

# Development of Teachers' Knowledge and Skills in Implementing a Physical Education Curriculum: A New Zealand Early Childhood Intervention Study

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Published online: 21 June 2017  
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**Abstract** In order to support children's physical health and well-being in early childhood education programmes, it is important to understand how teacher practices concerned with physical activity and nutrition can be addressed effectively. Current evidence suggests that young children's opportunities for physical activity in early childhood are increasingly limited. This study assessed how teachers' knowledge and skills changed as the result of the implementation of a 10-week physical activity intervention programme (Jumping Beans) and participation in a

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related professional development programme. Participating teachers in four centres were interviewed before and after the intervention. Overall, qualitative and quantitative data from teacher interview data were highly positive, as a result of their participation. However, further research about how teachers' skills can be enhanced to intentionally teach with confidence in curriculum domains related to physical health and physical literacy needs to be considered.

**Keywords** Physical activity · Physical literacy · Motor development · Teacher knowledge · Professional learning · Early childhood education

**Résumé** Afin de préserver la santé et le bien-être physiques des enfants dans les programmes d'éducation de la petite enfance, il est important de comprendre comment les pratiques des enseignants soucieux d'activité physique et de nutrition peuvent être abordées de façon efficace. Il est possible d'affirmer qu'à l'heure actuelle les jeunes enfants ont des occasions de plus en plus limitées d'avoir des activités physiques pendant la petite enfance. Cette étude a évalué comment les connaissances et les compétences des enseignants ont changé à la faveur d'un programme d'intervention de 10 semaines en activité physique («Jumping Beans», haricots sauteurs) et de leur participation à un programme de développement professionnel sur le sujet. Les enseignants participants de quatre centres ont été interviewés avant et après cette intervention. Dans l'ensemble, les données qualitatives et quantitatives provenant des données des entretiens avec les enseignants sont très positives à la suite de leur participation. Toutefois, il faut envisager des compléments de recherche sur la façon dont les compétences des enseignants pourraient être renforcées pour leur permettre d'enseigner intentionnellement et avec confiance dans les domaines du curriculum relatifs à la santé physique et au savoir-faire physique.

**Resumen** Para apoyar la salud física y el bienestar de los niños en los programas de enseñanza preescolar (EPE), es importante comprender la manera eficaz de abordar las prácticas docentes relacionadas con la actividad física y la alimentación. Las pruebas disponibles actualmente apuntan a una creciente limitación de las oportunidades para actividad física de los niños pequeños en la primera infancia. Este estudio evaluó el cambio de los conocimientos y destrezas del docente como resultado de la ejecución de un programa de intervención de 10 semanas de actividad física (Jumping Beans) y de la participación en un programa de desarrollo profesional asociado. Los docentes participantes en cuatro centros fueron entrevistados antes y después de la intervención. En general, los datos cualitativos y cuantitativos de las entrevistas con los docentes fueron muy positivos como resultado de su participación. No obstante, se considera necesario investigar más la forma de mejorar las destrezas del docente para enseñar, intencionalmente, con confianza en los temas del programa relacionados con la salud y la educación físicas.

## Introduction

Obesity rates in New Zealand children are increasing at an alarming rate. With increasing numbers of children enrolled in ECE centres (Ministry of Education 2014), this environment is extremely important for promoting appropriate physical activity and nutrition practices. Approximately 40% of New Zealand's toddlers are in full-time childcare (Ministry of Education 2014), with higher rates of participation for older children. In the short term, more effective teaching practices and curriculum planning may lead to increased physical activity and enhanced motor skill development. Research suggests children with better motor skills may have improved academic and cognitive abilities and enhanced physical activity levels as adolescents and adults (Fedewa and Ahn 2011). In the longer term, the effects of children's physical experiences in ECE may impact on their life course, as the patterns of eating and physical activity established in early childhood will affect their whole lives (Campbell and Hesketh 2007; Tucker 2008).

The data reported in this paper are part of a larger study entitled "Physical education in early childhood (PEECh)", which examined how to promote physical education and good nutrition, in ECE settings as part of a strategy for reducing obesity and increasing children's resilience. It is thus consistent with the theme of this volume, which examines how early childhood systems can be transformed for future generations. PEECh used a mixed method intervention design to explore the impact of a 10-week "Jumping Beans" programme on children's physical activity, physical literacy and resilience. Physical literacy can be defined as having a positive attitude towards physical activity through experiences that provide a sense of achievement and enjoyment in physical activity, as well as the motivation and confidence to continue active participation in physical activity over time (Whitehead 2016). The Jumping Beans programme was combined with professional learning opportunities for teachers about physical activity, motor skill development and good nutrition practices. The influence of the combined Jumping Beans and professional learning to enhance teachers' knowledge, skills and attitudes to promote children's physical and healthy development is explored in this paper. Findings from the larger multidisciplinary "PEECh" study are reported elsewhere. This paper begins with examination of the context for child health in New Zealand and issues related to teachers' professional knowledge and practices in early childhood. The research methodology is explained, and the findings from pre- and post-intervention interviews and teacher evaluations of professional learning are presented. The implications for curriculum planning for children's physical well-being and directions for further research are considered.

## Child Health in New Zealand

Peters (2013) argued that New Zealand's standing in child health has slipped dramatically in recent decades. He highlights that the Organisation for Economic Cooperation and Development (OECD 2009) report, *Doing better for children*,

ranked New Zealand 29th out of 30 OECD countries and suggested that New Zealand needs a stronger policy focus on child health during the early years when it is easier to make a long-term difference.

The 2002 Children's Nutrition Survey (Ministry of Health 2003) focused on children aged 5–14 years showed nearly one-third of school-aged children were overweight or obese, with a high prevalence of sedentary behaviours and screen time, and a lack of physical education. By 2011, nearly one-third of New Zealand children were classified as overweight or obese (Ministry of Health 2012), including children in early childhood and evidence was found for obesity in 2-year-olds. Pacific and Māori children were 2.5 and 1.5 times, respectively, more likely to be obese than other children. There is growing evidence that children have too many sedentary opportunities and too little physical activity (Oliver et al. 2012; Wadsworth et al. 2012).

Although obesity in young children is rising, data on healthy child outcomes of parenting and ECE in New Zealand are not easy to find, although the current "*Growing up in New Zealand*" longitudinal study will be informative as the cohort participating in this study grows older. Currently there is evidence that 86% of children are perceived by parents to be healthy at age 2 years, while 83% are considered of normal weight, although actual weight is not yet compared to anthropometric studies of height, weight and body mass (Morton et al. 2014). There is evidence that toddlers have increasing screen time, and 2-year-olds are spending at least 1.5 h per day in sedentary screen use. Mitchell et al. (2008) review of early childhood outcomes suggests the evidence on health outcomes from ECE is slim. Apart from research on cortisol levels and childhood stress, most studies rely on parent reports and reports of short-term health outcomes related to current ECE experience, such as increased rates of illness. Mitchell et al. identify that children in higher-quality ECE programmes have lower cortisol levels and those programmes that include health support may improve child health outcomes.

## The ECE Policy Context

While there are guidelines for nutrition practices and physical activity in most countries, including New Zealand, low levels of physical activity in childcare have been found across a number of studies, although accurate measurement of specific levels of physical activity is complex (Gubbels et al. 2012; Hnatiuk et al. 2012). Children in childcare are less likely to engage in physical activity than if they were at home, although level of activity is also influenced by gender, weight, ethnicity and parental patterns of activity (Campbell and Hesketh 2007; Oliver et al. 2012; van Cauwenberghe et al. 2012). Some recent international studies have examined ways to increase children's levels of activity, with encouraging results (Chow et al. 2015; Wadsworth et al. 2012). These studies have important implications for ECE curriculum in New Zealand.

The regulatory environment specified in the Education (Early Childhood Services) Regulations (NZ Government 2008) includes minimum space for outdoor play, provision of dining facilities and record keeping about food. In order to maintain a licence to operate, ECE centres must meet the minimum standards

related to ratios, space, curriculum, safety and delivery of the legislated curriculum (currently *Te Whāriki*). Centres must also have a successful regular review by the Education Review Office (NZ Government 2008), using established criteria. The regulations provide minimum standards for structural quality (Dahlberg et al. 2007). The ECE curriculum (Ministry of Education 1996, 2017) specifies principles, strands and goals, which include child health in the Health and Well-being (Mana Atua) strand and physical literacy in the Exploration (Mana Aotūroa) strand, where guidance is offered to support process quality related to pedagogical practices. The curriculum is based on sociocultural theorising (Vygotsky 1978), and it indicates that teachers will use intentional teaching and a range of pedagogies to support learning and development. Centres are advised to use Ministry of Health resources and to enrol in the Heart Foundation's "Healthy heart award programme" and use associated organisational resources. However, centre managers and/or teachers can make decisions about physical activity and dietary choices, as long as they can demonstrate consistency with regulations and the curriculum. There is considerable scope for interpretation and variability in centre quality, as noted by a recent Education Review Office report (ERO 2015), particularly for infants and toddlers, where opportunities for physical activities may be limited.

### Physical Education in the Early Childhood Context

There is little specific research evidence on how much daily physical activity children require, but there are some useful guidelines. The World Health Organization (WHO) recommends a minimum of 1 h of vigorous physical activities per day (WHO 2007). Shape America (NASPE 2002) and Sport NZ (SPARC 2007) promote an additional 60 min of unstructured physical activity per day. Children should not be sedentary for more than 60 min per day, except for sleep (i.e. no long periods of sitting on a mat in a group). However, adequate space for children to engage in a range of physical activities that raise their heart rate may not be available in centres (Kolt et al. 2005). There is also evidence that children do not get sufficient physical activity to ensure they develop bone density, aerobic fitness and motor skills (Tucker 2008). Physical activity alone may not reduce obesity in childhood, so issues related to inadequate nutrition also need to be addressed (Timmons et al. 2007).

Teachers are responsible for decision-making about curriculum opportunities (Ministry of Education 1996, 2017), but this may be constrained by management decisions, fear of risk and litigation, lack of knowledge or strong discourses about the types of opportunities for physical activities that should be offered to children (Kolt et al. 2005; Coleman and Dymont 2013). It is of concern that initial teacher education programmes may allocate only a minimum number of hours to address childhood nutrition and physical activity because domain-specific knowledge (e.g. subject content) is not always taught in-depth to ECE teachers (Kane 2005; McLachlan et al. 2013). This omission may occur because it is assumed that children are "naturally active"; a stimulating environment is sufficient; or teachers are influenced by Reggio Emilia inspired discourses about the environment being

the third teacher (Fraser and Gestwicki 2002), which may be interpreted that explicit teaching is not required.

Children's physical activity opportunities may also be limited by teachers' perceptions of risk (Little et al. 2011) and rigid playground regulations (Coleman and Dymont 2013). Notions of "cotton wool" children are evident—teachers' avoidance of physical risk is reinforced by rigid regulatory codes for outdoor play environments. Barriers in providing a wide range of physical activity opportunities to children include teachers' lack of information, knowledge and skills; limited pre-service and in-service professional learning; and lack of confidence (Kolt et al. 2005; Oliver et al. 2007).

In the light of these findings, this study sought to find ways to increase teacher knowledge and confidence about issues related to nutrition, physical activity and motor skill development in early childhood settings. The research aim of the larger study was also to identify the impact of a 10-week physical activity and literacy programme on children in ECE centres. This paper reports the influence of the 10-week programme plus professional learning workshops on teachers' knowledge, skills and attitudes within ECE environments about the value of a physical activity and literacy programme in their practice.

## Methodology

The mixed method study (Punch 2009) was a collaborative venture between the multidisciplinary research team and two organisations, *Jumping Beans International* and *BestStart Educare*. Jumping Beans International is a well-established provider of specialist physical activity classes for children from birth to 6-year-olds. BestStart is the umbrella organisation for over 280 childcare centres in New Zealand. BestStart provides care and education for 15,000 children daily and employs 1700 teaching staff. The study design was negotiated between the research team and both organisations, and jointly funded by Massey University Research Fund and BestStart Educare. It received ethics approval from the university Human Ethics Committee, and consent for participation was requested from all participating teachers and parents of children.

Four childcare centres in low socio-economic communities were identified by BestStart as appropriate research sites. Two were the primary intervention sites and the two other centres served as the control group for comparison. It was agreed that the two centres in the control would also receive the Jumping Beans intervention subsequently (a waitlist control), so that no children or teachers missed out on the opportunity to participate. Criteria for centre choice included: adequate space for obstacle courses; a high ratio of qualified staff; and enrolled children included Māori and Pasifika children (children of Pacific Island descent); who have been identified as having a greater incidence of obesity in childhood (Ministry of Health 2012). All qualified teachers in the four centres were invited to participate and none declined. Untrained staff were excluded, because professional learning for qualified teachers who should hold knowledge about physical education was a key focus of the study.

The study design involved Jumping Beans staff delivering 1 × 45-min session per week in four childcare centres over a 10-week period. At each session, children had a range of different locomotor and object control experiences to help support the development of fundamental movement skills [e.g. landing (two feet); spring (leap, jump); statics (balance); locomotion (run, slide, gallop, hop); rotations (swinging); and manipulative skills with balls (such as batting, bouncing, throwing, bowling, catching, kicking)]. Teachers were informed how change in children's abilities would be measured during the professional learning workshops. Measurement included the Test of Gross Motor Development (Ullrich 2000). See Figs. 1 and 2 for examples of the types of opportunities Jumping Beans offered.

All teachers were encouraged to participate in the physical activity sessions with the children. Jumping Beans staff were asked to give participant teachers suggestions for centre-specific activities (based on available space and equipment) for teachers to deliver post-intervention. In addition, all participant teachers were invited to attend three workshops run by Jumping Beans staff and a paediatric nutritionist, who was a member of the research team. The workshops were interactive and involved presenting teachers with new knowledge and trying out various physical literacy and nutrition activities. The workshops were designed to add the theoretical and research knowledge to the professional learning programme. The workshops focused on the following:

1. Nutrition—practical tips to enhance knowledge.
2. Physical activity—brain development; primitive reflexes; red flagging developmental delays; cephalocaudal and proximodistal development; sensory motor integration; vestibular activities; eye tracking; learning styles; effective praise.



**Fig. 1** Example of an obstacle course in one of the centres



**Fig. 2** Another example of an obstacle course

3. Physical literacy—fundamental movement skills and how these skills relate to learning outcomes in relation to children’s enjoyment of physical activity, their confidence in participation and movement skills.

Teachers were invited to participate in a 30-min semi-structured interview following the intervention, where they could reflect on how the intervention had affected their knowledge, skills, beliefs and practices. Teachers were also asked to complete questionnaires developed by the research team and the Jumping Beans organisation to record information about their prior experiences of physical education and nutrition knowledge (pre-intervention) and to gather feedback about the professional learning experiences and support (post-intervention). Post-intervention questionnaires targeted teachers’ ratings of both the Jumping Bean sessions (eight items) and the professional development workshops (eight items).

Interviews took place in a meeting room in each centre and were audiotaped, with the teachers’ consent. Teachers were asked questions in a three-part interview protocol: (1) qualifications and experience as a teacher; (2) understandings of physical education in early childhood and the role of the teacher; and (3) perceptions of physical education in the ECE curriculum. Questions were all open-ended in order to encourage teachers to speak freely. Audio files were transcribed then independently coded by the first and second authors, to increase the validity and reliability of the analyses (Punch 2009). Content and thematic analyses were completed using a process of constant comparative analysis. Emergent codes were first identified against each interview question, then across interview questions and then across interviews to identify dominant themes. Similarities and differences in coding between coders were discussed and adjustments made to codes as needed.

## Results

### Pre-intervention Interviews

Eighteen teachers ( $n = 16$  females,  $n = 2$  males) participated in the pre-intervention interviews. Six teachers held a Diploma of Teaching (ECE); five had a Bachelor of Education; four had a Bachelor of Teaching (ECE); two had a Graduate Diploma of Teaching (ECE); and one had a Graduate Diploma of Teaching (Primary). Seven had teaching degrees or diplomas from universities, with the remainder gaining their qualification from polytechnics ( $n = 6$ ) or private training organisations ( $n = 5$ ). The teachers ranged in teaching experience from less than a year to more than 20 years; employment time within the ECE centre ranged from 6 months to 14 years. The average number of years of teaching experience was 7.8 years.

Teachers were asked whether they used any theories or research to support their teaching of physical education in the curriculum. Eight of the 18 teachers said they did not, while the remainder used a range of theoretical sources, including Piaget, Vygotsky, Bronfenbrenner and others. However, none articulated a clear explanation of why these theories were relevant. There were two dominant themes about how children develop physical knowledge and skill: modelling and exploration. Teachers stated that modelling happened through observation of teachers, parents and peers, while exploration involved actively performing actions, play and using their bodies. Two other, but less dominant themes, concerned attainment of physical skills relevant to age and stage of development or by having access to appropriate resources. For example, teachers commented:

I think they learn through play. Through guidance and through the relation of materials that challenge them that make them want to achieve it.

By doing physical activities and like us educators providing them that opportunity to have that physical education and then through a variety of materials that you use in the Centre. And by exploring and experiences, including by taking the challenges.

Teachers were also asked how they knew that children were developing physical knowledge and skills and how they would assess this (see Table 1). The predominant theme was about observed evidence of physical development but also included some social and personal elements about participation and taking risks which related to research on resilience and self-regulation (Goldstein and Brooks 2013).

When asked about their role in supporting children's physical education, the predominant theme was about facilitation ( $n = 12$ ); following by providing and setting up resources ( $n = 9$ ); teacher engagement ( $n = 6$ ); and encouragement ( $n = 6$ ), with other comments about challenging and supporting children, as well as educating parents. The word "teaching" was conspicuous by its absence. It appeared that teachers did not consider it their role to teach children physical knowledge or skills. When questioned about their level of confidence teachers reported being either "quite confident" ( $n = 11$ ) or "very confident" (5), with the

**Table 1** Aspects of children's development that teachers consider important to observe

Teachers could identify more than one aspect of development

Child development observed	Number of teachers
Physical development	5
Balancing	7
Coordination	9
Gross motor skills	4
Participation	5
Confidence	6
Interest	3
Independence	1
Challenging themselves	1
Evaluating space around them	1
Developmental checklist	1

remaining two teachers saying they needed to do more research on the subject. However, teachers also commented on being constrained about what they could do by parents' expectations and cultural differences in the perceived importance of playing outside and gaining sensory and physical experiences, as the following quote suggests:

...then they shouldn't be exposed to hot and cold weather ... it's very sunny, they should be kept inside and all this sort of thing. So, I mean the parents will come and tell us 'Like okay, please don't send my child outside, please don't ... let them play in the sandpit' and this sort of thing. .... Winter time they don't want to see the children outside.

Teachers cited a number of curriculum strands of *Te Whāriki* (Ministry of Education 1996) that related to physical education and nutrition, but with loose explanations of relevance. Few teachers had any professional learning in physical education following their initial teaching qualification. Balls, hula hoops and obstacle courses were the predominant resources that teachers used to promote physical activity and motor skill development, with some more limited use of ropes, planks, slides, bikes and so forth. A typical comment was that the opportunities offered were limited by resources available and most identified a "wish list" and the need for more challenging equipment.

When asked whether there was a designated area for physical education, all teachers responded "outside" and most talked about a "go-with-the-flow" approach to curriculum planning for physical education. A further nine teachers suggested that inside could be used too, for activities such as dance at whole group sessions (typically called mat times), but the focus of inside activity was constrained to one off events, rather than regular opportunities. Opportunities for physical activity could occur anytime, as all teachers commented on an "indoor-outdoor" flow policy, where children could choose to go outside to play anytime. Planned opportunities for physical play at mat times were reported to occur daily for 12 teachers, with others reporting a less frequent focus. Other less regular activities that promoted physical activity were excursions, with 12 of the teachers reporting this as

another way to promote physical activity. Teachers were asked to identify how they would strengthen physical education and many commented that they needed more resources or dedicated time to physical education, but were constrained by administrative decision-making, budgets and rosters.

### Ratings of Professional Learning

All teachers were invited to rate their experiences of the Jumping Beans programme and the workshops on completion of the intervention. Not all of the teachers were able to participate in all the Jumping Beans sessions and not all of the teachers attended the three workshops. This lack of participation presented issues for other members of the teaching team in the centre because it made subsequent implementation of any new ideas gained from participation in the programme more difficult.

The ratings shown in Table 2 indicate overall very positive views of the Jumping Beans programme and the professional development workshops. Items were all rated on a six-point scale and on all items across the two scales teachers indicated agreement with the value of the two programmes (an overall rating of 5.7).

**Table 2** Teacher ratings on the quality of the intervention and the professional development workshops

	Mean rating
Jumping Beans (JB) physical activity session ratings	
1. JB is a good way to teach fundamental movement skills to young children in ECE settings	5.7
2. I would recommend the use of JB to other teachers	5.7
3. JB encourages safe risk taking which transfers to children's learning	5.6
4. JB is easy to use while still meeting the needs of all children in the setting	5.5
5. JB would result in positive effects for children's learning	5.5
6. JB is practical in the amount of planning time required for implementation	4.5
7. JB could be implemented in a setting with 30–40 young children	4.5
8. Overall, JB is beneficial for young children	5.6
Professional development workshops (JB PD) ratings	
1. JB PD increases teachers' knowledge of fundamental movement skills	5.7
2. Most teachers would think JB PD is a valuable use of their professional time	5.6
3. Most teachers would find JB PD suitable for planning and implementing a physical activity and skills programme	5.5
4. Most teachers would like to have more JB PD to learn more about children's physical activity	5.5
5. JB PD is practical in terms of the amount of time required	5.5
6. I would recommend JB PD to other teachers	5.5
7. Most teachers would be satisfied with the PD trainings and the hands-on on-site programme with the children	5.4
8. Overall, Jumping Beans PD is beneficial for teachers	5.7

Rating scale: 1—strongly disagree to 6—strongly agree

However, teachers had slightly lower ratings for indicators related to the feasibility of the Jumping Beans sessions with regard to amount of time that might be required for implementation and the feasibility of including large numbers of children in a session.

Teachers' comments suggest that they enjoyed the experience and that both Jumping Bean sessions and workshops were valuable for their own professional learning, as indicated in the following comments:

The PD's were educational and fun! Great to have this focus on nutritional and physical learning.

There was so much to learn from the programme. I have really enjoyed being a part of it. Very enthusiastic and prepared team.

The sessions with children were most helpful because it gave me first-hand knowledge on setting up the environment for different physical skills.

Summaries of the evaluation data indicated that teachers were satisfied with the professional learning that they had received and, in many cases, wanted more learning opportunities.

### **Post-intervention Interviews**

Most teachers stated that children learn physical knowledge and skills by being active—this finding was unchanged. Participation in the Jumping Beans programme was seen to expand teachers' repertoire of teaching practices, but there was little change in beliefs about children's learning and development that were recorded. Many teachers identified a greater awareness of the importance of physical activity, rather than a change in beliefs. Few teachers could identify relevant theory or research related to physical activity, paralleling findings at pretest, although some mentioned the importance of brain development that was raised in workshops, which had increased their awareness. The importance of the link between experiences of physical play and brain development was important new learning for many teachers.

Some teachers had made changes to the outdoor environment to either remove risk or create more challenge in response to the workshops. Some commented they looked at the outdoor and indoor environment with "fresh eyes". In most centres, teachers had considered how to increase physical activity indoors, especially on wet days. Issues related to parental pressure to stay inside had been managed by increasing physical play inside in one centre, in particular. This teaching team ran a parent education programme to get parents to try the Jumping Beans activities and experiment with the nutrition tasks that they had experienced at workshops, such as estimating the amount of sugar in juice. Teachers reported an increased awareness by parents of the importance of children's diet, physical activity and development of motor skills.

Teachers reported a stronger focus on fundamental movement skills and the teachers' role in promoting them—a new question posed by teachers was, "How can

I help children to learn?" Many discussed opportunities for both inside and outside play, versus the earlier focus on simply setting up an outdoor environment.

The need for more challenging resources was identified by most teachers. Children were seen to gain confidence with the Jumping Beans resources and teachers said they had "wish lists" for similar resources. This focus on the resources was a negative finding because the focus of the professional learning was intended to help teachers identify how they could use their existing resources to good effect, rather than requiring new resources.

At post-intervention, few teachers could articulate how *Te Whāriki* was used in relation to physical activity, so this finding was unchanged. This suggests that an increased focus was needed on the links between the curriculum, *Te Whāriki*, and practice was needed in any future professional learning sessions. Some teachers talked about the links with the New Zealand Curriculum (Ministry of Education 2007), which was a new focus, and reiterated the importance of the BestStart "*Be school ready*" programme as an aim of the curriculum, although the specifics were not explained. A new finding was the recognition by most teachers that the predominant strand for physical education was "Exploration" in *Te Whāriki* (Ministry of Education 1996). Some commented on the potential usefulness of having a concrete learning outcome for physical education so that teachers could be "on the same page" and be looking for the same aspects of learning and development, a finding that will be facilitated by the inclusion of a learning outcome for physical literacy in the updated *Te Whāriki* (Ministry of Education 2017). Some teachers also reported an increased awareness of the link between nutrition and children's learning and development. Meals had been changed in two centres, with perceived improvement in children's behaviour.

Some teachers ( $n = 8$ ) identified that they were previously overconfident about their knowledge and skills and needed to learn more about how to be more intentional in their teaching. Others ( $n = 5$ ) noted that physical education was an area of growth for them—although not a passion; they could see its importance; the need to show interest; and the need to plan for and be involved in children's physical play. Some teachers had created time and space for physical activity—after *kai* (a meal or snack) or they had more deliberate use of inside space. One teacher commented that she was "more thoughtful and engaged" than before.

Most teachers ( $n = 14$ ) said they had gained important knowledge, skill and confidence in promoting physical activity in young children through participation in the Jumping Beans intervention. One commented that she had to "step up" her game to offer children similar challenge when Jumping Beans was not there, because children had gained so much from the programme and she wanted to continue to support their learning. All teachers identified the need for more intentional teaching of physical and motor skills for children and reflected on their previous belief that a stimulating outdoor environment was sufficient. Teachers' reported that their awareness of how to increase resilience in young children through free play, semi-structured and structured play had increased. Teachers in one centre noted that children had learned to follow instructions and to wait their turn in Jumping Beans and that this was filtering to other curriculum activities and

supporting socio-emotional development, of which a key factor is self-regulation (Goldstein and Brooks 2013).

Most teachers ( $n = 12$ ) identified new ways to use existing resources to promote physical play both indoors and outdoors, but they stated that a lack of challenging or replacement resources was still a problem. Resources and professional learning opportunities were named as ongoing issues. An online resource bank of ideas was suggested, as well as regular professional learning sessions to keep their ideas current. Some teachers ( $n = 3$ ) said they would like more ideas on how to promote physical activity in infants and toddlers, although their ideas for older children had increased.

Other teachers commented that a regular time for a structured physical literacy/motor skills programme was something that children would enjoy and would be of value in terms of children's learning. However, a negative finding was that several teachers did not feel confident to initiate such a programme themselves and wanted ongoing access to either Jumping Beans or to a coach that travelled between centres. Although teachers reported feeling more confident, the finding that they preferred someone external to the centre to provide a service, rather than expanding their own repertoire of knowledge and skills, was a disappointing finding.

## Discussion

As the findings across the teacher interviews suggest, it is possible to increase teachers' knowledge, skills and attitudes to promote physical activity, motor skills and good nutrition in centres, as well as awareness of the importance of intentional teaching of children for all of the above. However, the findings suggest that the intervention did not go far enough in increasing teachers' confidence to offer a challenging physical education programme without an increase in material resources or external support, confirming findings from previous studies that teachers themselves are a key barrier in implementing physical education activities (Kolt et al. 2005; Coleman and Dymont 2013; McClintic and Petty 2015). Although teachers reported that they could see significant changes in children's physical learning and that they needed to "step up", they still tended to externalise responsibility. Further research is needed to identify how teachers can be supported to become fully functioning in this area of the curriculum, with the typically limited resources in a childcare centre. This might include a longer period of intervention, greater frequency of classes or follow-up coaching (McClintic and Petty 2015; Oliver et al. 2007).

There is evidence in this study that teachers need greater guidance on both physical activity and nutrition in early childhood and, currently, there is a lack of resources. Although the Sport New Zealand website has resources on physical activity, there is a dearth of research on nutrition in ECE listed in Ministry of Education or Ministry of Health publications. There are guidelines for developing policies and practices for both physical activity and nutrition, but little evidence on effectiveness of these policies to support child health. Interestingly, the Australian Government has gone further with its development of National Quality Standards

aligned with the Early Years Learning Framework, with explicit guidance on practice (Active Healthy 2014), which is an area for improvement in New Zealand.

The findings did not endorse other studies which have identified perceived risk as a major barrier (Coleman and Dymont 2013), but they do provide further evidence about the key barriers in New Zealand being teacher knowledge, skills and attitudes (Kolt et al. 2005). Furthermore, the findings across the four centres suggest some fundamental conditions for successful implementation of professional learning, which may help address some of the mixed findings of this study. These conditions include:

- The necessity for the participation of all teachers in professional learning workshops and hands-on involvement in physical activity programmes.
- The need for collaboration of teaching teams to improve children's access to indoor and outdoor physical play opportunities to establish and maintain new practices.
- A need for ongoing professional learning workshops, online resources and workshops for parents.

For centres, there are also some implications for planning, assessment and evaluation of physical activity programs. For children, this involves opportunities for regular fun, engaging and fundamental motor skill-enhancing classes, as well as opportunities for free play (Wadsworth et al. 2012). Children also need positive reinforcement for being physically active and to engage in healthy eating. Teachers are likely to gain greater confidence if they experience coaching and ongoing professional learning opportunities about physical literacy and nutrition, and encouragement to work collaboratively to plan for physical activity in the curriculum (Cauwenberghe et al. 2012; Chow et al. 2015; Wadsworth et al. 2012). There are also obvious implications for greater inclusion of physical education and nutrition in initial teacher education programmes (McLachlan et al. 2013).

### Limitations and Further Research

There are some limitations to the present study. First, the decision to not include untrained staff was identified as problematic by some teachers. As they commented, some of the qualified teachers did not attend all the Jumping Beans sessions and workshops and were resistant to change, while untrained staff were keen to learn new ways of doing things. A further study could involve all staff and accept the inevitable variability in the pre-intervention knowledge base. Second, teachers did not consistently keep logs about their practice, so examining pre- and post-change was problematic. Some simpler way of assessing teachers' practices, such as a weekly online survey, might yield stronger results.

We also propose further research in this area of the curriculum, including:

- Benchmarking of physical activity and nutrition knowledge of ECE teachers.
- A longer-term physical literacy intervention and examination of the impact on children's physical activity.

- A study to quantify relationships between children's physical literacy and academic ability, behaviour/resilience, diet and sleep patterns of preschool children.
- Review and analysis of how teachers are learning about physical activity and nutrition in initial teacher education programmes.
- Research on teachers' beliefs and practices following the release of the updated edition of *Te Whariki* in 2017.

## Summary and Conclusions

Although this study is limited in size and scope, and it does not offer data on long-term changes in teachers' practices, it does offer insights into an approach to professional learning to increase physical education in the curriculum that used hands-on participation in the Jumping Beans programme and professional learning workshops. Although the findings suggest teachers benefited from participation in the intervention, we hypothesise that longer term and increased intensity of professional learning opportunities are needed to bring about changes in practice to ensure maintenance and further development of physical activity programmes for young children. Further research is needed to identify what is required to create long-lasting changes in knowledge, skills and attitudes to physical education in the early childhood curriculum. Although not reported here, the accompanying positive results for children in this study indicate this is a worthy focus of further research.

**Acknowledgements** Funding was provided by Massey University Research Fund (Grant No. 1000017892) and BestStart Educare.

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