental or general physical activity which, in a health paradigm can be seen as sufficient if health outcomes are achieved – and a structured physical education program that forms part of children's formal education and development of their physical literacy. Research suggests that many classroom teachers don't value physical education as an integral part of the formal curriculum – or equate it to the school's organised sport program (Clarke, 2000; Medland & Taggart, 1993). A New Zealand study, found teachers' professed valuing of physical education was not reflected in their practices (Gordon, Dyson, Cowan, McKenzie & Shulruf, 2016).

Fundamental Movement Skills (FMS) are the "foundation movement or precursor patterns to more complex skills in games, sports, dance, gymnastics and physical recreation activities" (ACARA, 2014, Health and Physical Education, Glossary). The development of these skills, which are grouped into body management, locomotion and object control, is an explicit focus in the early years through to Year 2 of the Australian Curriculum (Hands, 2012, p.12). FMS competency: is considered a reliable measure of children's movement capabilities; is strongly predictive of physical activity and cardio-respiratory fitness in children and adolescents (Lubans, Morgan, Cliff, Barnett & Okely, 2010); and plays a role in children's physical, social, emotional and health outcomes (Hands, 2012, p.11). Studies of Australian primary school children over an extended period indicate that mastery of these skills is low (Hardy, King, Farrell, Macniven & Howlett, 2010; Hardy, King, Espinel, Cosgrove, & Bauman, 2011; Hardy, Reinten-Reynolds, Espinel, Zask, & Okely, 2012; Okely & Booth, 2004; van Beurden, Zask, Barnett & Dietrich, 2002). In a systematic review, Lander, Eather, Morgan, & Salmon (2017, p. 135) highlight the teacher's role in ensuring the success of interventions to improve FMS, while noting that research into teacher training in FMS interventions has received little attention.

Teachers' willingness, capability and opportunity to provide good quality physical education is determined by a mix of factors with systemic barriers being identified as contributing to low confidence, competence and interest (Lynch & Soukup, 2017; Morgan & Hansen, 2008). The inadequate preparation and physical education qualifications of teachers has been identified as a significant factor (Hills, Dengel, & Lubans, 2015). Other studies focus on the impact of teachers' own primary school experience on their confidence to teach physical education, and the degree to which this overrides their reception of physical education pedagogy presented in their teacher education course (Morgan & Bourke, 2005, 2008). In a large study of primary school physical education in New Zealand, teachers' perceptions of physical education in light of the new philosophical and conceptual framework, workloads and increasing outsourcing of physical education, were examined (Gordon, Dyson, Cowan, McKenzie & Shulruf, 2016). The study found the situation is

schools was variable, and while some teachers were successfully embracing the new frameworks others were not. The under-resourcing and lack of support when compared to other areas of the curriculum (literacy and numeracy), along with the increased outsourcing to external providers, were seen as contributing factors. The observation that that outsourced programs were not being evaluated in terms of pedagogy and assessment of learning, reinforced perceptions that children's physical education was undervalued (Petrie & Hunter, 2011).

The connection between physical literacy and performing arts is not well researched – even though Dance is integrated into the Physical Education program in the United Kingdom. In the context of the Canadian curriculum, Barrett & Winters (2013) make a case for envisioning the arts subject of Dance as a significant avenue for developing children's physical literacy *in conjunction* with the physical education curriculum; while others such as Bajek, Richards, & Ressler (2015) advocated *incorporating* dance in the USA physical education curriculum for this purpose.

The Research Study: Teacher Preparation for Developing Children's Physical Literacy

This study contributes to the field by examining generalists pre-service teachers' preparation and confidence to educate young children for the purposes of developing their physical literacy. The study asks, *How well prepared are pre-service teachers to implement a program of learning experiences that contributes to children's development of physical literacy?* Answering this involves considerations such as the nature and extent of relevant units in the pre-service course, the amount of practical experience obtained by pre-service teachers, their own lifestyle choices, beliefs and experiences, as well as their theoretical and pedagogical abilities - including their diagnostic abilities. It also embraces the performing arts subjects as having a role in the development of physical literacy. A mixed methods research design was devised and the necessary Research Ethics certification (DINHAJ-HU02599) obtained for the project.

Research Method

With refernce to Bachelor of Education courses for Early Childhood and Primary, data were gathered through an environmental scan of courses in 12 Australian universities; and at one university, a content analysis of relevant units; a review of students' teacher practicum records (n = 227); and an online survey of 57 pre-service teachers from B Ed Early Childhood (n = 15) and B Ed Primary (n = 42) courses.

The environmental scan of the course offerings at 12 Australian universities was conducted to obtain a 'helicopter view' of physical literacy contributing subjects in the B Ed course structure. This scan of course units determined the prominence of physical literacy-related units. Information gleaned was used as a frame for describing and making inferences about the characteristics of the message conveyed by the unit description (McKeone, 1995).

A content analysis of the unit outline, unit goals, weekly objectives and weekly activities of the Physical Education unit and the Performing Arts unit in the B Ed (Primary) and B Ed (Early Childhood) at one university was carried out. This was undertaken to identify the dominant messages and subject matter about physical literacy within the relevant units.

An online survey of pre-service teachers in the B Ed Primary and B Ed Early Childhood at one university gathered data about the population's characteristics, self-reported capabilities, behaviours, and attitudes, and teaching confidence. It also looked at the demonstration of knowledge about educational expectations and the typical teaching interventions that would be required in particular situations. The survey was a combination of 54 multiple choice and open-ended questions structured around the different dimensions of physical literacy as expressed in the Whitehead description (2007, 2013).

Fifty of the survey questions were multiple-choice using varied Likert scales that generated quantifiable data. Questions related to both personal engagement and teaching application. They covered actual physical or movement capabilities, personal behaviours, practices, attitudes, and confidence.

Questions about background included questions related to Indigeneity and past or current experience of living in regional, rural and remote locations where a more physically active lifestyle might be expected because of the different nature of work and recreation in these areas. The significance of culture or changed physical circumstances in relation to participants' own physical movement and engagement led to the use of multiple choice options for some questions that included: "I used to do this or was able to do this", and "This would be culturally inappropriate for me to do".

Additionally, there were seven open-ended questions presenting scenarios about children and physical movement. These related to teaching Fundamental Movement Skills (FMS) which are a key feature of early physical education and involve intentional teaching. The purpose of these questions was to determine the participants' ability to put theory into practice by interpreting a scenario; and/or identifying the type of learning experience; and/or diagnosing a need; and/or an intervention prompted by the scenario.

A Cronbach's Alpha test of the survey was conducted, and the resulting score was .797. The test showed that the survey reliably measured what it was intended to measure, and that the survey could be used by others with little or no modification. In the analysis of the responses, deductive coding was used to process the qualitative questions using Whitehead's principles of physical literacy (Neuendorf, 2002).

Finally, supervisors' evaluations of lessons undertaken by 2nd and 3rd year students on teaching practicum (n= 227) over two years were reviewed to identify instances where physical education or performing arts has been the focus.

Findings

Environmental Scan

The scan of 12 School of Education websites across Australia revealed that ten of these had one Health and Physical Education unit and one Arts Education unit where physical literacy development was integral – or evident in some parts of the unit. Two of the universities had two Health and Physical Education units and one Arts Education unit. Any difference in the amount of attention to areas of the curriculum where physical literacy is primarily developed was minimal. Based on this, we can reasonably say that across the 12 universities, intentional attention to physical literacy occurs for less than 6% of the initial teacher education course.

Unit Content Analysis

For the specific units analysed, the unit content description of Health and Physical Education suggests that the utilitarian aspect of motor development, skill acquisition,

movement skills, components of fitness, spatial awareness and games-based teaching models are in focus. Objectives specifically articulating or addressing the idea of physical literacy were not recorded. When drilling down to the weekly/topic content it was found that physical literacy is mentioned in approximately 5% of these, so the paradigm may well underpin the way the content is presented. Even when physical literacy is not the acknowledged goal, the contributory nature of any physical education content to this goal is still relevant.

The unit content description of arts units suggests that developing fundamental understandings about the elements of the performing arts (dance, drama, and music) and implementing the curriculum are in focus. No direct reference to physical literacy is made at the unit description or weekly topic levels, though the consistent references to developing dance, drama and music literacy implies the necessary development of physical literacy.

Survey

In the analysis of the survey, responses to questions were sorted into six groupings and clustered into two categories (Table 1).

Personal attributes Personal Physical Literacy (PPL).	Actual physical literacy capability (APC),
	Physical literacy behaviours (PLB)
	Physical literacy attitudes (PLA).
Teaching attributes Organisational Physical Literacy (OPL).	Teaching mindset and understanding of physical literacy development for children (SM)
	Personal teaching confidence (PTC)
	Teaching skills for physical literacy (PLT)

Table 1: Physical Literacy Categories and Groups

A Total Physical Literacy (TPL) score was calculated by combining the total scores of students' Personal Physical Literacy (PPL) and the students' Organisational Physical Literacy (OPL) (Table 2).

	APC	**PLB**	**PLA**	**SM**	**PTC**	**PLT**
Ave	2.55	3.11	3.96	3.57	3.77	2.18
SD	0.40	0.42	0.59	0.46	0.46	0.95

APC – Actual Physical Capability; PLB – Physical Literacy Behaviours; PLA – Physical Literacy Attitudes; SM - School Mindsets; PTC - Personal Teaching Confidence; PLT – Physical Literacy Teaching; PPL – Personal Physical Literacy; OPL – Organisational Physical Literacy; TPL – Total Physical Literacy

Table 2: Physical Literacy Averages

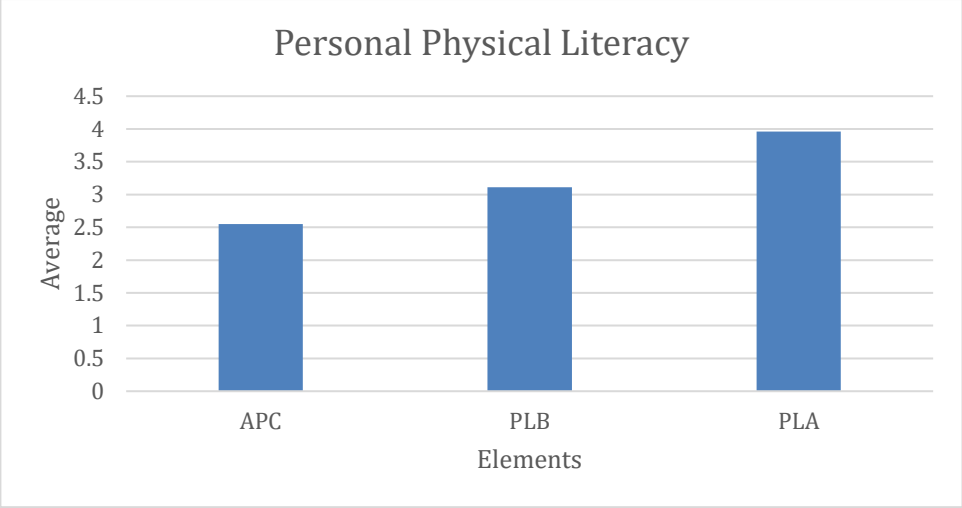

Figure 1: Personal Physical Literacy Averages

While the participants demonstrated a positive attitude to physical literacy, their actual physical capability was much lower.

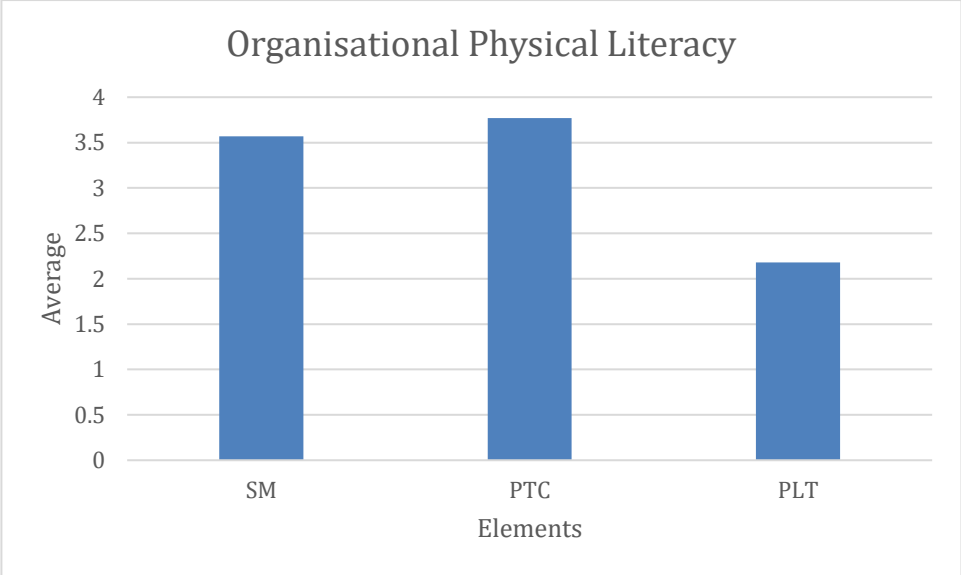

Figure 2: Organisational Physical Literacy Averages

The data showed that the participants' capacity to interpret or respond to a range of teaching scenarios was not well developed.

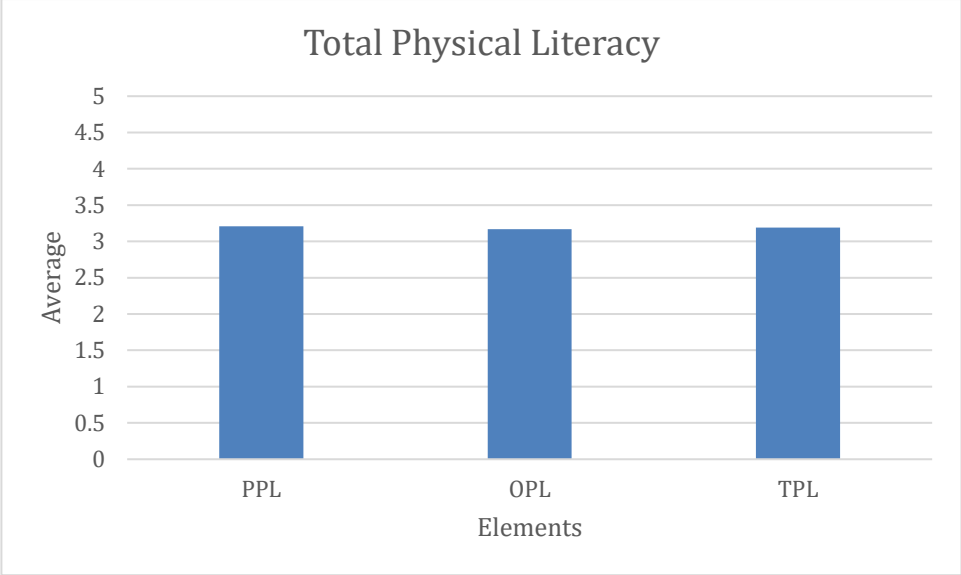

Figure 3: Element and Total Averages

The Total Physical Literacy average was 3.19. As this is the first time this survey has been conducted, the score itself is only indicative. The data reveal that respondents' strongest areas are their attitude towards physical literacy (PLA), their confidence to teach (PTC) and their knowledge about physical literacy and pedagogical principles (SM).

Respondents enrolled in Early Childhood course showed a higher valuing of physical literacy (PLA) than those in the B Ed Primary; and those who have completed all their physical literacy-related units showing higher attitudinal scores overall. Respondents' general confidence (PTC) and knowledge about teaching (SM) in subjects where physical literacy was being developed was sound.

The weakest areas were participants' reports of their own physical capabilities (APC) and their capacity to interpret or respond to a range of teaching scenarios (PLT). In terms of respondents' own physical capabilities, the low score was consistent across age groups, course (Early Childhood or Primary), location (rural/city upbringing or current location), and whether they had already completed all course units related to physical literacy or not. The poor outcome for questions related to responding to teaching scenarios (PLT) persisted with respondents who had completed all their physical literacy related units. Notably the on-campus group was weaker than the online group.

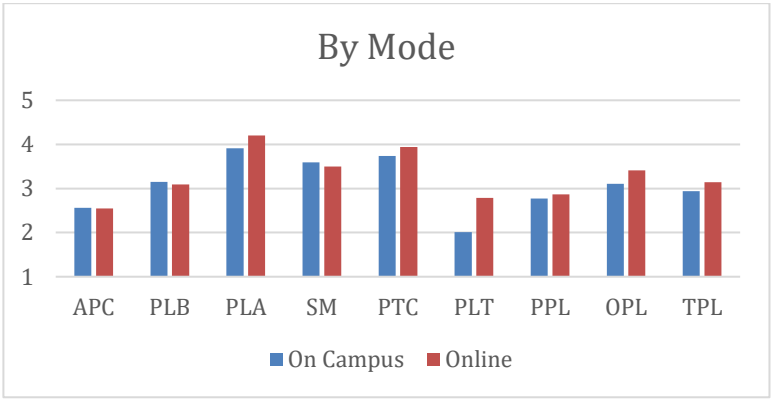

Figure 4: Responses by mode of education (on-campus or online)

When viewed by age, there was little difference in personal physical capability (APC). The 30-39 age group was weakest in terms of attitudes (PLA). The 40+ age group

was weakest in terms of understanding of knowledge about teaching (SM) while at the same time scoring better in terms of how to respond to different teaching scenarios (PLT). By contrast, the 18-29 age group scored lowest in relation to different teaching scenarios (PLT).

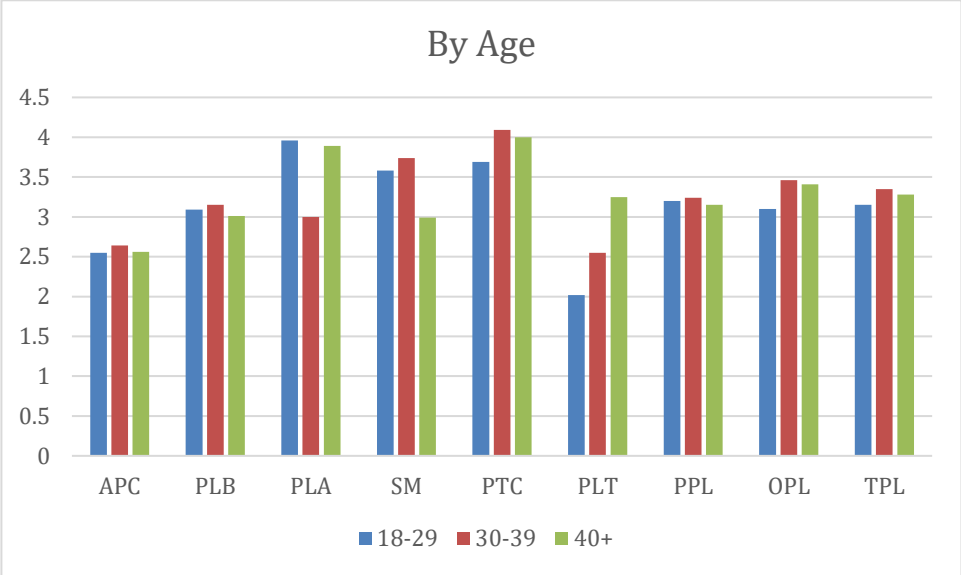

Figure 5: Responses by age grouping

Respondents who had completed the H&PE unit had better teaching skills (PLT) though noticeably those who had completed the Performing Arts unit were less able. Further investigation would be required to establish why this is the case.

Practicum Reports:

The review of practicum reports by supervisors showed that the evaluated lessons were predominantly literacy and numeracy focused, with some HASS, Science and Health lessons also evaluated. Less than 1% of evaluated lessons had a physical education or performing arts/arts focus. While this review doesn't reveal the number of opportunities pre-service teachers had to take physical education or performing arts/arts lessons while on their practicum, the low number of evaluated lessons suggests that either physical education and performing arts/arts lessons were not prominent in the weekly schedule of lessons and/or were not seen as important ways to gauge a pre-service teacher's competence.

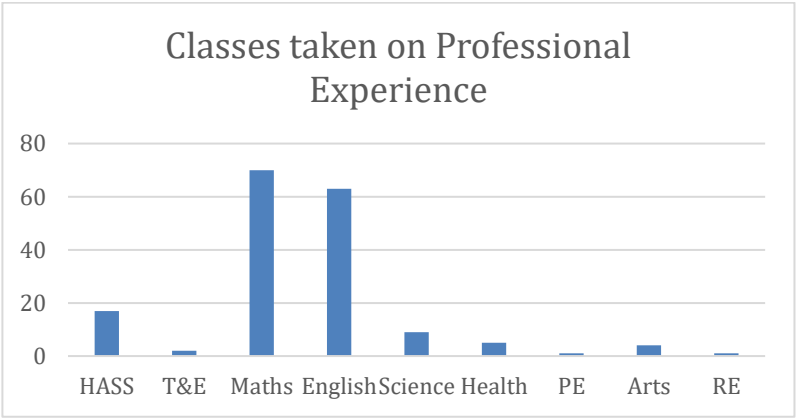

Figure 6: Professional Practicum Experience

Discussion

The environmental scan of initial teacher education courses across Australia reveals that opportunities to develop pre-service teachers' capabilities for teaching in physical literacy related subjects in initial teacher education courses are constrained. The content analysis of units in two courses shows that the units are mainly focussed on attending to pre-service teachers' comprehension of the early childhood principles/school curriculum, and helping them develop basic strategies for addressing teaching requirements – with only modest development of pre-service teachers' own experience/performance capabilities.

This focus is reflected in the higher scores in pre-service teachers' theoretical understandings and confidence about the relevant curriculum areas that promote physical literacy. Early childhood pre-service teachers scored higher that their primary counterparts in relation to their understanding of the importance of physical development. This can be reasonably attributed to the strong focus throughout the course on whole-child development in the early years.

Since becoming physically literate is essentially an embodied process, pre-service teachers need to be able to translate their theoretical understandings into active, physical or practical experiences for learning. The study shows that the capacity of pre-service teachers to interpret, diagnose need, or intervene purposefully in relation to different educational scenarios is an area of weakness.

In this research, a causal link is not made between personal physical capability and teaching effectiveness but a correlation is clear. In the same way that personal maths literacy underpins maths teaching competency, so personal levels of physical literacy underpin teaching competency in this area. The low levels of pre-service teachers' reported personal physical capability means that the focus on curriculum and pedagogy in the university units is not as effective as it would be if the students came to these units with a good level of personal physical literacy. Furthermore, the evidently limited supervised opportunities to develop practical experience during teaching practicum compounds the problem.

Without a rich experiential context for interpreting the curriculum and pedagogical elements covered in the units, and limited supervised opportunities to apply their learning on teaching practicum, pre-service teachers who demonstrate sound theoretical knowledge and confidence will still struggle to put their learning into practice in a meaningful way.

Given the combination of pre-service teachers' underdeveloped personal physical capabilities, a focus on curriculum and pedagogical theory in their relevant university units, and seemingly limited opportunities to practice teaching in physical education and performing arts when completing teaching practicum, it is difficult to see how developing novice teachers' competency to create a rich program of physical literacy development in early childhood centres and primary schools can be achieved without the introduction of alternative practices and/or additional support.

The research suggests recasting university units to provide more active learning – while still retaining the strong curriculum and pedagogical features. Even within the time constraints of university units and classes, and the widespread use of online learning options, measures to amplify this style of teaching can be undertaken. Pre-service teachers can develop and demonstrate personal competency through videos of personal performances for assessment. At one university for example, pre-service teachers are required to submit videos of themselves undertaking dance performances they have choreographed. Similarly, they also video themselves teaching a small group of children then edit the video with their analysis of four pedagogical skills they have demonstrated.

Videos can be used as teaching resources too. Children's movement capabilities are demonstrated in the video and pre-service teachers identify what teaching is required.

Potentially, this diagnosis and intervention process could be extended or enhanced by apps developed to support this.

A requirement that pre-service teachers must take a physical education class and/or a performing arts class while on teaching practicum would be a simple and effective way of building practical knowledge and capabilities. Making this an integral part of the formal assessment process would also serve to affirm the value of the relevant learning areas in the curriculum.

The nature of embodied learning suggests that additional support programs in the form of professional development would benefit from focusing on *active* and *practical* learning processes to complement the study undertaken in initial teacher education courses.

In demographic terms, we were not able to discern from this sample, any influence of culture/Indigeneity; nor any significance in a rural/remote upbringing where a more physically active lifestyle might be expected. Notable features were distinctly lower scores in the 18-29 age group's ability to address teaching scenarios (PLT); the 30-39 age group's poorer attitude towards physical literacy (PLA), and the 40 plus age group's poorer understanding of physical literacy education (SM) – when compared to the other two age groups. This would suggest that any proposed professional development program should give some attention to different types of needs associated with different age groups.

Limitations

The primary limitations of the study were that the detailed analysis of the units and the pre-service teacher survey was conducted at only one university; and an ethnographic analysis, especially around gender and Indigeneity was not possible because of the size of the sample.

Conclusion

Developing physical literacy among children extends beyond the provision of outdoor play opportunities; and sits in contrast to any competitive, high-level sports performance model of physical education. Instead developing physical literacy requires a structured educational program that promotes an inclusive and holistic engagement in a wide range of active pursuits in a variety of contexts. The habits, skills, practices and disposition established in childhood underpin active lifestyles and the benefits of this accrue throughout life. The framework for developing children's physical literacy exists within the EYLF and the Health and Physical Education Learning Area and the performing arts subjects within The Arts Learning Area of the school curriculum. Despite this, Fundamental Movement Skills – the most elementary form of measurable physical literacy in children's development - are not well developed in Australian children.

This study shows that the pre-service teachers who will be responsible for implementing programs to develop children's physical literacy have quite well-developed confidence and theoretical understandings about teaching for physical literacy but don't necessarily have the personal physical literacy and practical diagnostic and teaching skills to implement a meaningful program that involves embodied and active learning experiences.

The outcomes of this research suggest that greater attention to practical and physical learning experiences is required to develop teaching competencies in a meaningful way. The trend to shorter on-campus class times and the increase of online learning at universities has compromised the practical learning processes that embodied learning necessitates; however

technology does allow for alternative ways to engage pre-service teachers in practising and demonstrating both personal and teaching capabilities.

Specific requirements that pre-service teachers on practicum are assessed teaching a physical education and/or performing arts lesson would provide invaluable learning experience while also reinforcing the importance of these learning areas.

Novice teachers will require additional support by way of professional development once they are in schools. This too needs to focus on active learning experiences to build competency, and be tailored to take account of different needs. Given the limitations of broadly implementing professional development programs, the possibilities offered by mobile devices, apps and affordable technology to support teachers' planning, diagnosis and intervention, and to collect data about children's development, could be beneficial.

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