Fostering knowledge connections between healthy eating, active play and sustainability in early childhood education

by

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<th>Chapter Number</th>
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Abstract

The overall aim of this thesis was to evaluate a pedagogical curriculum intervention that combines the messages of healthy eating, physical activity and environmental sustainability, delivered to children at four-year-old kindergarten. Chapter 1 introduces the state of obesity in young children and the pressures from 360-degree marketing which influences children’s food, toy, clothing, and play choices. Early childhood education is positioned as an ideal setting for the development of healthy lifestyle knowledge and behaviours using pedagogical approaches. Chapter 2 presents the General Method for the two major studies. The study presented in Chapter 3 verifies that the intervention is feasible to deliver in a four-year-old kindergarten classroom. Increases in children’s sustainability knowledge and some healthy eating variables were seen. The curriculum early childhood educators presented in the course of the feasibility study is presented in Chapter 4. The work, guided by the funds of knowledge approach, identifies the play-based curriculum ideas that combined the messages of healthy eating and environmental sustainability. Chapter 5 presents an evaluation of the curriculum delivered in the randomised trial. Evidence suggests that wellbeing and sustainability concepts were bonded within the play-based activities. Taken together, Chapters 4 and 5 demonstrate the educator’s expertise in developing and providing quality education experiences that builds young children’s knowledge. Chapter 6
presents the evaluation of the randomised trial which was found effective at increasing children’s integrated knowledge of healthy eating and sustainability. Changes in healthy eating variables were also found including an increase in vegetable consumption and a decrease in unhealthy snack foods, compared to the wait-list control. Driven by these positive findings, the position paper presented in Chapter 7 introduces ‘Childhood education’ as the 7th ‘C’ of the Six-C’s ecological model. It argues that early childhood education can play a critical role in childhood obesity prevention. Indeed, this role cannot be overlooked, however without the partnership of parents, the longevity and reinforcement of these messages may be limited. To identify how parents can be successfully engaged in obesity prevention interventions conducted in early childhood settings, a systematic review was conducted. Presented in Chapter 8, it identifies the aspects of the parent components that led to weight changes in preschool children. In the event of a future parent component that would be added to the current intervention, an exploration into the parental understanding of the combined messages of healthy eating, physical activity and environmental sustainability was conducted. Chapter 9 presents these findings. The knowledge connections that parents produced were related to habitual, daily activities and were strongly linked to food decisions. Two connections were linked to their child’s kindergarten, through policy and curriculum activities. The general
discussion in Chapter 10 provides a summary and analysis of the evidence presented considering future research.
# Table of Contents

CHAPTER 1 — General Introduction ............................................................. 23
The Problem of Obesity in Children: Current and Future Health Risks ......24
360-Degree Marketing: Impacts on Risk Factors Leading to
Overweight and Obesity in Preschool Children ......................................28
Socio-ecological Explanations for Weight Development in Children ..31
The Overarching Conceptual Framework Driving This Thesis ..........34
Early Childhood Education ...................................................................37
A Pedagogical Approach to the Development of Healthy Lifestyle
Behaviours .............................................................................................44
Aims and Thesis Outline: ......................................................................52
References...............................................................................................55

CHAPTER 2 — General Method ................................................................. 75
Ethics ..................................................................................................... 75
Procedure ...............................................................................................76
Participants ...........................................................................................81
The Intervention ....................................................................................84
Measures and Materials ........................................................................87
Statistical Analysis ................................................................................96
References...............................................................................................98

CHAPTER 3 — Feasibility of Conducting a Randomised Trial to Promote
Healthy Eating, Active Play and Sustainability Awareness in Early
Childhood Curricula ..............................................................................101
Abstract ..................................................................................................101
Introduction ............................................................................................102
Methods .................................................................................................103
Study Design..........................................................................................103
Study Protocol........................................................................................104
Children’s Knowledge of Healthy Eating, Active Play, and
Environmental Sustainability of Their Food and Toy Selections ....105
Children’s Food Preferences, Digital Media Viewing and Physical
Activity Habits.......................................................................................106
Primary Outcome: HAS Assessment .................................................. 241
Secondary Outcome: Eating Habits ..................................................... 245
Third Outcome: Physical Activity ....................................................... 246
Discussion .......................................................................................... 246
Strengths .......................................................................................... 248
Limitations ....................................................................................... 249
Conclusion .......................................................................................... 249
References ......................................................................................... 251

CHAPTER 7 — Early Childhood Education and Health Working in Partnership: The Critical Role Early Childhood Educators Can Play in Childhood Obesity Prevention ..................................................................... 258
  Leveraging Early Childhood Education Through the Foundation Laid by Parents ................................................................. 259
  A Solutions Approach to Obesity Prevention Derived from New Knowledge ........................................................................ 261
References ......................................................................................... 264

CHAPTER 8 — Obesity Prevention Interventions in Early Childhood Education and Care Settings with Parental Involvement: A Systematic Review ........................................................................ 268
Abstract .............................................................................................. 268
Introduction .......................................................................................... 269
Method .................................................................................................. 272
  Eligibility Criteria ........................................................................... 272
  Search Strategy ............................................................................... 272
  Selection Process .......................................................................... 273
  Quality Assessment ....................................................................... 275
Results .................................................................................................. 277
  Study Description ........................................................................... 277
  Main Targeted Outcomes .............................................................. 295
  Methodological Quality ................................................................. 296
  ECEC Interventions: ................................................................. 300
Parent Engagement in Studies Producing a Change in BMI ............ 302

Discussion.............................................................................................................. 304

How Have Parents Been Incorporated into Childhood Obesity Interventions Conducted in ECEC Settings and to What Extent, if any, Does Their Involvement Impact the Outcomes of the Intervention? ................................................................. 304

What are the Methodological Limitations of ECEC Childhood Obesity Prevention Interventions That Have Included a Parental Component? .............................................................................................................. 308

What Recommendations Can Be Made for Future Research? ........ 310

Conclusion .......................................................................................................... 310

References .......................................................................................................... 311

CHAPTER 9 — Understanding Parents’ Knowledge Connections Between Healthy Eating, Physical Activity and Sustainability Awareness .............. 322

Introduction ........................................................................................................ 322

Method ................................................................................................................ 325

Design ................................................................................................................ 325

Participants ....................................................................................................... 325

Recruitment ..................................................................................................... 326

Interview protocol................................................................................................ 326

Data extraction .................................................................................................. 327

Results ............................................................................................................. 329

Concept Map ..................................................................................................... 329

The Knowledge Connections Between Healthy Eating and Sustainability .......................................................................................................................... 332

The Knowledge Connections of Physical Activity/Active Play and Sustainability .......................................................................................................................... 336

Kindergarten Practices and Educator Influence ............................................ 337

Discussion ......................................................................................................... 339

Strengths and Limitations ............................................................................ 348

Future research and implications ............................................................... 348

Conclusion ......................................................................................................... 349

References ......................................................................................................... 351
CHAPTER 10 — DISCUSSION

Summary of Findings

General Discussion

Early Childhood Education and Health — Interdisciplinary Perspectives Aligned to Focus on Healthy Lifestyle Knowledge and Behaviours in Young Children

Leveraging a Bottom-Up Approach to Curriculum Development for Healthy Eating and Environmental Sustainability

Combining Health and Sustainability Messages Within Early Childhood Education

Building a Sense of Agency in Children for Their Own Healthy Lifestyle Choices

Understanding Parental Engagement and Support of Healthy Lifestyle Behaviour Messages in Early Childhood Education

Future Directions and Implementation

Conclusion

References

APPENDIX A — Authorship Statements

APPENDIX B — Journal Permissions

APPENDIX C — Ethics

Deakin University Human Research Ethics Approval

Evidence of ethics approval from Victorian Department of Education and Early Childhood Development

APPENDIX D — Supplementary Materials for Chapter 2

Educator Plain Language statement and consent

Confidentiality Agreement

Children’s Assent Form

Pedagogical Communication Strategy

Study 1 Child Interview and Data Recording Sheet

Study 1 Interview Images

Study 2 Interview Images

Study 2 Child Interview and Data Recording Sheet
Table of Figures

CHAPTER 1

Figure 1 The Six-Cs Developmental Ecological Model of Contributors to Overweight and Obesity in Childhood. ........................................................... 32
Figure 2 Conceptual framework of the thesis ................................................. 36
Figure 3 Pedagogical Play Framework ........................................................... 42
Figure 1 Linking areas of research into environmental education, the prevention of childhood obesity and digital technologies with EYLF learning outcomes. ........................................................................................................ 141
Figure 2 Sample case-study provided to educators during the first professional learning workshop ................................................................. 142
Figure 3 Conceptual summary of educator generated topics specific to well-being and environmental education in the early childhood curriculum when planning from children’s observed popular-culture interests with a specific focus on food-products ........................................................................... 152
Figure 1 Pedagogical play Framework .......................................................... 183
Figure 1 Consort Flow Diagram ................................................................. 233
Figure 1 PRISMA flow diagram ................................................................. 274
Figure 2 Healthy eating and sustainability knowledge connections ........... 331
Figure 3 Physical Activity and Sustainability knowledge connections ...... 332
List of Tables

CHAPTER 3

Table 1 Demographic Statistics ................................................................. 111
Table 2 Eating and Physical Activity Questionnaire (EPAQ): Intervention compared to control at baseline and follow up .............................................. 117
Table 3 Eating and Physical Activity Questionnaire (EPAQ): Within group changes baseline to follow-up ................................................................. 119
Table 4 Qualitative interview data ............................................................. 121
Table 1 Identified topics for well-being and environmental education as content areas with sample planned learning experiences ........................................... 146
Table 1 Integrated conceptual framework for wellbeing-and-sustainability ......................................................................................................................... 198
Table 2 Completed integrated conceptual framework for wellbeing-and-sustainability ................................................................................................ 201
Table 1 Demographics characteristics of parents and children .............. 240
Table 2 Common connections and their explanations ............................. 242
Table 3 Trial Group comparison of Healthy Eating and Sustainability groupings ........................................................................................................ 243
Table 4 HES groupings differences within each trial group ................... 244
Table 2 Downs and Black Checklist ......................................................... 276
Table 3 Study Details ............................................................................. 279
Table 4 Main Targeted Intervention component .................................... 294
Table 1 Semi structured interview questions ...............................................327

Table 2. Healthy eating and Sustainability Quotes .................................334

Table 3. Physical Activity and Sustainability Quotes .............................337

Table 4. Kindergarten Practice and Educator Influence Quotes .............338
CHAPTER 1 — General Introduction

The overall goal of this thesis was to actively build preschool children’s knowledge concepts about healthy lifestyle behaviours and sustainability knowledge, in a combined as opposed to siloed approach, using play-based learning. Innovatively, this thesis combines health with early childhood education, providing evidence that two disciplines can work in partnership to generate health gains for young children during the formative preschool years.

This general introductory chapter begins with an overview of the problem of obesity in children and how 360-degree marketing impacts the risk factors which contribute to obesity in children. The Six-C’s socio-ecological model, the theoretical underpinning of this thesis, is then described, followed by early childhood theory into the funds of knowledge approach to curriculum development. How educators capitalise on children’s funds of knowledge in curriculum development is outlined. A pedagogical play framework developed to assist educators to include all play types in their curriculum is then discussed. The importance of early childhood educators in the prevention of childhood obesity is argued and the proposal of a 7th ‘C’ to the Six-C’s ecological model is presented. A pedagogical approach to obesity prevention involving educator’s expertise to build an integrated healthy eating and sustainability curriculum using play-based activities is then introduced. The general introductory chapter concludes
with the aims and outline of the thesis. Briefly, Chapter 2 describes the
general method of the empirical studies presented in Chapter 3 and Chapter
6. Chapters 4 and 5 provide an evaluation of the curriculum that educators
produced during the feasibility study and during the randomised trial study
presented in Chapters 3 and 6, respectively. Chapter 7 presents a paper
positioning the critical role that early childhood educators play in obesity
prevention. Chapter 8 presents the findings of a systematic review of the
literature conducted to explore how parents have been incorporated in
childhood obesity prevention interventions in early childhood education and
care settings. Chapter 9 extends this parent work and provides the findings
of a small study on parental knowledge of how health and sustainability
concepts are related. The final chapter, Chapter 10, contains the discussion
and concluding remarks of the thesis.

The Problem of Obesity in Children: Current and Future Health Risks

A widely used process in determining if a child’s weight is outside the
normal or healthy weight range is to calculate a Body Mass Index (BMI)
score that is standardised for age and gender (Simmonds et al., 2015). The
BMI is checked against a reference database that determines if the child is
thin, normal, overweight or obese. There is no consensus about which
reference database is the best (Rolland-Cachera, 2011) however three are
often used from the World Health Organisation (WHO) (de Onis, 2006),
International Obesity Task Force (IOTF) (Cole, Bellizzi, Flegal, & Dietz,
2000), and the Center for Disease Control and prevention (CDC) (Kuczmarski et al., 2000). Each reference database uses a different type of cut-off to establish the boundaries between thinness, normal, overweight and obesity, thus, the definition of overweight and obesity can shift. Regardless of which database is used, the number of children whose BMI indicates that they are at risk of being overweight, overweight or obese, has been increasing for decades.

The combined global prevalence of overweight and obesity in children has been consistently rising, from 4.2% in 1990; 6.7% in 2010, to an estimated 9.1% in 2020 which equates to 60 million children (Wang & Lim, 2012). In developed nations, data suggest that 23.8% of boys and 22.6% of girls aged 2-17 were overweight or obese in 2013 (Ng et al., 2014). Current Australian data of children aged 5-17 years, suggest the combined incidence of overweight and obesity is 27.4% (Australian Bureau of Statistics, 2015). This prevalence rate among children is a major concern because the risk of serious health implications now, and in the future, are high. For preschool aged children in particular who are already overweight or obese, this risk is inferred from early adiposity rebound. Adiposity rebound—the point when a child’s weight increases after reaching their lowest percentage of body fat (Pulgaron & Delamater, 2014), typically occurs between 5 and 7 years of age in healthy weight children. However, in overweight or obese children, adiposity rebound often occurs earlier, around 3 years of age. If this
happens, the chances of adiposity in adolescence and adulthood is significantly higher (Hughes, Sherriff, Ness, & Reilly, 2014; Rolland-Cachera, Deheeger, Maillot, & Bellisle, 2006).

There are significant economic burdens that are attributable to obesity in children. Recent Australian data suggest that obese preschool children have 1.62 times the healthcare costs than their normal weight peers (Hayes et al., 2016), adding an additional $17 million of direct costs to the Australian healthcare system (Brown, Moodie, Baur, Wen, & Hayes, 2017). These monetary costs represent sick children presenting to doctors and hospitals for physical health concerns related to their obesity, including respiratory, muscular-skeletal, ear, nose, mouth and throat, and digestive complaints (Hayes et al., 2016).

Without intervention, physical and psychological health disorders can emerge in the preschool years, however it is more common that these present later in childhood. Cardiovascular conditions (Shashaj, Bedogni, Graziani, & et al., 2014), metabolic disorders including pre-diabetes, insulin resistance and type 2 diabetes (Graversen et al., 2014; Levy-Marchal et al., 2010), orthopaedic problems (Kelley, Crabtree, & Zemel, 2017; Paulis, Silva, Koes, & van Middelkoop, 2014), and obstructive sleep apnoea (Su et al., 2016) are just some of the health conditions that present in overweight and obese children. Furthermore, the development of negative perceptions about overweight and obesity begins in preschool aged children and continues
throughout childhood. Preschool children can experience negative body image (Tatangelo, McCabe, Mellor, & Mealey, 2016), hold a negative body image for others (Ruffman, O’Brien, Taumoepeau, Latner, & Hunter, 2016), and accurately demonstrate stigmatisation to overweight dolls (Harrison, Rowlinson, & Hill, 2016; Worobey & Worobey, 2014). In addition, they can express stereotyping associated with overweight and obesity (Harriger, 2015) and experience depressive symptoms because of their own overweight and obesity (Morrison, Shin, Tarnopolsky, & Taylor, 2015). This evidence suggests that society’s development of weight bias begins in the youngest of children, at a time in a child’s life when adverse psychological outcomes can also originate.

The development of overweight and obesity in preschool children is a complicated interaction of risk factors, environmental stressors and demographic characteristics. Isolating the risk factors without considering the environmental determinants that support obesity development is not useful (Dev, McBride, Fiese, Jones, & Cho, 2013). One recent review identified over 20 childhood obesity risk factors including screen time, specifically television viewing, diet intake, physical activity and parental factors including BMI, feeding practices and maternal education among others (Dev et al., 2013). Despite the breadth of this review, children’s exposure to food marketing was not included as a risk factor. This is a significant limitation because the drive to consume foods from media and
merchandise, can impact how children want to play and what they want to eat.

360-Degree Marketing: Impacts on Risk Factors Leading to Overweight and Obesity in Preschool Children

Omnipresent advertising that exposes children to foods that are unhealthy, as well as, toys and clothing that are derived from unsustainable practices that also promote unhealthy lifestyles, is a factor in obesity development. Many have argued that the significant increases in child weight gain and the massive expansion of child-directed food advertising for energy dense, nutrient poor foods are related (Buijzen, Rozendaal, & de Droog, 2014; Cairns, Angus, Hastings, & Caraher, 2013; Swinburn et al., 2011). In addition, packaged meals with toy premiums, toys, clothing and merchandise, successfully support the branding strategies of the marketing industry (Story & French, 2004). Preschool children are particularly vulnerable to this advertising because developmentally, they are unable to discern the persuasive intent (Calvert, 2008; Carter, Patterson, Donovan, Ewing, & Roberts, 2011). While restrictions on television advertising to children are largely commonplace in the western world (Hawkes & Lobstein, 2011; Raine et al., 2013), they do not capture the online and other media environments (Calvert, 2008). The emersion of marketing messages within our society has been termed 360-degree marketing — the media environment that exposes young children to multiple forms of advertising...
This advertising which is specifically aimed at children, uses the ‘hook’ of popular culture interests to market energy dense foods, toys and clothing. Marketing agencies exploit the fact that preschool children identify popular culture characters as friends (Buijzen et al., 2014). Further, the collection and use of food, toys and clothing that embody popular culture interests replaces the companionship that the child feels for their favourite character, when they are not able to watch them (Buijzen et al., 2014).

Robust evidence suggests that marketing of unhealthy food to children influences children’s: (1) food attitudes and preferences; (2) nutrition knowledge; (3) purchasing behaviours; and (4) consumption of energy-dense nutrient poor food consumption (Cairns et al., 2013). A common marketing strategy is to attach toy premiums to fast food meals - a successful strategy known to increase consumption (Longacre et al., 2016). Apart from the potential weight gain implications from fast food meal consumption, there is evidence that these often discarded, mass-produced, inexpensive toy premiums are leaching toxic heavy metals in landfills (Short et al., 2016). Furthermore, on a global scale, the production of food, starting at the seed through agriculture, manufacture, transport, packaging and so on, accounts for 30% of all human generated greenhouse gas emissions (Johnston, Fanzo, & Cogill, 2014; Vermeulen, Campbell, & Ingram, 2012). Therefore, what we eat, how it is produced, where it comes from, should be considered for health and sustainability consequences when purchasing...
foods (Cafaro, Primack, & Zimdahl, 2006; Hyman, 2010). The call for sustainable diets has been made to improve the health of our society and that of our environment (Johnston et al., 2014; Mason & Lang, 2017).

The deleterious effects of the global food system on the environment is largely unknown by adults, let alone children (Macdiarmid, Douglas, & Campbell, 2016). Without this knowledge, parents are less equipped to resist demands for highly packaged, energy-dense nutrient poor foods, which carry health and environmental burdens. This is of increasing importance as children significantly influence the types of foods they consume in the home (Nørgaard, Bruns, Christensen, & Mikkelsen, 2007; Turner, Kelly, & McKenna, 2006). Also, most children today have access to monetary funds for the purchase of food, toys and clothes. Recent estimates of the buying power of children and teens in Australia was A$1.8 billion (Turner, 2016), and in the United States was US$1.2 trillion (White, 2013). Corporations employing 360-degree marketing techniques aim to capture as much of this money as possible through children’s pester power and influence on their family (Huang et al., 2016). Without the necessary health and sustainability knowledge, children are likely to be vulnerable to these messages and unable to resist the highly packaged foods, toys and clothing with their favourite characters.
**Socio-ecological Explanations for Weight Development in Children**

The research outlined in this PhD thesis was informed by the six C’s socioecological model of child weight development (Harrison et al., 2011). This model has foundations in ecological systems theory which seeks to explain child development (Bronfenbrenner, 1979), and extends Davison and Birch’s (2001) original model of the predictors of childhood weight status, by taking into consideration the risk and protective factors within a child’s environment (Davison & Birch, 2001).

**The Six-C’s Model.** Advances in understanding about the impact of genetics in weight development led Harrison et al. (2011) to extend the ecological model proposed by Davison and Birch (2001). Harrison et al.’s model is in the shape of concentric rings with the risk factors presented closer to the centre of the model exerting a greater influence on child weight than those in the outer rings (see Figure 1.1). The six- ‘C’s model places genetic factors in the centre labelled the Cell. Subsequent rings around the centre identify environmental factors significant in child weight development including include the Child, Clan, Community, Country and Culture (Harrison et al., 2011).
Figure 1 The Six-Cs Developmental Ecological Model of Contributors to Overweight and Obesity in Childhood.
The child and clan. The child carries some responsibility for their own obesity development through their choices in physical activity, media use, spending money, dietary intake, nutritional knowledge seeking, and self-regulation, among others (Harrison et al., 2011). Many of these are choices, which can be modified positively through the provision of knowledge and skills. This starts at home with the Clan, where the family provides a cultural and historical framework of knowledge and skills supporting the child’s social construction of the world (Skouteris et al., 2011). In addition to familial modelling and provision of healthy foods/feeding and sustainability knowledge to a child, this knowledge is also likely to reach preschool children within the early childhood education setting.

Community, country and culture. A significant contributor to child weight development is the effects of marketing to children, particularly food marketing. Food marketing has been identified on three levels within the Six-C’s model — Community, Country and Culture. The repetition of marketing on three levels, signifies the considerable influence it can have on children’s health behaviours and ultimately on weight outcomes. In the Community level, the effect of food marketing is identified as culturally specific media portrayals (e.g. popular culture characters advertising energy dense foods). In the Country level, the way food is portrayed in the media is identified (e.g., television advertising, and other forms food marketing that pervade all forms of media). In the Culture level, the population’s
acceptance of food marketing to children is argued to be complicit in child weight development (Harrison et al., 2011). 360-degree marketing is present on the community, country and culture spheres of influence on child weight development. This marketing, directed at children, for food, toys and clothing is impacting healthy weight development and has negative environmental consequences.

The Overarching Conceptual Framework Driving This Thesis

Figure 2 graphically presents the conceptual framework that informed the research of this thesis. The PhD program of research presented here addressed five ‘C’s within the Six-‘C’s model of child weight development; this was achieved by: 1) involving the child in play-based activities about healthy eating, active play and sustainability linked to children’s popular culture media interests; 2) respecting the ‘clan’ for the knowledge and skills which they have shared with their child — that is, the family supports the development of children’s healthy eating knowledge, physical activity behaviours and sustainability habits. They are also the gatekeepers for children’s exposure to digital media and support their child’s popular culture interests; 3) involving community organisations like the child’s early childhood education service which are connected to the child and clan; 4) By identifying the country’s portrayal of food through advertising that is targeting young children, specifically by using children’s interests in popular culture characters in curriculum development; and 5) by challenging the
cultural acceptance of food marketing to children through early childhood curricula designed to develop agency. In this context, it is the early childhood educators who can build children’s knowledge of the connections between healthy lifestyle behaviours and sustainability concepts using play-based curriculum activities.

As seen in Figure 2, early childhood educators use and contribute to the ‘funds of knowledge,’ that children bring to the early childhood centre in the form of their interests (described in more detail on page 37). Funds of knowledge are the historical and cultural knowledge and skills particular to a household (Moll, Amanti, Neff, & Gonzalez, 1992). Educators incorporate the children’s funds of knowledge to drive the pedagogical play. This type of play is central to curriculum because it builds knowledge in children that has explanatory power required for agentic decision making (Gelman & Kalish, 2006). Consequently, the importance of early childhood education cannot be underestimated and a 7th “C” is added to the model to depict this as shown in Figure 2.
Conceptual framework of the thesis: Six-C’s and educational theory working in partnership for obesity prevention

Community
Country
Culture
Digital media exposure
Popular culture

Child
Cell

Health and sustainability behaviours
Popular culture interests

Funds of knowledge

Clan

Parents and family provide experiences that build health and sustainability concepts.
Are the gatekeepers for popular culture and exposure to digital media

Early childhood educators

Develop play-based curriculum using children’s interests as a funds of knowledge

Pedagogical play framework

Open ended play Modelled Play Purposefully Framed

7th C — Childhood education

Using pedagogy to respond to the obesity problem

Integration of health and sustainability concepts within play-based learning activities that draw on children’s popular culture interests as a funds of knowledge.

Figure 2 Conceptual framework of the thesis
Early Childhood Education

Early childhood is defined as the period between birth and eight years of age (Department of Education and Training, 2016). This period has been categorised as a significant period of rapid change in children’s development (Department of Education Employment and Workplace Relations, 2009). Early childhood education is highly regarded within many societies because it supports physical, social, emotional and cognitive development leading to positive outcomes in adulthood (Campbell et al., 2014; Hines, McCartney, Mervis, & Wible, 2011; Nores & Barnett, 2010). Early childhood education provides learning opportunities, social interactions and experiential practice of our world within a safe environment; these learning opportunities can also be described as curricula.

Curriculum within early childhood education is defined as ‘all the interactions, experiences, activities, routines and events, planned and unplanned, that occur in an environment designed to foster children’s learning and development.’ (Department of Education Employment and Workplace Relations, 2009, p. 45). This broad definition encompasses all the experiences children share within the education service. When educators plan for children to learn about a concept, typically they will develop play-based learning experiences. Play-based learning is “a context for learning through which children organise and make sense of their social worlds, as they engage actively with people, objects and representations” (Department
of Education Employment and Workplace Relations, 2009, pp.6). It is accepted as the way young children learn and the way that knowledge acquisition is fostered in the early years (Wood, 2010).

**Building play-based curriculum activities using children’s popular culture interests — the funds of knowledge approach.** The social construction of children’s development and learning are fundamental tenets within Vygotsky’s sociocultural theory (Vygotsky, 1980). Children’s learning occurs through their play, interactions and communications with peers including parents and friends (Wentzel & Watkins, 2002). An early childhood educator who acknowledges the socially constructed experiences, knowledge, culture and interests that have shaped these children, can structure their curriculum accordingly. Identifying and using interests from the home within early childhood play-based curriculum has foundations in the funds of knowledge approach (Moll et al. 1992).

The funds of knowledge approach to curriculum provision conceptually assists educators to link children’s interests to their curriculum, making it context driven, interesting and likely to support concept formation. Originally presented in published work in 1992, Moll and colleagues sought to provide an innovative alternative to the rote instruction which was commonly received by the poorer Hispanic communities in Tucson, Arizona (Moll et al., 1992). By acknowledging the historical and cultural skills and knowledge that working-class households shared,
educators were able to connect the curriculum activities to the home-life worlds. Consequently, an increase in the quality of the curriculum and academic learning outcomes were seen because the contextual framing of the curriculum facilitated the children’s connections between what they knew, with what was unknown (May, 2013).

Much of children’s pre-existing knowledge comes from their home-life worlds where learning is multilayered and derived from the ‘chaos’ of ordinary lives (Gonzalez, Moll, & Amanti, 2006). It is not uncommon for multiple concepts to be taught together within routine activities; for example, literacy, shape, numeracy and measurement (Nutbrown, 2006) within a baking activity. It is also within this ‘chaos,’ as Gonzalez, Moll & Amanti (2006) describe it, that children are likely to be exposed to media which drives their popular culture interests. Using the funds of knowledge approach enables educators to identify children’s popular culture interests as a cultural experience derived from their home-life experiences. This perceptual shift enables educators to develop context-driven curriculum that will foster robust connections between home and the service (Kabuto & Martens, 2014). Moreover, curriculum drawn from their interests is likely to engage children more effectively and for a longer period of time (May, 2013).

**Play-based activities for curriculum provision.** Young children’s interests form the basis for children’s play. In particular, popular culture interests for young children like being Spiderman or Elsa from Frozen, can
drive their play, expression and communication. Within this play, children are constructing and test knowledge, in both solitary and social interactions with peers (Ebbeck, Yim, & Lee, 2013). Open-ended play, or play without adult guidance is not adequate to promote learning on its own (Hatch, 2010; Nolan & Kilderry, 2010), however, neither is providing academic instruction without any play (Pyle, DeLuca, & Danniels, 2017). A balance between adult delivered concept knowledge and open-ended play needs to be provided.

Providing content knowledge to children within early childhood education goes by many names including intentional teaching (Duncan, 2009; Epstein, 2007), conceptual play (Fleer, 2011) and purposefully framed play (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2017). One of the roles of educators is to provide a range of play experiences that includes open-ended play and concept driven play. This balance has been termed ‘pedagogical play’ — the balance of providing learning experiences using different types of play, in particular child-driven play and teacher-initiated activities for children (Edwards et al., 2017; Wood, 2010). Supporting educators to use pedagogical play ensures a variety of play experiences will be provided to children, enabling rich contextual knowledge to be developed.

**The Pedagogical Play Framework.** Early childhood educators use a number of different types of play in their play-based activities. On the whole, however, research has shown that open-ended play has been used
primarily for the purpose of child development, and teacher directed play has been singled out for academic instruction (Pyle et al., 2017). In their review, Pyle et al., (2017) found that only four studies of the 168 reviewed that included all play-types together for the purposes of learning: Cutter-Mackenzie & Edwards, 2013; Edwards & Cutter-Mackenzie, 2011; Howard, Miles, Rees-Davis, 2012; Walsh, et.al., 2006. The findings of Pyle et al.’s review revealed that these play types can be used in combination, and not in isolation to build both children’s development and academic learning. An integrated approach which values both children’s open-ended play and the educator’s academic instruction is important because it recognises their significance as equals. Figure 3, graphically represents the play-framework that includes three play types founded in educational theory (Trawick-Smith, 2012; Wood, 2010): open-ended play; modelled play; and purposefully-framed play. The play-framework is based on two principles: 1) all play-types are of equal pedagogical value; and 2) the play-types can be used in combination (Edwards et al., 2017). That is, all play types are valuable and are valued differently by children and teachers (Edwards et al., 2017).
Each play type depicted in Figure 3 enables the exploration of new concepts in different ways: Open ended play allows children to explore a new concept in their own time; modelled play introduces the educator as a knowledgeable peer who can demonstrate a new concept; Purposefully-framed play uses the educator to provide resources and co-develop concepts with children to produce an understanding of concepts (Edwards et al., 2017).
Concepts are the building blocks of ideas that allow for the mental representations which enable the organisation of experiences, categories, events and properties (Gelman, 2009). They are essential to the broader idea of knowledge because they help to create meaning. Vygotsky (1987) contends that children begin their understanding and development of knowledge through the development of everyday concepts. These develop through children’s interaction with cultural tools and artefacts which are present in their everyday lives. These everyday concepts are preliminary and are often inaccurate (Vygotsky, 1987). Children have little evidence to support these everyday concepts, and as such are modifiable through support, new evidence or observation of peers. Through the assistance of an early childhood educator and the play types displayed in Figure 3, these everyday concepts can be transformed into scientific concepts. A scientific concept explains how and why things act, behave or work in a certain way and develops through academic instruction (Vygotsky, 1987). Educators who actively build concepts with children not only foster the academic construction of knowledge but also the use of imagination connected with reality. This role is founded within the notion of conceptual play, where imagination within a play based experience facilitates the child’s extension beyond what is known (Fleer, 2011). The educator who frames play-based experiences to conceptually interact with academic concepts supports the development of scientific concepts.
The ultimate expression of knowledge for children is when mature concepts are borne from the cohesive expression of the everyday and scientific concept. Scientific concepts alone lack an intent or applicability within a child’s life. When a child understands the reasoning behind an everyday concept from a scientific perspective, they are enabled through explanatory power to make agentic decisions (Gelman & Kalish, 2006; Halford, Wilson, & Phillips, 2010). Thus, building health and sustainability concepts through the use of play-based curriculum activities and social engagement should lead to decision making abilities. For example, a child may have a very simple everyday concept that ‘people eat carrots’. After some instruction by the educator, the child will understand that ‘people eat carrots because they are good for them’. The development of the mature concept comes when the child makes a decision: ‘I will eat a carrot because it’s healthy and good for me’. Translating their concepts into experiential action demonstrates the mature concept in action. Young children can understand and make decisions when they comprehend the reasoning behind their actions (Gelman & Kalish, 2006).

**A Pedagogical Approach to the Development of Healthy Lifestyle Behaviours**

Early childhood education as a whole including the service, the educators and the play-based curriculum they provide can influence risk factors relevant to child weight development (Waters et al., 2011). This is supported by governance at both the macro and micro level. At the macro
level, Australian healthy eating policies for food cooked in services (National Health and Medical Research Council, 2013), national curriculum frameworks (Department of Education Employment and Workplace Relations, 2009) and quality assessments (Australian Children’s Education and Care Quality Authority, 2017), guide the provision of food, the built environment and quality of early childhood education curriculum. At the micro level, internal centre-based policies like nude food (food without any packaging in lunchboxes), only offering water, and outdoor play are common in education settings. Early childhood educators tie together governance requirements, children’s funds of knowledge, and parental support through play-based curriculum experiences for the development of healthy lifestyle behaviours young children. This characterises a pedagogical response to the physical, social and digital obesogenic environments which enable unhealthy weight gain in children. Current childhood obesity research has been slow to identify the early childhood education sector’s potential in the prevention of obesity, only recently being recognised by major international health organisations (Center’s for Disease Control and Prevention, 2016; World Health Organization, 2012; Waters et al., 2011). Targeted obesity prevention strategies within the sector have slowly emerged despite the fact that the sector has long attended to health and wellbeing as an everyday best practice (Jalongo et al., 2004). A pedagogical approach for the development of healthy lifestyle behaviours in the early childhood sector,
has a role to play in a solution based approach to obesity prevention in the preschool years. As such, early childhood education has been proposed to be the 7th ‘C’ in the ecological model (Skouteris et al., 2017).

The overall aim of this PhD thesis was to mobilise the 7th C to build preschool children’s knowledge concepts about the links between healthy lifestyle behaviours and sustainability knowledge as a pedagogical approach to the development of healthy lifestyle behaviours. Building related knowledge, where two or more concept areas are combined in the one idea, is known to strengthen learning outcomes. In fact, it is standard methodology in Finland’s early childhood education system, a country that has the best education system in the world (Finnish National Board of Education, 2010). Relating health and sustainability concepts to develop new knowledge is innovative and incorporates two mandatory requirements for early childhood educators’ professional practice: The Early Years Learning Framework (EYLF) (Department of Education Employment and Workplace Relations, 2009) and the National Quality Framework (Australian Children’s Education and Care Quality Authority, 2017).

**Education for sustainability within early childhood curriculum.**

Environmental education within Australia was present within the literature as early as 1970 (Evans & Boyden, 1970) and has evolved in its expression throughout the decades (Tilbury, Coleman, & Garlick, 2005). Currently termed Education for Sustainability (Lewis, Mansfield, & Baudains, 2010),
an emphasis is on building personal responsibility and a sense of agency towards the environment (Davis, 2010). Since the research gap of education for sustainability within early childhood was identified (Davis, 2009), sustainability research has grown. This has informed practice and education for sustainability is now regularly practiced within early childhood education settings in Australia (Somerville & Williams, 2015).

**Healthy lifestyle behaviours in early childhood education curriculum.**

Health, including healthy eating and physical activity, has long been a standard inclusion in early childhood curriculum and also within the education sector (Willis, 1956). In the United States, government funded programs like Head Start which began in 1965, sought to stem the effects of poverty through early childhood education with health and nutrition components (Zigler & Styfco, 2010). In the past, Australia’s early childhood education system was largely comprised of services within the non-for-profit and faith based sectors (Elliott, 2006). The quantity, quality, and equitable access to services may explain why the Australian government has not initiated any population level initiatives like Head Start. Regardless, the welfare of children within education and care has remained paramount. Healthy eating and promotion of physical activity have become a feature of the early childhood curriculum in recent years, partially in response to mandatory requirements stated in the EYLF and the National Quality

**Using the 7th C to integrate health and sustainability in curriculum.**

Integrating health and sustainability concept knowledge in curriculum activities is a relatively new idea, supported by the notion that children’s wellbeing can grow through interactions with their natural environment (Cooke, 2010). Unfortunately, the idea of teaching these concept areas together is conceptually challenging and not practiced commonly. As a result, health and sustainability curricula have been taught in conceptual silos (Abernethy, 2016), failing to capitalise on the related aspects of the concept areas. Furthermore, the curriculum is abstracted from the natural way information presents within families and the cultural experiences shared with communities (Gonzalez et al., 2006). This can lead to ineffective teaching practices because children’s interests are not leveraged, potentially reducing their active involvement and impairing their desire to incorporate new knowledge into existing knowledge frameworks (May, 2013).

Identifying the 7th C, acknowledges the potential of the early childhood sector and the expertise of the educator, to provide solution-focused approaches to obesity prevention. The PhD program of research outlined here, focused on one possible solution — the integration of healthy lifestyle behaviour and sustainability messages within a play-based curriculum. Whilst a challenging task, the foundations are already set by: 1)
the national requirements to teach healthy eating and physical activity and sustainability concepts (Australian Children’s Education and Care Quality Authority, 2017; Department of Education Employment and Workplace Relations, 2009); 2) health and sustainability concepts have long been taught using play-based learning within early childhood settings, albeit separately; and 3) healthy lifestyle behaviour and sustainability concepts are of interest to children, especially when they are linked to young children’s popular culture interests (Edwards et al., 2016). Hence, the foundations are already in place to build context driven, integrated healthy lifestyle behaviour and sustainability knowledge in children through pedagogical play-based curricula.

**Building a context driven, integrated solutions approach to obesity prevention within early childhood.** In the past, a focus on individual risk factors has led to siloed research areas, including: obesity prevention research addressing outcomes from unhealthy eating; media research into ways children consume and use media; reduction in marketing to children; research into environmental education methodology and its incorporation into early levels of education to children. This is not an efficient way to deal with a multilayered, multifactorial problem with interconnecting factors that influence each other. Skouteris, Do, Rutherford, Cutter-Mackenzie, & Edwards (2010) called for solution-focused research linking health, sustainability and early childhood education. They ran a series of focus
group discussions with early childhood educators to clarify the effects of 360-degree marketing within their classrooms (Edwards, Skouteris, Rutherford, & Cutter-Mackenzie, 2013). One educator in these focus groups summed up the educator’s problem concisely:

“You know there is the one child who has got the Ben10\textsuperscript{tm} image on his t-shirt and it only takes one child. So, nobody could be wearing their polar fleece at kindergarten\textsuperscript{2}, but the one kid will go ‘check it out, my singlet’ and this starts the play off. We have all these children that would have the Ben10\textsuperscript{tm} yoghurt and they probably have the apple puree, and they have BBQ Shapes\textsuperscript{tm} (savoury biscuits). We always say, ‘make the healthy choice first, where is the fruit with the skin?’ So they pull it out and eat that and go ‘can I eat the shapes now?’” (Edwards et al., 2013, pp.287)

Seeing this play out over and over in their classrooms, the educators felt disempowered and unable to pedagogically respond. Their desire was to support children’s play in a way that built health and sustainability concepts, however they lacked the skills to positively engage with children’s popular culture interests given these also have negative consequences on food and toy choices.

\textsuperscript{2} In relation to this thesis, ‘kindergarten’ refers to a government funded, 4-year-old early childhood education program provided to children in the year before they start school.
Previous obesity prevention research has neglected the expertise of the educator and failed to identify the role that early childhood pedagogy can have on the development of protective factors like knowledge, skills and agency. Indeed, researcher-led top-down interventions that do not identify children’s interests and do not integrate health and sustainability messages, can limit the intervention’s reach and reduce the translation of knowledge into action (see for example Wiseman, Harris, & Lee, 2016). Building curricula without engaging children’s interests is not natural to educators because they know it is unlikely to increase knowledge or change behaviour (May, 2013). The Healthy Eating and Sustainability (HES) (initially known as the Ben 10 project – see Chapters 3 and 4) program adopted a bottom-up approach, where the expertise of the educator was acknowledged. The primary aim of the HES program was to support the educators’ abilities to integrate healthy lifestyle behaviour and sustainability messages in their pedagogical, play-based experiences in order to foster a sense of agency for future health and sustainability behaviours (Hilppö, Lipponen, Kumpulainen, & Rainio, 2016; Kumpulainen, Lipponen, Hilppö, & Mikkola, 2014).

This bottom-up approach is characterised by supporting educators to draw on children’s funds of knowledge (the cultural and historical knowledge and skills developed within a household through experience) in a different way. In a novel approach, children’s engagement with digital media, which
exposes them to popular culture interests and 360-degree marketing, is viewed as a cultural experience (Hedges, 2010). This is an innovative move within early childhood education as popular culture interests have traditionally been considered inappropriate for play-based learning (Arthur, 2001; Urbach & Eckhoff, 2012). Ignoring children’s exposure to popular culture and 360-degree marketing does not prevent their contact with it, nor does it aid in building a digital literacy that can aid in resisting the pressures of 360-degree marketing. Therefore, using these interests as the spark to build health and sustainability knowledge is original and hypothesised to produce better learning outcomes.

**Aims and Thesis Outline:**

To the author’s knowledge, no published studies, with the exception of the publications included in this thesis, have explored the integration of healthy lifestyle behaviours (main focus on health eating) and sustainability awareness using play-based experiences within early childhood curricula. The overall aim of this thesis was to determine if a pedagogical curriculum intervention delivered in the early childhood setting would foster increases in preschool children’s integrated knowledge of HES concepts.

This thesis is comprised of a series of studies and publications. Chapter 2 describes the general method for the two empirical studies presented in Chapter 3 and Chapter 6, a feasibility study and randomised trial, respectively.
Chapter 3 presents a paper published in *Early Child Development and Care* (Morris et al., 2016). The aim of this study was to evaluate the feasibility of delivering a curriculum intervention with preschool aged children.

The paper in Chapter 4 describes the curriculum educators delivered in the feasibility study and was published in *Early Years: Journal of International Research & Development*, (Edwards et al., 2016).

The paper presented in Chapter 5, submitted in *Cultural Studies of Science Education* (Edwards, Morris et al, submitted) describes the integrated healthy eating and sustainability curriculum early childhood educators produced after their professional development delivered in the feasibility study. The overall aim of this paper was to identify the range of play-based activities educators developed to engage children in wellbeing and sustainability content.

The empirical study presented in Chapter 6 describes the evaluation of the randomised trial with a primary aim to increase children’s knowledge of healthy eating and sustainability through play-based experiences. This paper has been submitted to the *Australian Journal of Early Childhood*.

Taking the learnings from the randomised trial and previous publications, a position paper that identifies the critical role early childhood
educators play in childhood obesity prevention was published in *Early Child Development and Care* (Skouteris et al., 2017).

A persistent limitation identified in papers presented in Chapters 3, 4, and 6 was the lack of parental involvement within the early childhood curriculum intervention. Preliminary exploratory research about the role of parents in early childhood education research, and their related knowledge of health and sustainability concepts was conducted as the foundation for postdoctoral research. The aim of the published paper presented in Chapter 8 was to systematically review the literature for obesity prevention interventions that have been conducted in early childhood and are settings with parent involvement.

In addition, a qualitative study was conducted with the aim to understand how parents connect the concepts of healthy eating, active play and sustainability; the findings of this study are presented in Chapter 9. Interviews were conducted with 10 parents of preschool children asking them to identify integrated knowledge connections between healthy eating, active play/physical activity and environmental sustainability. Finally, the general discussion and implications of the thesis as a whole are presented in Chapter 10.


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http://research.acer.edu.au/cgi/viewcontent.cgi?article=1003&context=aer


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CHAPTER 2 — General Method

This PhD research project is comprised of two studies: Study 1, a feasibility study; and Study 2, a randomised trial. The aim of Study 1 was twofold: (1) to evaluate the feasibility of conducting a randomised trial among 4-year-old children; and (2) to evaluate the efficacy of a curriculum intervention to improve children’s knowledge about healthy eating, active play and the sustainability consequences of their food and toy selections. The aim of Study 2 was to increase children’s healthy eating and sustainability knowledge following a play-based learning curriculum intervention delivered by early childhood educators. This chapter outlines the general method for Study 1 and Study 2 from which the publications in Chapters 3 and 6 were derived, respectively. The author of this PhD thesis was involved in all stages of each study including: recruitment, data collection from all participants, evaluation of the data, writing and submission of publications.

Ethics

This body of research was approved by the Deakin University Human Ethics Committee - HREC 2013-220 (see Appendix C), Australian Catholic University Ethics Committee- HREC201439 V and Southern Cross University Ethics Committee-HREC ECN-14-001. This research was also approved by the Victorian Department of Education and Early Childhood Development (see Appendix C).
Procedure

Design

**Study 1.** The feasibility study was designed and implemented as a randomised trial with two groups – an intervention group and a wait-list control group. A blinded randomised trial was not possible as the intervention group educators’ required knowledge of the study’s purpose to frame their curriculum activities appropriately. Wait-list control group educators received limited but not erroneous knowledge about the project, largely about their participation and that of the children. Researchers collecting the child interview data were not blinded; however, interview data were coded by researchers who did not collect the data and who did not know to which trial group the children belonged.

**Study 2.** The design of Study 2 was a randomised trial as per Study 1. No changes in the study design were made.

**Randomisation procedure.** Our industry partner, Early Childhood Management Services (ECMS) manage over 70 early childhood centres across Victoria, offering kindergarten, sessional and long day care to over 6500 children (Early Childhood Management Services, 2017). In both studies, early childhood education and care centres were recruited and randomised from the pool of services they manage.

**Study 1.** Two small regions of metropolitan Melbourne were selected: north-western and north-eastern. Two kindergarten centres were randomly
selected per region and allocated to the intervention group (2 centres) and the wait-list control group (2 centres). Randomisation occurred by selecting centre names from a drawstring bag. Allocating one centre per region to the intervention group forced the other service into the wait-list control group. This was conducted by a researcher not involved in the project. The centres were located in Hoppers Crossing, Point Cook, Tarneit and Werribee West. Across the total of 4 centres that participated, there were 12 kindergarten groups with six in the intervention and six in the wait-list control groups.

**Study 2.** ECMS have a number of services across Victoria, Australia within several Local Government Areas (LGAs). These LGA’s were used as the unit of randomisation in the larger study. On individual sheets of paper, the names and indication of socio-economic status (SES) (as measured using Socio-Economic Index for Areas (SEIFA) scores) of all LGAs that ECMS has services within were placed in a draw-string bag. As LGA’s are large geographical areas, one LGA per high and low SES region were randomly selected by pulling the name out of the drawstring bag. All eligible kindergartens within the selected LGA were invited to participate. Random permutations of 1 for intervention and 2 for wait-list control were calculated by a researcher not involved in the project using a computer algorithm. Assigning one kindergarten to a trial group forced the closest agreeable service into the opposite group. Using this process LGA’s within two large regions of Melbourne were selected: western and southern. Services in the
western region were located in the suburbs of Caroline Springs, Melton, Melton West, and Tarneit. These have lower SEIFA scores. Services in the southern region with higher SEIFA scores were located in the suburbs of Black Rock, Caulfield, Oakleigh, and Sandringham.

**Recruitment.**

*Educator recruitment.* The process of recruiting educators was the same for both Study 1 and Study 2, and occurred following the randomisation of centres. For Study 1, educators were recruited in May and early June 2014. Recruitment in Study 2 occurred approximately in February of 2015 and 2016, to allow for three data collection time points during each respective year. All educators within a kindergarten that was randomly selected to participate in the research project were eligible to participate, and were recruited at an information session about the study. The session was conducted after work hours; a meal was provided and educators were also paid for their time.

The information session was split into two parts. The first part provided an initial orientation to the project and the allocation of trial groups was identified. All educators were informed that they were not required to participate and no adverse effects from upper management would ensue if they chose to decline participation. For Study 1, no centre representative declined participation, for Study 2, two centre representatives declined participation. The study’s timeframe prevented the recruitment of
additional centres and this accounts for the uneven distribution of intervention and wait-list control services in Study 2.

**Wait-list control group.** Once all the educators agreed to participate and were aware of their trial group allocation, the wait-list control group educators were informed that they needed to leave. It was explained that the intervention group educators were about to receive part one of three professional development sessions. The wait-list control group educators were informed that they would receive the professional development six months after the intervention was delivered. In addition, they were advised that researchers would attend their services for data collection procedures, which would begin in the coming months. The wait-list control group educators were asked to continue with their usual curriculum.

**Intervention group.** The intervention group educators who remained at the session for the second part were provided with extra details pertaining to the project including: their requirement to develop and implement a play-based curriculum integrating healthy eating and sustainability messages; that their attendance at two additional professional development sessions to support their curriculum development was required; and details about the parent and child data collection procedures was provided. A plain language statement, consent form and confidentiality agreement (see Appendix D) were then supplied. These were either signed and returned on the night, returned via post using a provided reply-paid
envelope, or collected at the service when parent recruitment began. Educators were informed that parent/child dyads would be recruited from their services in the coming months and that baseline data collection would begin prior to beginning the intervention curriculum.

**Parent/child recruitment.** The parent/child recruitment procedure for Study 1 and Study 2 was the same. Parents were invited to participate via personal invitation from the researchers as they waited to collect their children from the kindergarten session. The eligibility criteria included parental age over 18 years, and the ability to read and write English. Limited funding necessitated the English language criteria. The researchers determined eligibility when they provided the parents with the plain language statement and consent forms (see Appendix D). These forms were returned either immediately, via post using a reply-paid envelope or were held at the kindergarten’s administrative office for collection by the researchers upon arrival for data collection. Information contained in the plain language statement explained the study purpose and background, what participation required for both the intervention group and wait-list control group, possible benefits and risks from participation, privacy and confidentiality, right to withdraw, details of the research team and where to direct complaints. Upon return of the consent forms, parent/child dyads were allocated an alphanumeric code for identification. All future documentation was marked with the code for identification. The master
sheet matching the participant names and their codes was saved in a password-protected folder on a Deakin University Server.

**Child assent.** Assent describes a child agreement to participate in research when consent has already been granted on their behalf. The procedure for obtaining assent from participating children was the same for both Study 1 and 2. All participating children, in line with standard research practices, were asked to provide their assent (Oulton et al., 2016). The assent form (see Appendix D) included pictures of each task that they would do with the researcher, being weighed and having their height measured and being interviewed. A happy face or an angry face with a stop sign was pictured next to the pictures of each task. Children were invited to circle the happy face if they wanted to proceed or the angry face if they did not want to proceed. They were also invited to write their name at the bottom or draw a picture if they couldn’t write. Children were able to consent to selected components of the data collection procedure (e.g., only being weighed), however this did not happen on any occasion.

**Participants**

**Descriptive statistics.**

**Study 1.** The total number of parent/child dyads recruited were 90 from the intervention group and 65 from the wait-list control. Demographic data were collected once, and characteristics were calculated from the 78 participants who responded to the survey (46 intervention group and 32
wait-list control group; See Table 1 on page 108). The demographic survey was provided only at baseline in hardcopy, which largely explains the low response rate. The mean age of intervention mothers was significantly higher than the wait-list control — 35.17 years compared with 33.16 years. This was the only significant difference in the demographic statistics calculated. The combined incidence of overweight and obesity in intervention group mothers was 37.2%, and 45.9% in wait-list control group mothers. For fathers, the combined incidence of overweight and obesity in the intervention group was 63.4% and 55.6% for wait-list control. Just under 60% of intervention mothers had a university qualification (59.6%); this was 48.6% for the wait-list control group mothers. Combined family income was essentially matched for both the intervention and wait-list control groups. For children at baseline, their mean age was 4.57 years for the intervention group and 4.69 years for the wait-list control group. Over 80% of children in both intervention and wait-list control group were a normal weight using the World Health Organisation Body Mass Index cut offs (Cole, Flegal, Nicholls, & Jackson, 2007). Demographic data were not collected from the educators; all were female with a bachelor level of education as required by ECMS.

**Study 2.** The total number of parent/child dyads recruited were 305, 172 intervention group, and 133 wait-list control group, with a final sample of 300 after five children declined assent. 241 parents responded to the
demographic survey from which the demographic statistics have been calculated (See Table 1 on page 238). The gap in non-responders to the demographic survey reduced from Study 1, because the survey was provided at every timepoint until it was completed, and in multiple formats. Non-responders did not return any questionnaires or the demographic survey. Evaluation of the demographic variables found only one significant difference for father's height. The mean age of the intervention group mothers was 35.15 years, and 35.32 years for the wait-list control group. The combined incidence of overweight and obesity for intervention group mothers was 47.9% and 43.7% for wait-list control. For fathers, this was considerably higher: 68.4% for the intervention group and 77.7% for the wait-list control group; 49.2% of intervention group mothers held a university qualification, as did 51.9% of wait-list control group mothers. As per Study 1, combined family income was very closely matched between groups. For children at baseline, the mean age for the intervention group was 4.76 years, and 4.68 years for the wait-list control group. The combined incidence of normal and underweight children was 73.1% for the intervention group and 61.8 for the wait-list control group. There were 18.6% of children in the intervention group who were at risk of overweight with 8.4% already overweight/obese; 28.2% of wait-list control group children were at risk of overweight with 10% already overweight/obese. Demographic
The Intervention

The protocol for the intervention has been published (Skouteris et al., 2014). There was no change in the intervention protocol between the delivery in Study 1 and Study 2. The intervention required early childhood educators to develop and implement play-based curriculum activities, which taught related healthy eating and sustainability concepts. Prior to the delivery of this curriculum, Professional Development (PD) sessions were provided. Up to six hours of PD was provided over a two-month period, broken into three sessions, each approximately two hours long (1.5 hours for Study 1). The first PD session for intervention educators occurred in the second half of the initial recruitment meeting: May/June for Study 1 and February for Study 2.

In this first session, a pedagogical tool kit was supplied to the educators, which supplemented the PD sessions. It included three resources designed to support educators in their curriculum development: 1) a Pedagogical Communication Strategy (PCS) borne out of worked completed prior to this PhD thesis (Edwards, Skouteris, Rutherford, & Cutter-Mackenzie, 2013) (See Appendix D); 2) a reference book titled: Young children’s play and environmental education in early childhood education (Cutter-Mackenzie, Edwards, Moore, & Boyd, 2014); and 3) a journal article
which defined the pedagogical play framework (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2016). This has since been extended to include interactive modules and exemplars of best practice approaches, see Chapter 7.

Access to a purposefully-developed website which required a password protected login, was also provided at this first session. Within this website were resources including, YouTube clips, PDF’s pertaining to healthy eating and sustainability, and content knowledge to support educators in their curriculum development. These resources would become more relevant in the second and third PD sessions.

The emphasis of the first PD session was to provide instructional guidance on how to use the PCS. The PCS is a tool which supports educators to use children’s popular culture interests in a way that supports wellbeing and sustainability education. Once the first PD session was complete, researchers began parent/child recruitment and baseline data collection.

The second PD session, conducted a month later (approximately July for Study 1; March for Study 2), focused on using the pedagogical play framework which was provided as a resource within the pedagogical tool kit. The pedagogical play framework identified three types of play — open-ended play, modelled play, and purposefully framed play (Edwards et al., 2016). The session invited educators to consider how to incorporate all three play types within the curriculum activities they would develop as part of the
intervention. The use of the three play types was identified as best practice methodology.

The third PD session conducted approximately one month later (August for Study 1; April for Study 2), was a brainstorming meeting where curriculum ideas were explored for their viability and scope. In Study 1, there was no previous evidence base with which to provide examples of play-based learning activities which integrated healthy eating and sustainability messages. However, the environmental education book from the toolkit was explored as a starting point for some of these activities. For Study 2, several activities which were trialled in Study 1 were presented as exemplars. The table from the findings presented in Chapter 4 (see Table 1, page 144) were presented and discussed.

The third PD session also outlined evidence-based, best practices for the educators to incorporate in their implementation of the curriculum where possible. These practices include: 1) implementing the play-based learning experiences in the morning if possible or early in the session to capture children’s cognitive awareness; 2) repeated implementation of the experiences up to twice a week, between four and eight weeks; and 3) use of multiple real life-world props and resources in the play-based learning experiences, e.g., food packaging. Use of all three play types in curriculum activities was also reinforced from the previous PD session.
At the conclusion of the third PD session, the educators were invited to implement their play-based intervention curriculum activities for a minimum of between four to six weeks, and up to eight weeks, as it suited their schedule. This timeframe was chosen to flexibly fit in with the educators existing planning as well as room dynamics, scheduled incursions, public and school holidays, all of which can impact on the amount of time needed to deliver curriculum. After this time, the researchers would return to conduct immediate post intervention data collection.

**Measures and Materials**

**Child data collection process.** Study 1 and Study 2 had a different number of data collection points. Study 1 had two data collection time points as the purpose of the study was to measure the feasibility of delivering the program. The time points were baseline and immediate post intervention. Study 2 had three data collection time points as originally intended — baseline, immediate post intervention, and three months’ post intervention. All children took part in a two-step data process after their assent was obtained: 1) an interview; and 2) anthropometric measures. The interview protocol required modification after Study 1’s implementation (to be discussed in detail below), while the anthropometric measurements and materials did not change. The anthropometric measures collected in both Study 1 and Study 2 were gathered for exploratory purposes and not as outcome measures.
Interview process and materials (primary outcome).

Study 1. The children’s interview was audio recorded using a ‘Zoom’ brand microphone supplied by Deakin University. The answers were also recorded on an interview sheet (see Appendix D). The interview process was conducted within the classroom, in full view of the educators and other children. Children were shown seven pictures (see Appendix D), one at a time, with a different question for each picture. The first two pictures of lollies (candy) and ice-cream (1), and fruits and vegetables (2) were accompanied by the question “what can you tell me about these foods?” The third and fourth pictures of children in a playground (3) and children sitting and using an iPad (4) had the question “what can you tell me about what these children are doing?” Questions five and six were about the biodegradability of rotting/composting fruits and vegetables (5), and plastic popular culture branded drink bottles (6); the question was phrased here was “do you think these things would turn into soil if they were buried?”. The final question was about the recyclability of paper, an empty water bottle and a cardboard box (7). This interview schedule was pilot tested, prior to commencement of Study 1, with a small sample of preschool children to determine the schedule’s relevancy, the children’s ability to complete the task, and possible responses.

Lessons learned from Study 1’s interview’s data. The data derived from the interviews did not reveal children’s knowledge of healthy eating or
active play. Rather, children were inclined to name the items they saw on the pictures, despite the open-ended questioning. Initial testing of the interview protocol prior to its implementation did not reveal this issue, and a complete revision of the interview protocol was conducted.

**Study 2.** The revised interview protocol comprised of three tasks: 1) a sorting task; 2) an example connection task; and 3) a connection task. All tasks were pilot tested with a small sample of preschool children not included in the program prior to the commencement of Study 2 in approximately January 2015. New photographs were selected collaboratively by all researchers in response to the change in the protocol. They were chosen to ensure the greatest number of possible knowledge connections between health and sustainability concepts (see Appendix D). Tasks 1 and 3 used the same eight photographs: decomposing fruit and vegetables; a Peppa Pig\(^3\) ice-cream box; several carrots; a group of children running; an empty McDonald’s fries box; a water drop; children watching television with a McDonalds advertisement; and two council rubbish bins. Task 2 used three images: a cup, a clock and two bottles of milk. All interviews were audio recorded and comments were recorded on the interview sheet (see Appendix D).

The sorting task required the use of two, A4 sized laminated pieces of paper, one with a large green circle and one with a large red circle. These

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\(^3\) a commercial television program popular with preschool aged children
were placed on the table in front of the child. The child was told that the green circle meant ‘go, do or eat that’ and the red circle meant ‘stop, don’t do or don’t eat that’. Children were shown each of the eight pictures in random order and asked, would you put this picture with green, (go, do or eat that) or red (stop, don’t do or don’t eat that). A justification of the sorting choice was not sought, as the duration of the interview protocol was already at the maximum for a preschool child’s quality attendance at a task (Mahone & Schneider, 2012). The example exercise used three different pictures, of cups, clock and two bottles of milk. Children were asked ‘which pictures do you think belong together’? The correct answer was cup and milk. In the final task, all eight pictures from Task 1 were placed randomly on the table. Children were asked, ‘looking at these pictures again, do any of these belong together? When the child had made their selection, children were then asked, ‘why do they belong together?’ This continued until the child expressed that all options were exhausted. Children were thanked for their time and told they could return to their classroom activities or complete the anthropometric measures if they had not been conducted.

**Anthropometric measures and materials.** Children were asked to remove their socks, shoes, bulky clothes and headwear prior to any measurements. A stadiometer was used to measure height (handy height scales model PE087), and medical grade digital scales were used for weight (Charder model MS-3200). A child was asked to step onto the stadiometer
with their heels together, touching the metal upright. The measuring device was lowered onto their head and their height was recorded onto the respective interview sheets for Study 1 and Study 2 (see Appendix D). The child was then asked to step onto the scales and without touching anything wait until the numbers came up. The researcher then recorded the weight to one decimal point onto the interview sheet. This process remained the same for Study 1 and 2.

**Parent data collection process and materials.** All parents were required to fill in the Eating and Physical Activity Questionnaire (EPAQ) (Bennett, de Silva-Sanigorski, Nichols, Bell, & Swinburn, 2009) at data collection points coinciding with their child’s data collection. At baseline, demographic questions were included. These questions were in three sections: 1) child details including gender, country of birth, birth order, number of siblings; 2) mothers and fathers’ details including age, country of birth, highest level of education, height and weight; 3) family income, starting at $25,000 or below, and increasing in increments of $20,000 to over $145,000 (see appendix).

**Eating and Physical Activity Questionnaire.** The EPAQ has good relative validity compared to 24-hour recall food intake data, and is specifically for use with preschool populations (Bennett, de Silva-Sanigorski, Nichols, Bell, & Swinburn, 2009). The questionnaire is deemed to have a low time burden because it takes approximately 5-10 minutes to complete.
It contains questions in three sections. It begins with questions about sedentary and physical activity. Parents are asked to identify how long their child consumed screen time across the morning, afternoon and evening of the previous day. Thinking about the previous week, parents were asked to state how frequently the child went somewhere for physical activity. They are also asked for their perception of their child’s preference of play-type either active play with movement, inactive, sedentary play or both equally.

The second set of questions were about the child’s beverage consumption the previous day. The five beverages specifically identified in the questionnaire were plain milk, flavoured milk, soft drink or sugar sweetened drinks, water or juice serves consumed. The range of servings to select from were zero to six or more, with a ‘don’t know option. The beverage serving size was stated as being 125mls. Parents were invited to share if they diluted any of the beverages when their child drinks them with a yes or no tick box.

The third set of questions was about food consumption. A range of commonly consumed foods were investigated rather than a complete recall of meals consumed. The question asked ‘yesterday, how many servings of the following foods did your child have? A serving size was described for each food types: vegetables (1/2 cup cooked vegetables or baked beans, or 1 cup salad), packaged snacks (30g packet chips, one fruit strap or one muesli bar), fruit (one apple or banana, or 1 cup grapes, or 11/2 tbsp. sultanas),
confectionary (1/2 regular chocolate bar or small handful of lollies) and cakes/cookies (1 small slice of cake, 1 iced donut or 4 plain sweet biscuits). The possible serving available for selection was zero, half, up to five or more. A ‘don’t know’ option was also available. Two further questions were asked. Parents were invited to share their child’s usual vegetable intake measured by number of serves, and frequency of takeaway or fast-food consumption; the possible selections were less than once a month, 1·3 times per month, once per week, 2·4 times per week, up to 2 or more times a day. This concluded the questionnaire and parents were thanked for their participation.

**Study 1.** The EPAQ was collected from parents at two-time points, with the first questionnaire including baseline demographic questions (see Appendix D). The parents were given the questionnaire in hardcopy only, attached to a letter telling parents that their child had been interviewed that day. Parents were asked to use the reply-paid envelope provided or hand it to their child’s educator for collection by the researchers. Educators were responsible for following up with parents on the return of the EPAQs.

**Lessons learned from Study 1’s parent data collection procedure.** Feedback from parents and educators from the pilot study revealed problems with the questionnaire’s delivery and educator follow-up. Hardcopy only versions of the questionnaire were not welcomed by parents. Electronic versions needed to be made available. Parents were also reluctant to do the
questionnaire more than once. The educators stated that they did not have time to follow up parents about the questionnaires. Changes based on feedback were incorporated into the data collection procedure for the second study.

**Study 2.** Firstly, the researchers took on the role of following up parents about the questionnaires. Secondly, in an effort to reduce parental non-compliance with the EPAQ return, parents were offered a $15 Coles/Myer voucher upon completion and return of all three questionnaires at baseline, immediate post intervention and 3 months’ post intervention). In addition, the EPAQs were provided in hard copy and through a mobile friendly, digital link which was emailed. Parents were also telephoned after two reminder emails and two text messages, with the offer of completing the questionnaire over the phone.

**Educator data collection process and materials.**

**Study 1.** In an effort to obtain data about the curriculum that the educators produced, each educator was given a checklist to complete each week (see Appendix D) that: requested a brief description of the delivered curriculum; the time and duration of the intervention; number of children involved; props and resources used; assessment records used; and how the curriculum activities aligned with the Early Years Learning Framework Learning Outcomes (Department of Education Employment and Workplace Relations, 2009). The educators were asked to provide copies of their usual
planning and documentation to supplement the checklists. At the close of
the intervention, educators were invited to fill out a feedback survey and
participate in a focus group discussion with researchers (see interview
schedule in Appendix D). This feedback was required not only as part of the
feasibility evaluation but also to uncover the limitations, educators’
perceived value and use of the PCS in their curriculum development. The
focus group discussion was conducted at the kindergarten, after work hours
and a meal was provided; their employer also paid for their time. The focus
group discussion lasted one hour, was audio recorded and transcribed
verbatim. Analysis of this data can be found in Chapter 4.

Lessons learned from Study 1’s educator data collection. The pre-
prescribed nature of the checklist and heterogeneous documentation which
was received in Study 1’s data collection procedure revealed the need for a
different way to collate data. Changes in the educator data collection
procedure occurred in Study 2.

Study 2. To ensure comprehensive data, educators were asked to
compile their usual curriculum planning and implementation documentation
in a provided A3 sized visual diary, instead of the checklist. Documentation
of curriculum activities is a required part of an educator’s professional
practice and it includes Learning Stories (Carr & Lee, 2012), photographs,
planning notes and thoughts. The visual diaries were collected at the
conclusion of the intervention period. Analysis of these visual diaries is
presented in Chapter 5. Due to the broad geographical distance between educators both within and between regions, a single focus group discussion could not be held. Rather, individual, one-hour long interviews were conducted within work hours and a relief educator was employed to cover their absence in the classroom. The purpose of the interview was to determine the value of the professional learning, specifics of curriculum intervention from the educator’s perspective. These interviews were audio recorded and transcribed verbatim (see Appendix D for interview schedule).

**Statistical Analysis**

Details pertaining to each study’s analyses are outlined in their respective chapters; see Chapter 3 for Study 1 and Chapter 6 for Study 2. Further methods about the evaluations conducted for Study 1 and Study 2 can be found in the respective methods sections of the published papers in Chapter 3, 4, 5 and 6.

No statistical adjustments for clustering effects conducted for Study 1 or Study 2. There were several factors that indicated that the data would be independent and the effect of any clustering would be insignificant: 1) the curriculum provided to the was different for each kindergarten class; 2) the number of children recruited per kindergarten class was small; 3) there was no cross over of children between groups, kindergartens, suburbs or local government areas. In addition, a multi-level model analysis was conducted
for Study 2 and no differences in results were found for the outcome measures.
References


contemporary health, well-being and sustainability issues with
research into children’s play. Victoria, Australia: Deakin University.
CHAPTER 3 — Feasibility of Conducting a Randomised Trial to Promote Healthy Eating, Active Play and Sustainability Awareness in Early Childhood Curricula

Abstract

We sought to evaluate the feasibility of conducting a randomised trial to evaluate the efficacy a preschool/kindergarten curriculum intervention designed to increase 4-year-old children’s knowledge of healthy eating, active play and the sustainability consequences of their food and toy choices. 90 intervention and 65 control parent/child dyads were recruited. We assessed the study feasibility by examining recruitment and participation, completion of data collection, realisation of the intervention and early childhood educators’ experiences of implementing the study protocol; our findings suggest the intervention was feasible to deliver. In addition, children’s sustainability awareness of non-compostable and recyclable items increased. Children in the intervention group significantly reduced their sugary drink consumption and increased their vegetable intake at follow-up compared to control. We conclude with recommendations for revisions to the child interview and parent questionnaire delivery to ensure the roll out of the randomised trial is conducted efficiently and rigorously.
Key words: curriculum intervention, 4-year-old children, pilot feasibility evaluation, healthy eating, sustainability awareness

**Introduction**

Relatively few healthy eating and active living interventions have been conducted in early childhood settings as a prelude to obesity prevention (Waters et al., 2011). We know that the development of healthy lifestyle behaviours during the formative preschool years are influenced by ‘360-degree marketing’ - the media environment that sees young children exposed to multiple forms of advertising for high calorie foods and products such as toys and clothing (Edwards, 2013; Schor, 2004). As researchers from traditionally diverse fields, including obesity prevention, early childhood education, digital media education, and environmental education, we developed a pedagogical communication strategy titled ‘Generating New Knowledge in Early Childhood Education: Aligning Contemporary Health, Wellbeing and Sustainability Issues with Research into Children’s Play’ (Edwards et al., 2013). It integrates digital media education, environmental education and obesity prevention strategies for early childhood educators.

We were keen to establish the efficacy of using a pedagogical strategy to help preschool children respond to the significant pressures of ‘360-degree marketing’. Consequently, we performed a pilot study to assess the feasibility of conducting a randomised trial among 4-year-olds to evaluate the efficacy a preschool/ kindergarten curriculum intervention. These
interventions were designed by educators using the pedagogical communication strategy. We sought to evaluate effects of the intervention on children’s knowledge about healthy eating, active play and the sustainability consequences of their food and toy selections. The specific objectives of the feasibility evaluation were to examine recruitment and participation, completion of data collection, realisation of the intervention and early childhood educator’s experiences of implementing the study protocol. We hypothesised that the study protocol would be feasible to implement within the early childhood education setting.

Methods

Study Design

The pilot study was conducted in two services run by Early Childhood Management Services (ECMS) in the north-western regions and two in the north-eastern regions of Melbourne, Victoria; one service from each region was allocated at random to the intervention group and the other was allocated to the waitlist control group. In total, the intervention was delivered, with the consent of the educators, to six kindergarten groups across the two regions; the waitlist control also comprised six kindergarten groups. Baseline measures were obtained prior to the curriculum interventions being delivered by educators in their classrooms; follow-up assessments took place immediately following the completion of the intervention strategy.
Study Protocol

The study protocol has been published (Skouteris et al., 2014). The six intervention educators were provided with a copy of the pedagogical communication strategy and a book titled ‘Young children's play and environmental education in early childhood education’ (Cutter-Mackenzie et al., 2014). Using these resources, they were asked to develop a curriculum intervention that integrated content knowledge about healthy eating, active play and sustainability awareness. The intervention educators also participated in three, 1.5-hour professional learning sessions about digital media, popular-culture, health and environmental education in early childhood; these sessions took place between early June and early August, 2014. Sessions were conducted by investigators with expertise in the delivery of professional learning programs to educators and with content knowledge in the areas of play-based learning, environmental education, digital media literacy and healthy eating. Educators subsequently planned, developed and implemented a series of learning experiences with the children attending their kindergartens from early August to mid-September, 2014. The professional development sessions have been described in detail elsewhere (see Edwards et al. 2015). The control wait-list educators participated in an information session about the project and then continued their practice as usual.
Recruitment of children and parents occurred in June and July 2014; 155 children and their parents (all mothers) consented and completed baseline measures between late July and early August in 2014 and follow-up data were collected in late September 2014.

The project has been approved by the Victorian Department of Education and early Childhood Development, and by the Human Research Ethics Committees of Deakin University, Australian Catholic University, and Southern Cross University (DHREC 2013–220, 2014 39 V, and ECN-14-001, respectively).

**Children’s Knowledge of Healthy Eating, Active Play, and Environmental Sustainability of Their Food and Toy Selections**

All children provided assent for their participation prior to any measurements being taken. During a semi-structured interview, children’s knowledge of healthy eating, active play, and environmental sustainability was assessed using picture cards. The child interview protocol was based on the work of Lanigan (2011). The interview began with children being asked ‘what can you tell me about these foods’ when looking at images of ice-cream and confectionary (image 1) and fruits and vegetables (image 2). They were then asked ‘What can you tell me about what these children are doing?’ looking at children in sedentary activities with T.V., iPad and reading (image 3) vs. actively playing children on a playground (image 4). The environmental questions sought to understand children’s knowledge of
degradable or non-degradable items when buried. When looking at fruit and vegetable scraps (image 5) children were asked “do you think these things will turn to soil if they are buried”? They were asked the same question when looking at a Dora and Ben 10 plastic drink bottle (image 6). The final question was ‘which items can be recycled’ when looking at items in the last picture, that included paper, an empty box and a bottle of water (image 7).

**Children’s Food Preferences, Digital Media Viewing and Physical Activity Habits**

The Eating and Physical Activity Questionnaire (EPAQ) was used to measure children’s food and beverage preferences, and their sedentary and physical activity habits (Bennett, de Silva-Sanigorski, Nichols, Bell, & Swinburn, 2009). This questionnaire took 5-10 minutes to complete by parents. Parents indicated the number of servings of foods and beverages consumed by their child yesterday. Serving sizes available for selection ranged from 0, ½ up to 5 or more (6 or more for beverages), or ‘don’t know’. Snack or packaged foods were assessed using three categories: confectionary or chocolate; packaged foods; baked cakes and biscuits. The serving amount from these three variables were added to form an ‘unhealthy foods’ composite variable. Vegetable consumption was measured in two ways: by the number of servings eaten yesterday and also by indicating the child’s usual vegetable consumption. Fruit was measured in servings eaten yesterday. Five commonly consumed beverages by children were surveyed
for their consumption yesterday: fruit juice, cordial/flavoured sugar drink or soft drink, water, plain milk and flavoured milk. Juice, cordial/flavoured sugar drink /soft drink and flavoured milk servings were added to form a ‘sweet drink’ total score. Water and plain milk were assessed individually.

Physical activity was measured by number of times the child went somewhere for physical activity (e.g., To the park) and parents’ selection of their child’s preferred free time activity: either ‘usually chooses inactive pastimes’, ‘just as likely to choose inactive as active pastimes’ or ‘usually chooses active pastimes’. Sedentary behaviour was measured in number of minutes spent doing sedentary activities yesterday in the morning, afternoon and evening.

**Children’s Anthropometry**

Children were measured at each assessment using a stadiometer for height (handy height scale, model PE087) and standardised digital scales for weight (Charder, model MS-3200). Before weighing, children were invited to remove their shoes and take off jackets and hats to ensure that they were only wearing light clothing. These measurements were used to produce a body mass index (BMI, kg/m2) score for each participant. This score was standardised for age and gender using BMI-for-age z scores. Changes were evaluated using the BMI z score (BMIz) slope (Faith, Scanlon, Birch, Francis, & Sherry, 2004) according to the World Health Organisation (WHO) recommendations for children in this age group (de Onis M., 2006).
The Control Wait-List Group

Children in the control groups received “usual care” by their educators. The qualitative child interviews and the parent survey measures were administered at the same time points as the intervention groups (baseline and equivalent time to follow-up). The control group educators received the pedagogical communication strategy and the professional development sessions after the intervention was completed and follow-up data collected.

Educator Measures

Data collected from the educators consisted of the curricula developed for delivery in the project and children’s learning about environmental education and healthy eating as documented through assessment records, learning stories (Carr & Lee, 2012) and completion of a checklist that was provided to all educators. These measures were collected at the focus group discussion after the intervention was delivered in late November, 2014.

Feasibility Evaluation

The feasibility evaluation included an assessment of the following indicators (Kinnunen et al., 2008):

1) Recruitment and participation: Information on recruitment and participation numbers.

2) Completion of data collection: Assessment of data completeness was measured by the number of completed and returned parent
questionnaires at baseline and at follow-up and the number of child
interviews and anthropometric measures taken at baseline and follow-up.

3) Realisation of the intervention: An evaluation of the intervention delivery
was undertaken using a checklist. The checklist was provided to the
educators prior to the intervention delivery and had five sections. The
checklist was used to evaluate compliance with the following six points:
1) implementation of the intervention over 1-2 days across 3-4 weeks; 2)
morning delivery of the intervention; 3) use of a combination of whole
group and small group experiences and discussion; 4) use of real world
props like toys and food boxes; 5) maintenance of assessment records; and
6) linkage of curriculum intervention components to specific Early Years
Learning Framework outcomes (Department of Education Employment
Workplace Relations, 2009).

The EPAQ data were analysed for changes in children’s eating and
physical activity behaviours between the intervention and control groups
both at baseline and follow-up. In addition to the evaluation of the curricula
and intervention delivery from the educator’s perspective, the children’s
participation rates in the protocol were evaluated to determine if the
protocol is feasible to deliver: this was measured by a refusal rate expressed
as a percentage of the total number of children/families invited.
4) The educators’ experiences: Educators were asked for their feedback via:

(1) a focus group discussion, and (2) a feedback form which had five
questions about the implementation and delivery of the protocol.

Results

Recruitment and Participation

The total pool of children available to participate was 213 in the
intervention and 180 in the control. The number of children and parents (all
mothers) recruited was 90 and 65 in the intervention and control group,
respectively. All demographic variables were not significantly different
apart from maternal age where intervention mothers were slightly older, see
Table 1. All preschool groups were able to recruit equal to or more than ten
children per class as per the study protocol (Skouteris et al., 2014).
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<th>Table 1 Demographic Statistics</th>
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M-Mean; SD- Standard Deviation; N-number; Min-Minimum; Max-Maximum

*= Significant difference when comparing intervention to control

#Thinness grade 1,2,3 combined

† Child BMI statistics presented are z scores whereas maternal and paternal BMI are unstandardized scores.
The ECMS organisation was fully supportive of the project working collaboratively with the investigators to facilitate the pilot study. ECMS paid for replacement staff and the intervention educator’s time while attending the professional development sessions. The ECMS Early Years Advisors (EYAs) were a supportive conduit between the ECMS head office and each individual service. The educators put in considerable effort to develop curricula for the project. All intervention educators were female and held a qualification in early childhood education.

**Completion of Data Collection**

**Educator data.** Data collected from the educators consisted of an overview of the curricula developed using assessment records and a completed checklist. The checklist was used by five of the six educators; the educator who did not use the checklist, provided a brief description of the curriculum she delivered. While educators developed their curricula independently, there was a similar focus on food, rubbish, lunchbox evaluations and active play.

Evaluation of the checklist was undertaken to ensure that the data were complete.

(1) The first item on the checklist was the date and time the interventions were implemented. In all cases the intervention was run over a five-week period from the 18th of August to the 19th of September, 2014. Each week, play-based learning experiences were undertaken with
the children that varied in their delivery time anywhere from 5-10 minutes to all day events.

(2) It was suggested that educators implement the intervention in the morning when the children were most cognitively attentive. However, this was not possible every day as the pre-set session times included both mornings and afternoons, for example from 8:30 to 12:30 and 1:30 to 4:30.

(3) The total number of small-group and whole-group activities that were undertaken were not specifically documented by the educators; however, all educators reported using both whole group and small group activities when delivering their curriculum.

(4) Real world props were used to support the curricula. Since the topics were food related, commonly used props included actual lunchbox items, McDonalds packaging, the food pyramid and worm farms. The environmental connections to foods were topics related to waste and recycling (Edwards et al., 2015). The props used to explore these concepts included rubbish bins and clean ‘rubbish’ (i.e., plastic containers to sort into bins with appropriate symbols and pictures). Natural decomposing support props including compost, worm farms and food waste were used to facilitate activities and discussions in several curricula. Two groups buried degradable and non-degradable items in the soil to see what happens to them.
(5) The educators maintained assessment records of each child during the curriculum interventions through Learning Stories (Carr & Lee, 2012), observations and a detailed portfolio of experiences (Edwards et al., 2015). The final item on the checklist was to classify the curricula activities into one or more of the five Australian EYLF outcomes (Department of Education Employment Workplace Relations, 2009): 20 curricula activities were classified as achieving outcome 3 (Children have a strong sense of wellbeing); 18 for outcome 4 (Children are confident and strong learners) and 12 for Outcome 2 (Children are connected with and contribute to their world). There were two activities classified as achieving Outcome 1 (Children have a strong sense of identity) and five activities for Outcome 5 (Children are effective communicators).

**Parent’s Data.** At baseline, 90 and 65 parents completed the EPAQ in the intervention and control groups, respectively. The return rates at the second time point declined to 52.2% (47 parents) in the intervention group and 53.8% (35 parents) in the control group. This significant reduction was attributed to a number of factors including parents not returning hardcopy questionnaires and the responsibility resting on the educators to follow-up with parents at a very busy time (the end of the school year). Additional support for the collection of parent questionnaires is indicated.

**Children’s Data.** At baseline, 90 and 65 children participated in the intervention vs. control group. At follow-up 85 (94.4%) intervention children and 61 (93.8%) control children were measured and interviewed.
Attrition in child interview and anthropometric measures was attributed to illness, absenteeism, and child having left the service. The interview protocol capturing children’s knowledge of healthy eating, active play and environmental sustainability was only partially effective; it did not capture children’s knowledge of healthy eating or active play as children named the objects on the pictures without discussing their content or themes. Children responded to the environmental sustainability questions, providing their knowledge about what was and was not compostable or recyclable.

**Realisation of the intervention.** The educators complied with the intervention protocol by completing all research requests.

**Child BMI and the Eating and Physical Activity Questionnaire (EPAQ) data**

At baseline, the intervention group had a statistically (p=0.047) lower mean BMIz score (0.09, SD = 1.04) than children in the control group (0.50, SD = 0.77); 7.2% of the children were overweight and obese at baseline in the intervention and 18.8% in the control group. This difference remained significant at follow-up; p=0.049 (see Table 2). This significant difference is attributed wholly to presence of six children in the intervention group who are categorised as ‘thin’ on the WHO BMI scale. Removal of these children when making BMIz score comparisons between groups removes the significant difference (data not shown). The EPAQ was given to parents to complete at two time points: baseline and follow-up: parents received the EPAQ on the day their child participated
in the interview and measurement protocol. We present the findings here of comparisons between baseline and follow-up but caution against rigorous interpretation because our pilot study was not powered to evaluate these differences. At baseline there were no significant differences between the intervention and control group on the EPAQ variables, apart from intervention children going out more often for physical activity than the control (p= 0.041) (see Table 2). At follow-up, a significant difference was present for two variables: vegetable intake yesterday and sugary drink servings. The intervention group slightly increased their vegetable servings from 1.53 to 1.58 serves, while the control group decreased their serving from 1.23 to 1.04 per day; (p=0.002) (See Table 3). In addition, the intervention group reduced their sugary drink consumption from 1.08 to 0.77 servings a day, while the control group remained relatively constant (1.53 servings at baseline vs.1.47 servings at follow-up) (p=0.046).

Changes were seen in activity measures in the intervention group. The average number of times intervention children were taken somewhere for physical activity increased significantly from 2.90 times to 3.45 times per week (p=0.009). There were no significant changes in the control group on this variable (p=.276). The number of sedentary minutes decreased for the intervention group but not significantly. The control group significantly decreased their sedentary behaviour from baseline to follow-up (p=0.008) which is explained by an unusually high baseline mean.
Table 2 Eating and Physical Activity Questionnaire (EPAQ): Intervention compared to control at baseline and follow up.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Control</th>
<th>Difference</th>
<th>T test (DF)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usual serves of vegetables</td>
<td>1.52 (0.89)</td>
<td>1.43 (0.88)</td>
<td>0.09</td>
<td>0.668 (151)</td>
<td>0.505</td>
</tr>
<tr>
<td>N=88</td>
<td>N=65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable intake in serves yesterday</td>
<td>1.32 (1.11)</td>
<td>1.23 (1.04)</td>
<td>0.29</td>
<td>1.646 (133)</td>
<td>0.159</td>
</tr>
<tr>
<td>N=82</td>
<td>N=65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit intake in serves yesterday</td>
<td>1.95 (1.13)</td>
<td>1.77 (1.17)</td>
<td>0.18</td>
<td>0.925 (150)</td>
<td>0.102</td>
</tr>
<tr>
<td>N=90</td>
<td>N=61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Food serves yesterday</td>
<td>3.42 (1.91)</td>
<td>2.90 (1.74)</td>
<td>0.52</td>
<td>1.759 (153)</td>
<td>0.081</td>
</tr>
<tr>
<td>N=90</td>
<td>N=61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet Drinks serves yesterday</td>
<td>1.08 (1.40)</td>
<td>1.53 (1.70)</td>
<td>-0.45</td>
<td>-1.517 (111)</td>
<td>0.132</td>
</tr>
<tr>
<td>N=68</td>
<td>N=45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Energy snack foods serves yesterday</td>
<td>1.49 (0.97)</td>
<td>1.66 (1.60)</td>
<td>-0.17</td>
<td>-0.757 (136)</td>
<td>0.450</td>
</tr>
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<td>N=82</td>
<td>N=56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water serves yesterday</td>
<td>3.92 (1.44)</td>
<td>3.87 (1.58)</td>
<td>0.05</td>
<td>0.195 (150)</td>
<td>0.846</td>
</tr>
<tr>
<td>N=89</td>
<td>N=63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain Milk serves yesterday</td>
<td>1.24 (0.97)</td>
<td>1.52 (1.35)</td>
<td>-0.28</td>
<td>-1.48 (86.5)</td>
<td>0.189</td>
</tr>
<tr>
<td>N=82</td>
<td>N=53</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary behaviour minutes yesterday</td>
<td>122.94 (81.73)</td>
<td>139.91 (68.01)</td>
<td>-16.97</td>
<td>-1.343 (149)</td>
<td>0.181</td>
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<tr>
<td>N=89</td>
<td>N=62</td>
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<td></td>
<td></td>
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<tr>
<td>Frequency of child taken to a place for physical activity</td>
<td>3.19 (1.92)</td>
<td>2.61 (1.36)</td>
<td>0.58</td>
<td>2.062 (152)</td>
<td>0.041*</td>
</tr>
<tr>
<td>N=89</td>
<td>N=65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child BMIz score</td>
<td>0.09 (1.04)</td>
<td>0.50 (0.93)</td>
<td>-0.41</td>
<td>-2.01 (80)</td>
<td>0.047*</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Intervention Mean (SD)</td>
<td>Control Mean (SD)</td>
<td>Difference</td>
<td>T test (DF)</td>
<td>P value</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>Usual serves of vegetables</td>
<td>1.48 (1.02) N=46</td>
<td>1.32 (0.74) N=35</td>
<td>0.16</td>
<td>0.817 (79)</td>
<td>0.461</td>
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<tr>
<td>Vegetable intake in serves yesterday</td>
<td>1.58 (1.16) N=47</td>
<td>1.04 (0.89) N=34</td>
<td>0.54</td>
<td>2.266 (79)</td>
<td>0.02*</td>
</tr>
<tr>
<td>Fruit intake in serves yesterday</td>
<td>1.77 (1.00) N=47</td>
<td>1.65 (1.06) N=35</td>
<td>0.12</td>
<td>0.520 (80)</td>
<td>0.605</td>
</tr>
<tr>
<td>Healthy Food serves yesterday</td>
<td>3.36 (1.77) N=47</td>
<td>2.67 (1.52) N=35</td>
<td>0.69</td>
<td>1.848 (80)</td>
<td>0.068</td>
</tr>
<tr>
<td>Sweet Drinks serves yesterday</td>
<td>0.77 (0.92) N=45</td>
<td>1.47 (1.79) N=34</td>
<td>-0.70</td>
<td>-2.228 (46.2)</td>
<td>0.046*</td>
</tr>
<tr>
<td>High Energy snack foods serves yesterday</td>
<td>1.52 (1.33) N=47</td>
<td>1.82 (1.79) N=34</td>
<td>-0.30</td>
<td>-0.870 (79)</td>
<td>0.387</td>
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<tr>
<td>Water serves yesterday</td>
<td>4.19 (1.29) N=47</td>
<td>4.05 (1.67) N=35</td>
<td>-0.03</td>
<td>-0.169 (80)</td>
<td>0.866</td>
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<tr>
<td>Plain Milk serves yesterday</td>
<td>1.32 (0.79) N=40</td>
<td>1.31 (0.73) N=32</td>
<td>0.01</td>
<td>-0.068 (70)</td>
<td>0.946</td>
</tr>
<tr>
<td>Sedentary behaviour minutes yesterday</td>
<td>115.70 (62.09) N=47</td>
<td>116.14 (60.47) N=35</td>
<td>-0.44</td>
<td>-0.032 (80)</td>
<td>0.974</td>
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<tr>
<td>Frequency of child taken to a place for physical activity</td>
<td>3.36 (1.50) N=47</td>
<td>3.00 (1.90) N=35</td>
<td>0.36</td>
<td>0.976 (80)</td>
<td>0.332</td>
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<tr>
<td>Child BMIz score</td>
<td>0.06 (1.03) N=46</td>
<td>0.50 (0.74) N=37</td>
<td>-0.44</td>
<td>-2.02 (81)</td>
<td>0.049*</td>
</tr>
</tbody>
</table>

Note:
An asterisk indicates a significant result p=< 0.05
N: Number
SD: Standard Deviation
DF: Degrees of Freedom
BMIz: Body Mass Index zscore
Table 3 Eating and Physical Activity Questionnaire (EPAQ): Within group changes baseline to follow-up

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (SD) n</td>
</tr>
<tr>
<td>Usual serves of vegetables</td>
<td>1.52 (0.89) 88</td>
</tr>
<tr>
<td>Vegetable intake in serves yesterday</td>
<td>1.52 (1.11) 87</td>
</tr>
<tr>
<td>Fruit intake in serves yesterday</td>
<td>1.95 (1.13) 90</td>
</tr>
<tr>
<td>Healthy Food serves yesterday</td>
<td>3.42 (1.91) 90</td>
</tr>
<tr>
<td>Sweet Drinks serves yesterday</td>
<td>1.08 (1.40) 68</td>
</tr>
<tr>
<td>High Energy snack foods serves yesterday</td>
<td>1.49 (0.97) 82</td>
</tr>
<tr>
<td>Water serves yesterday</td>
<td>3.92 (1.44) 89</td>
</tr>
<tr>
<td>Plain Milk serves yesterday</td>
<td>1.24 (0.97) 82</td>
</tr>
<tr>
<td>Sedentary behaviour minutes yesterday</td>
<td>122.9 (81.73) 89</td>
</tr>
<tr>
<td>Frequency of child taken to a place for physical activity</td>
<td>3.19 (1.92) 89</td>
</tr>
<tr>
<td>Child BMIz score</td>
<td>0.09 (1.04)</td>
</tr>
</tbody>
</table>

*Note:*
SD-Standard Deviation; DF-Degrees of Freedom; n-number; BMIz-Body Mass Index z score; An asterisk indicates a significant result p=< 0.05
**Children’s Data.** The delivery of the interview and measurement protocol saw no adverse events reported to either research or education staff. Most children were happy to participate in the interview and measurement protocol: 97.8% of intervention and 95.3% of control children participated. The refusal rate at baseline was low: 2.2% in the intervention group and 4.7% in the control group with no refusals at follow-up.

While the interview process did not uncover children’s knowledge of healthy eating and active play, it did show changes in children’s knowledge about what items could (Question 5) and could not (Question 6) be composted and recycled (Question 7), (see Table 4). A Pearson’s chi-square analysis and fisher’s exact test was utilised for the analysis of these questions. No significant differences were found when comparing the intervention to the control group on question 5, 6, or 7 at either baseline or follow-up. Intervention group children were close to a significant increase in knowledge at follow-up about compostable items (Question 5) when compared to the control group (p=0.051). A number of significant within group differences were found. Both intervention and control group children’s understanding of items being non-compostable (Question 6) increased from baseline to follow up, (Intervention, p=0.010; Control, p=0.021. Control group children’s knowledge of compostable items (Question 5) significantly decreased with the number of incorrect answers increasing from baseline (25) to follow-up (35) \( \chi^2=11.875 \) (1), \( p=0.001 \). Intervention group children demonstrated a significant
Table 4 Qualitative interview data

**Question 5:** Do you think these items would turn to soil if they were buried? (compostable items) Correct: Yes

**Question 6:** Do you think these items would turn to soil if they were buried? (non-compostable items) Correct: No

<table>
<thead>
<tr>
<th>Between Group differences</th>
<th>Intervention</th>
<th>Control</th>
<th>Intervention</th>
<th>Control</th>
<th>Chi Square $X^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Question 5 Baseline</td>
<td>33</td>
<td>25</td>
<td>42</td>
<td>33</td>
<td>$X^2=0.011$ (1), p=0.918</td>
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<tr>
<td>Question 5 Follow up</td>
<td>34</td>
<td>35</td>
<td>49</td>
<td>26</td>
<td>$X^2=3.795$ (1), p=0.051</td>
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<tr>
<td>Question 6 Baseline</td>
<td>73</td>
<td>54</td>
<td>10</td>
<td>10</td>
<td>$X^2=0.393$ (1), p=0.531</td>
</tr>
<tr>
<td>Question 6 Follow up</td>
<td>75</td>
<td>56</td>
<td>8</td>
<td>5</td>
<td>$X^2=0.089$ (1), p=0.765</td>
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</table>

**Within Group Differences: Intervention Group**

<table>
<thead>
<tr>
<th>Question 5 Baseline to Follow up</th>
<th>Baseline</th>
<th>No</th>
<th>Yes</th>
<th>$X^2=1.094$ (1), p=0.296</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Follow up</td>
<td>33</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Question 6 Baseline to Follow up</td>
<td>Baseline</td>
<td>73</td>
<td>10</td>
<td>p=0.010, FET *</td>
</tr>
<tr>
<td></td>
<td>Follow up</td>
<td>75</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Within Group Differences: Control Group**

<table>
<thead>
<tr>
<th>Question 5 Baseline to Follow up</th>
<th>Baseline</th>
<th>No</th>
<th>Yes</th>
<th>$X^2=11.875$ (1), p=0.001 * (negatively)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Follow up</td>
<td>25</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Question 6 Baseline to Follow up</td>
<td>Baseline</td>
<td>54</td>
<td>10</td>
<td>p=0.021, FET *</td>
</tr>
<tr>
<td></td>
<td>Follow up</td>
<td>56</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Question 7:** Which items do you think can go in the recycle bin? The child is shown a picture of some paper, a cardboard box and an empty water bottle. Correct: 3

<table>
<thead>
<tr>
<th>Between Group Differences</th>
<th>IG 1</th>
<th>CG 1</th>
<th>IG 2</th>
<th>CG 2</th>
<th>IG 3</th>
<th>CG 3</th>
<th>Chi Square</th>
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</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>17</td>
<td>14</td>
<td>13</td>
<td>10</td>
<td>49</td>
<td>34</td>
<td>$X^2=0.178$ (2), p=0.915</td>
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<td>Follow up</td>
<td>7</td>
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<td>16</td>
<td>17</td>
<td>58</td>
<td>38</td>
<td>$X^2=1.486$ (2), p=0.476</td>
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**Within Group Differences: Intervention Group**

<table>
<thead>
<tr>
<th>Intervention Baseline</th>
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<th>3</th>
<th>Chi Square (likelihood ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow up</td>
<td>17</td>
<td>13</td>
<td>49</td>
<td>$X^2=13.524$ (4), p=0.009*</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>16</td>
<td>58</td>
<td></td>
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</tbody>
</table>

**Within Group Differences: Control Group**

<table>
<thead>
<tr>
<th>Control Baseline</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Chi Square (likelihood ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow up</td>
<td>14</td>
<td>10</td>
<td>34</td>
<td>$X^2=6.263$ (4), p=0.180</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>17</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
IG- Intervention group
CG- Control group
FET- Fisher’s exact test
An asterisk indicates a significant result p=< 0.05
increase in their understanding about the recyclability of the three items (paper, box, water bottle) on the picture, \( \chi^2 = 13.524 \) (4), \( p = 0.009 \), while the control group showed no change (\( p = 0.180 \)) (See Table 4).

_Educator’s Experiences._ Each of the intervention educators were asked to fill out a feedback survey and partake in a focus group discussion with research staff. The feedback survey asked five questions: 1) what were the learnings for you and your service as a result of your involvement in the pilot; 2) what changes have you made to your program as a result; 3) what feedback did you receive from children and families about the program; 4) was this a good project to be involved in; and 5) where there any challenges as a result of being involved in the project? Four of the six educators filled out the survey. Every educator noted that the timeframe for implementation was too short for such an intensive project. Family feedback was either absent or negligible however some stories about what the children said to the parents were filtered back to the educators. All educators noted that more parental involvement was needed to link the work of the kindergarten to the home. The educators felt that it was a valuable program because it provided new experiences and ideas for the children about environmental education and healthy eating. The project also supported collaboration among educators. All educators remarked that they needed more resources, such as online materials in addition to hard copy ones, and more time to develop the planned play-based learning experiences. Additionally, the educators expressed their difficulty in following up with parents about the consent.
and questionnaire, because they were time constrained; they suggested that the researchers take responsibility for this in future studies.

**Discussion**

The aim of this study was to evaluate the feasibility of conducting a randomised trial among 4-year-old children to evaluate the efficacy of a preschool/kindergarten curriculum interventions on children’s knowledge about healthy eating, active play and the sustainability consequences of their food and toy selections. Educators worked with the research team to design the curricula using the pedagogical communication strategy. We assessed the study feasibility by examining recruitment and participation, completion of data collection, realisation of the intervention and early childhood educators’ experiences of implementing the study protocol. Our evaluation revealed that the study protocol is feasible to implement within the early childhood education setting with several areas for consideration and revision for future research. First, to improve data collection from parents at follow-up, several alternate ways of completing the questionnaire (which only takes 5-10 minutes) are needed, such as an online survey, collection of the data by a researcher over the phone at a time that works best for the parent, or having researchers go to preschools classes to offer assistance with completing the survey at child drop off and/or pick up. Secondly, the child interview protocol needs to incorporate opportunities for children to express their contextualised experiences of engaging in certain behaviours; more open-ended questioning may assist with this. In addition, a connection circle exercise
and other systems thinking tools that have been used among children of diverse ages could be used to more effectively capture children’s mental models of how things work in their world (The Waters Foundation, 2015). Such an exercise would provide both qualitative and quantitative data, and an opportunity for children to connect all the major concepts of the project: healthy eating, physical activity, environmental sustainability and digital media impacts.

A limitation that was highlighted by the educators and research staff is that of parent engagement. The study protocol does not have any form of parent engagement within the curriculum or content that is being delivered within the service. The educators acknowledged that stronger messages can be delivered to the children when the parents are engaged and a parent component is now being incorporated into a larger study. Finally, a website has been designed to provide additional resources for educators who take part in the randomised trial moving forward.

**Conclusion**

In conclusion, this intervention is feasible to deliver and most importantly secured the engagement of the educators and the management staff of ECMS. Child participation in the curriculum interventions appeared positive, further attesting to the feasibility of conducting this randomised trial.
References


CHAPTER 4 — Young Children Learning About Well-Being and Environmental Education in the Early Years: A Funds of Knowledge Approach

Abstract

Early childhood educators currently provide content focused learning opportunities for children in the areas of well-being and environmental education. However, these are usually seen as discrete content areas and educators are challenged with responding to children’s interests in popular-culture inspired food products given these influence their consumption of energy-dense, nutrient-poor and highly packaged food in the early childhood setting. This paper reports preliminary findings from a pilot randomised trial examining the interconnectedness of sustainability, well-being and popular-culture in early childhood education. Planning, assessment documentation and summaries from twenty-four learning experiences implemented by six educators over a six-week period were analysed using a deductive approach. Twenty well-being and environmental education topics were identified and shown to be generated by the educators when considering the children’s ‘funds of knowledge’ on popular-culture inspired food products. We argue that topics derived from children’s engagement with popular-culture may help educators to create an integrated approach to curriculum provision. This may impact child weight and facilitate obesity prevention and environmental sustainability as children create stronger connections between these content areas and their everyday choices and practices.
Keywords: environmental education; well-being; popular culture; early childhood curriculum
Introduction

How to build on children’s popular-culture interests in the early childhood curriculum has long been a problem for educators. In part, this is because popular-culture has not been readily accepted by the field as promoting interests considered ‘appropriate’ to the provision of play-based learning for young children (Arthur 2001). Popular-culture in the early years is characterised by connotations of over-marketization to young children (Linn 2004), and as fostering a reduction in children’s capacity to engage in imaginative play (Smirnova 2011). The ‘problem’ of popular-culture in the early childhood curriculum also stems from uncertainty regarding the content knowledge to be derived from building on these interests as a basis for learning; this is because while interests and activities such as playing with sand, dramatic play and block building are well understood to foster language and mathematical learning, what exactly may be learned from a child’s fascination with Spiderman™ or Frozen™ is not always as clear to educators. In part, the problem of popular-culture integration in the early childhood curriculum has been addressed by research examining the use of popular-culture as a ‘fund of knowledge’ acquired by children in the home and community settings (Hedges 2011). ‘Funds of knowledge’ informed research suggests capitalising on the knowledge and skills children have acquired at home as a basis for formal educational provision (Moll et al. 1992). This research suggests that popular-culture interests can be used to generate viable learning experiences for young children, particularly in the areas of literacy and technology education (e.g. Dyson 2003; Marsh 2004).
However, in recent times, the problem of popular-culture interests in the early childhood curriculum has become even more complicated than in the past. This is because the range of technologies commonly available to young children has increased their engagement with multiple forms of digital media, including television programmes, movies, games and apps (Lauricella, Wartella, and Rideout 2015). A consequence of this increased media engagement is young children’s exposure to 360-degree marketing (Schor 2004). 360-degree marketing is a form of marketing for popular-culture and popular-culture products that surrounds children (particularly in Western minority contexts) in multimodal forms, including through mainstream media engagement such as television, movies, games and apps – but also, through associated and cross-promoted avenues such as magazines, toys, books, food products, clothing, advergaming and promotional offers (Cook 2014). The increased multimodality of popular-culture in young children’s lives is problematic for early childhood educators because it means that young children’s interests in popular-culture characters and narratives manifest in the early childhood setting in multiple ways. This includes: children’s interest in role-playing particular characters, wearing clothing associated with a preferred character, trying to bring popular-culture inspired toys into the early childhood setting, and consuming popular-culture inspired food products during snack and lunchtimes (see for example: Zevenbergen 2007). Our own research with educators suggests that while they are committed to recognising young children’s popular-culture interests, they do not always know how to respond to these interests in curricula terms –
particularly as this pertains to the consumption of popular-culture inspired food products brought to the early childhood setting (Edwards et al. 2013). The latter dilemma is doubly manifested given the mal-consumption of such products, alongside the socio-ecological circumstances surrounding their production and distribution worldwide (Hillcoat 2014).

Food products are especially challenging in the context of the early childhood curriculum because they are typically energy-dense, nutrient-poor and highly packaged. These aspects of the products are contrary to the well-being and sustainability imperatives of the early childhood curriculum where educators try to engage children in learning about healthy eating behaviours and environmentally sustainable practices. However, the products themselves remain highly attractive to young children because they feature popular-culture characters, and are strongly connected to other multimodal forms in which they are likely to experience that character, such as movies, games, clothing, toys and apps (Edwards 2014). Thus, while the children are interested in the product, educators are concerned that the product does not represent the most appropriate food choice children could make from a nutritional or sustainability perspective. An emerging issue in early childhood education, therefore, is how to build on young children’s popular-culture interests as a basis for learning more about the health and sustainability consequences of consuming such food products.

This paper reports on research conducted with a group of early childhood educators in Victoria, Australia. Our aim in this paper is to
consider how educators are able to use children’s popular-culture interests to generate topics associated with well-being and environmental education as content areas in the early childhood curriculum (with a specific focus on food products). We report early findings from research we have conducted in the context of a broader project focused on children’s understandings about healthy eating and sustainability following participation in well-being and environmental education based on popular-culture interests. Our focus in this paper is not on the children’s learning per se – but on the *identification of topics educators generate* when planning well-being and environmental education learning experiences for young children based on children’s popular-culture interests. We consider this initial work an important step forward in understanding how educators might engage with the contemporary manifestation of children’s popular-culture interests in the early childhood curriculum. This is because to date, little is known about the likely range of topics educators can explore with young children when considering the well-being and sustainability consequences of children’s popular-culture interests pertaining to consumption of popular-culture inspired food products. Prior to providing an overview of the pilot project and findings, we consider the literature related to well-being and environmental education in early childhood education. We also further explain the concept of funds of knowledge as the theoretical framework informing the project.
Well-Being and Environmental Education in Early Childhood Education

Well-being and environmental education represent recent areas of content concern and focus in early childhood education. This is not to say that well-being and environmental education do not have a history of provision in the early years as this would be incorrect. Young children’s social, emotional and physical health has long been a concern of early education, while nature studies and the provision of outdoor learning experiences have also been highly valued (Klaar and Öhman 2014). However, well-being and environmental education as content areas have taken on a new significance in the early years against a backdrop of concerns regarding environmental sustainability more broadly (see for example: UNESCO 2012, 2014), and the impact of digital media consumption and 360° advertising on young children’s health and well-being (Rutherford, Brown, and Bittman 2011). In this paper, we consider ‘well-being’ in terms of overweight and obesity prevention, and ‘sustainability’ in terms of environmental education.

Overweight and obesity. Overweight and obesity in the early years is internationally recognised as a significant health issue for young children. Increased consumption of digital media, exposure to 360° marketing, the ready availability of energy-dense foods and a reduction in physical activity are commonly indicated factors in the high levels of overweight and obesity occurring in the early years (Rutherford, Biron, and Skouteris 2011). It is estimated that 42 million children aged five and under are overweight across the globe (WHO 2015). Overweight and
obesity is a problem in early childhood because early patterns of weight gain tend to be maintained into adulthood. Problems associated with overweight and obesity for children and adults include an increase in non-communicable diseases such as diabetes or cardiovascular ill health, and social-emotional difficulties, such as depression, low self-esteem and anxiety (Jacka et al. 2010).

In early childhood education, attempts at reducing overweight and obesity tend to be conducted as intervention studies. Here, programmes advocating healthy eating, an increase in physical activity and a decrease in sedentary activity associated with digital media consumption are often implemented in early childhood settings in an attempt to increase children’s levels of healthy eating and exercise (Hesketh and Campbell 2010; Marco, Zeisel, and Odom 2014; Morris et al. 2015). Often these programmes show improvements in children’s behaviour, but the extent to which they are long lasting is not known, and the rate of overweight and obesity in the early childhood years continues to grow. One problem with intervention approaches to well-being is that they are not strongly connected with existing curriculum practices in early childhood education which focus on the co-construction of learning experiences based on children’s interests. For example, existing approaches are often top-down, and require early childhood educators to implement healthy eating and exercise programmes developed by experts from beyond the early childhood field. Typically, the programs are developed in the absence of any discussion with educators, and/or without strong connections to children’s existing interests. We believe that capitalising on young
children’s popular-culture interests as they pertain to food products as a basis for engaging children in well-being education represents an alternative to existing top-down approaches to obesity prevention (Skouteris et al. 2010, 2014a). This is because well-being education generated by educators according to young children’s interests is potentially more meaningful to children than intervention approaches designed to change children’s behaviour without necessarily attending to what they understand about healthy eating and exercise. This approach aligns with literature regarding the understandings primary school aged children hold of their own bodies, and their knowledge of healthy eating practices as a basis for intervention (Roos 2002; Hesketh et al. 2010).

**Environmental education.** Environmental education in early childhood is increasingly recognised as a significant area of content and curriculum provision. This is due in part to the efforts of scholars keen to identify appropriate ways of engaging young children in environmental learning (Duhn 2012; Elliott 2010), combined with developments at a more global level with respect to promoting environmental education across all levels of education (UNESCO 2009, 2012). In early childhood education, the term ‘education for sustainable development’ is more typically used in Europe, ‘education for sustainability’ in Australia, while the term ‘environmental education’ is more frequently used in the USA and Asia (Davis and Elliott 2014). These terms represent philosophical orientations and debate within the field of environmental education more broadly (Jickling and Wals 2007), while Sauve (2005) suggests they are connected with beliefs regarding the extent to which the role of
environmental education is to engage learners in critical understandings of their relationship with the world, or conversely, to participate in education that promotes sustainability and sustainable practices. In this paper, we use the term environmental education with the clear acknowledgement that there are indeed a multitude of perspectives as it concerns the naming and framing of environmental education and sustainability in early childhood education (Cutter-Mackenzie and Edwards 2013).

As recently as six years ago, research into the conduct of environmental education in early childhood was considered so minimal that Davis (2009) described it as ‘black hole’. However, increased interest in engaging children in environmental education in the early years (Hägglund and Pramling Samuelsson 2009), the research advocacy of key scholars in the area (Pramling Samuelsson and Kaga 2008) and the inclusion of environmental education in early years’ curriculum frameworks have resulted in a rapid increase in research in this area (Siraj-Blatchford 2009). Such work shows that contrary to early concerns that young children are too socially, emotionally and cognitively immature to engage in learning about the environment, they are in fact capable of engaging with these ideas (Elliott and Davis 2009). This is particularly the case where environmental education topics connect strongly with young children’s localised experiences – such as in the areas of growing food, exploring local habitats, waste reduction, recycling and composting. Research also shows that pedagogical approaches to engaging young children in learning about these topics can be developed in ways
that align with the use of play-based learning in the early years (Edwards and Cutter-Mackenzie 2013). An under researched aspect of environmental education in early childhood education is the extent to which young children’s popular-culture interests can be used as a basis for engaging in learning about sustainability practices, such as reducing consumption, recycling and composting. With respect to food products, the extent to which popular-culture interests can also be used to help children learn about the production and consumption of localised food (e.g. growing vegetables) is also under examined. We suggest that engaging children in their popular-culture interests as a basis for generating environmental education topics provides a meaningful basis for children learning about sustainability practices that connects more strongly with their daily lived experiences than approaches that focus on sustainability in abstracted modes that Sobel (2008) would describe as ‘developmentally inappropriate’. For example, non-localised climate change (e.g. the melting icecaps in Antarctica) is one such abstraction of knowledge in early childhood environmental education (Cutter-Mackenzie, Payne, and Reid 2011). Likewise, non-localised malconsumption (e.g. the mass consumption of fossil fuels) is additionally abstracted.

**Theoretical Perspective: ‘Funds of Knowledge’**

‘Funds of knowledge’ is a concept derived from the anthropological work of Vélez-Ibáñez and Greenberg (1992) who studied the exchange of knowledge and expertise within Mexican-American families in the face of economic deprivation. They suggested that families develop particular ‘funds’ of knowledge or skills that help them in their daily functioning,
such as obtaining and cooking food, childcare and earning money. They
adapted the notion of ‘funds’ from the work of Eric Wolf, who had
previously identified the different types of funds needed to maintain a
family on a daily basis, including funds for food and housing, funds for
ceremonial activities and funds for replacing family items (Moll and
Spear-Ellinwood 2012). Research by Moll et al. (1992) suggested that the
‘funds of knowledge’ concept held implications for the provision of
meaningful learning experiences for children in formal education settings.
They argued that if teachers were sensitive to a range of skills,
information and knowledge children acquired through their participation
in family life that these ‘funds of knowledge’ could be used a basis for
promoting more formal learning. In early childhood education, the
concept has been used to foster increased understanding about the range
of interests and experiences children are likely to have outside of the
early childhood setting. For example, Hedges, Cullen, and Jordan (2011),
suggest that children’s outside interests or ‘funds of knowledge’ are often
broader than supposed by early childhood educators, and include
reference to their experiences of cooking, helping care for siblings,
 gardening, car care and engagements in popular culture. Using children’s
funds of knowledge as a basis for curriculum provision is argued to
increase the relevance of learning experiences for young children and to
increase children’s engagement in content learning (Hedges and Cullen
2005) The use of popular culture in the early years is often argued from a
‘funds of knowledge’ perspective, and has been shown to support young
children’s literacy and technological learning (e.g. Barnyak and McNelly
2015; Black 2010). In this paper, we use the ‘funds of knowledge’ concept to also acknowledge children’s interest in popular-culture, but focus on how popular-culture can be used by educators to generate topics associated with well-being and environmental education in the early childhood curriculum with a specific focus on food products.

Method

The larger study from which the findings presented in this paper are drawn was conducted as a pilot randomised trial examining the influence of educator provided learning experiences about well-being and environmental education on young children’s understandings about healthy eating and sustainability practices. Two groups of degree qualified educators and children participated. Group A educators (n = 6) participated in three professional learning sessions about digital media, popular-culture, well-being and environmental education in early childhood. They then planned and implemented a series of learning experiences with the children (n = 128) attending their kindergartens. Group B educators (n = 6) participated only in an information session about the project and continued their practice as usual (receiving the professional learning session at a later date). Baseline and post-intervention data were collected regarding the children’s understandings about healthy eating and sustainable practices (a detailed account of the larger project methodology within which this pilot is situated can be found in Skouteris et al. 2014b). In this paper, we narrowed our focus to the group A educators: specifically, the topics they generated about well-
being and environmental education based on the children’s interests in popular-culture. Food products were a particular area of interest.

The professional learning sessions provided to the group A educators were derived from previous work we had conducted with children, families and educators on the impact of young children’s media engagement and consequent popular-culture interests on their explorations of well-being and environmental education in early childhood settings. This work showed that while educators were committed to recognising children’s popular-culture interests in the curriculum they did not know how to respond to these when the interests entered the early childhood settings as highly consumable, packaged and energy-dense food products in young children’s lunchboxes (Edwards et al. 2013). They were also unsure about how best to capture popular-culture interests expressed through the children’s role play as a basis for learning about well-being and environmental education. In response, we developed a pedagogical statement outlining contemporary research into young children’s digital media consumption; their engagement with popular-culture; obesity prevention in early childhood education (e.g. well-being); and environmental education in the early years (Skouteris et al. 2012).

In this pedagogical statement we linked each of these areas of research to the Australian Early Years Learning Framework (EYLF) learning outcomes (DEEWR 2009), and suggested that play-based learning should be central to exploring each of these areas relative to the EYLF outcomes (see Figure 1).
During the first professional learning session, we discussed each of the research areas (digital media, popular-culture, obesity prevention and environmental education) using the pedagogical statement. We also provided educators with case studies featuring young children’s interests in digital media and popular-culture, and how these were manifest in the early childhood curriculum, for example, through food products brought to the centre, items of clothing worn by children featuring popular-culture characters and young children’s interests in playing out digital media narratives in their socio-dramatic play (see Figure 2). The educators reflected on each of the case studies and identified which content areas (e.g. well-being, environmental education) were evident in the interests of the case study children.

Figure 1 Linking areas of research into environmental education, the prevention of childhood obesity and digital technologies with EYLF learning outcomes.
During the second professional learning session, educators were provided with content information related to well-being and environmental education. This included information regarding how to read nutritional food panels, energy expenditure, children’s physical exercise and aspects of environmental education associated with sustainability in early childhood, including composting, recycling, waste reduction and growing food. Educators were also introduced to pedagogical models for engaging children in content learning in early childhood education settings, such as using open-ended, modelled and purposefully framed play (Cutter-Mackenzie et al. 2014; Trawick-Smith 2012; Wood 2013). Prior to attending the third professional learning workshop, four-year-old Jonathon wakes up wearing his Octonauts pyjamas. His father organises some breakfast for him which he eats from his favourite Spider Man bowl. Next he brushes his teeth using the Wiggles toothpaste his younger sister selected the day before at the supermarket. He gets dressed making sure to put his Ben10 singlet on underneath his kindergarten t-shirt. Now that he is ready, he has some free time which he is allowed to spend using the family iPad. He navigates quickly to the Australian Broadcasting Corporation iView website and downloads an episode of the Octonauts. Meanwhile, his sister sits beside him watching Peppa Pig on the television. When his episode of Octonauts is finished Jonathon grabs his Nintendo 3DS, and swaps his Mario Kart card for his new Octonauts game. Halfway through the game Jonathon is called by his Father to help pack the lunch he will later take to kindergarten. Jonathon gets out his Spider Man lunchbox and drink bottle, goes to the fridge and grabs a Ben10 yoghurt which he adds to the box alongside the sandwich and fruit his Father has already packed. He puts the lunchbox and drink bottle in his Octonauts backpack and quickly stuffs his new Octopod toy in as well because he is hoping to play with this at kindergarten. Two of Jonathon’s friends, Emil and Taneesha also enjoy watching the Octonauts. Together the three children spend a lot time at kindergarten discussing episodes they have seen on iView. They often re-play Octonauts episodes using the fort in the outdoor area as their Octopod. Much to Jonathon’s envy, Emil has the complete set of the main Octonauts characters, including Barnacles, Kwazii, Peso, Inkling, Tweak, Dashi and Turnip. Jonathon hopes Emil will bring the toy characters to kindergarten so that they can use them in his new Octopod.

**Figure 2 Sample case-study provided to educators during the first professional learning workshop**
session, the educators developed draft plans for implementing well-being and environmental education learning experiences with the children. They researched children’s existing popular-culture interests (through group discussions, observations and questioning) and used these as a basis for their initial sets of planning. The planned learning experiences were further workshopped during the third professional learning session. Following completion of the third workshop, the educators implemented the planned learning experiences with children over a 6-week period during the third term of the kindergarten year. All planning and implementation was recorded by the educators using their usual planning and assessment procedures. A ‘summary of implementation’ sheet was also completed by educators in which they recorded the time, date, use of materials, topic and use of pedagogical strategies informing each learning experience. At the conclusion of the implementation period, the educators attended a focus group interview. The focus group interview facilitator invited educators to reflect on the interests they had identified for children; that is, how they had planned for learning in relation to these interests and their thoughts regarding children’s learning about well-being and environmental education as a result of the planned learning experiences.

**Participants and Recruitment.**

This project was completed with ethical approval from all three of the participating universities, and the Victorian Department of Education and Early Childhood Development. Participant recruitment occurred through the managing body of a cluster management service in
Melbourne, Victoria (Australia). In keeping with ethical protocol, educators were invited to participate in the study, and attended an initial information session after which they could indicate their willingness to participate. All educators worked in a low-mid socio-economic region of Western Melbourne providing education to children aged 4–5 years in funded four-year-old kindergarten programmes. All educators held Bachelor degrees in early childhood education (minimum of a three-year degree). Years of teaching experience ranged from 2 to 15.

**Data Analysis.**

As noted above, we focus here on the data represented by the educators' planning and assessment documentation and the completed 'summary of implementation' sheets. Each educator developed at least four planned learning experiences each. This meant we had up to 24 sets of planning, assessment documentation and completed summary sheets. The data were analysed collectively. This was because our unit of analysis was the well-being and environmental education topics generated by educators as content areas of the early childhood curriculum (with a specific focus on food products) (Baxter and Jack 2008). Collective analysis of the data required that the planning, assessment documentation and completed summary sheets for all six educators were collated. A specific unit of analysis supported a deductive approach to analysing the collated data. Deductive approaches to qualitative data analysis use ‘sensitising concepts’ to establish categories to which data can be assigned (Auerbach and Silverstein 2003). Our two main categories were well-being and environmental education. All the data
were read through and topics associated with either well-being or environmental education identified. On a second reading, all data assigned to a topic were accorded a frequency count and located in a table as either a ‘well-being’ or ‘environmental education’ topic. Through this process, the topics generated by educators associated with well-being and environmental education as content areas of the curriculum in relation to children’s popular-culture interests were identified. For each identified topic, we recorded a typical planned learning experience to illustrate what that topic was likely to look like in practice. Following the initial identification of the topics, the planning documentation and completed summary sheets for each educator were then analysed to chart the pattern of occurrence for each topic over the 6-week period of implementation. Charted topics were overlaid to develop an overall conceptual summary of educator generated topics specific to well-being and environmental education in the early childhood curriculum when planning from children’s observed popular-culture interests with a specific focus on food products.

**Findings**

Educators generated 20 main topics associated with well-being and environmental education as content areas of the early childhood curriculum. These topics were derived from identified popular-culture interests held by the children with a specific focus on food products. Six of the topics were associated with well-being education; 12 were associated with environmental education; and the remaining two topics connected well-being and environmental education. Table 1 lists the identified topics
for each content area, and provides a typical planned learning experience to illustrate the implementation of the topic in practice.

Table 1  *Identified topics for well-being and environmental education as content areas with sample planned learning experiences.*

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Topic</th>
<th>Typical Planned Learning Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellbeing</td>
<td>Incentives</td>
<td><em>Discussing</em> Why do we like toys in ‘meal deals?’*&lt;br&gt; <em>Role Playing</em> Offering toy incentives with meals in a pretend MacDonald’s established in the home corner</td>
</tr>
<tr>
<td>Nutritional</td>
<td>Value Panels</td>
<td><em>Discussing</em> What does this information on the package tell us about the food?</td>
</tr>
<tr>
<td></td>
<td>Sugar content of food</td>
<td><em>Doing</em> How many teaspoons of sugar are in this food?&lt;br&gt; <em>Comparing/Contrasting</em> How many teaspoons of sugar are there in a can of Coke, a banana or a tub of yoghurt?</td>
</tr>
<tr>
<td></td>
<td>Exercise/energy expenditure</td>
<td><em>Doing</em> Feel how our heart beats faster when we sit still, walk, run,</td>
</tr>
</tbody>
</table>
jump. Which activities make our heart beat faster?

*Discussing* Heart beats mean our bodies are working and using energy. Energy is in our food as sugar. How many heart beats do we need to use the different teaspoons of sugar in a can of Coke, a banana or a tub of yoghurt?

### Sometimes foods

*Identifying* What ‘sometimes’ foods do we have in our lunchboxes?

*Charting* How many ‘sometimes’ foods do we bring in our lunchboxes each day?

### Food groups/pyramid

*Reading* What does this food group chart/pyramid say about which foods are ‘everyday’ foods and which foods are ‘sometimes’ foods?

*Role Playing* Empty plates and cut out images of food in the home corner. Creating ‘food group charts’ when serving ‘meals’

### Environmental Education

#### Organic foods

*Identifying* Which foods in our lunchboxes are not packaged (e.g. fruits, vegetables, sandwiches?)
<p>| Packaged food | <strong>Charting</strong> How many compostable foods (i.e. from organic food sources) do we bring in our lunchboxes each day? |
| Recycling    | <strong>Doing</strong> How much packaging is there on the packaged food products we bring in our lunchboxes over the course of a week? <strong>Role Play</strong> What packaging do we need for food purchased in a pretend MacDonald’s established in the home corner? |
| Rubbish      | <strong>Identifying</strong> Which items from our lunchboxes cannot be recycled or put in the compost? <strong>Charting</strong> How much unrecyclable rubbish do we generate in one week? |</p>
<table>
<thead>
<tr>
<th>Topic</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food scraps</td>
<td>Identifying</td>
<td>Which items from our lunchboxes are compostable?</td>
</tr>
<tr>
<td>Decomposition</td>
<td>Identifying</td>
<td>What happens to different items (an apple core, banana skin, plastic doll, plastic packet) when we bury them and dig them up again a week later?</td>
</tr>
<tr>
<td>Reduce/reuse</td>
<td>Identifying</td>
<td>What strategies can we implement to reduce/reuse packaging on food items and the number of toy incentives?</td>
</tr>
<tr>
<td>Compost</td>
<td>Doing</td>
<td>Establishing a compost and regularly composting waste food items</td>
</tr>
<tr>
<td>Worms</td>
<td>Doing</td>
<td>Turning over compost and looking at worms Discussing What are worms doing in the compost?</td>
</tr>
<tr>
<td>Living things</td>
<td>Doing</td>
<td>Examining living things in the compost Identifying What are the characteristics of living things</td>
</tr>
<tr>
<td>Non-living things</td>
<td>Identifying</td>
<td>What are the characteristics of non-living things</td>
</tr>
</tbody>
</table>
Growing food

Doing: Planting vegetable seeds and growing food; using compost on vegetables

Reading: How does compost help vegetables grow?

Connected Toys

Discussing: What are toy incentives?

Why do we like toy incentives?

What happens to toy incentives when we have finished playing with them?

Everyday foods

Doing: Growing vegetables and eating vegetables as ‘everyday’ foods

The findings also produced an overall conceptual summary of educator generated topics specific to well-being and environmental education in the early childhood curriculum when planning from children’s observed popular-culture interests with a specific focus on food products. This summary suggested that educators would commence by identifying children’s popular-culture interests (through discussion, observation and questioning), before using interests to establish food products as the springboard for generating the well-being and environmental education topics. In this study, two main identified interests, were popular-culture characters (e.g. Dora the Explorer, Frozen, Spiderman, Ben10, Ninja Turtles), and children’s participation in a fast-food shop role play (going to McDonalds). Five main topics were
generated in response to these interests, including compostable foods, packaged foods, recycling, rubbish and nutritional value panels. Identified topics tended to lead educators to consideration of an additional topic. For example, considering the packaging associated with food products led to consideration of the role of incentives when purchasing foods. Examining incentives established ‘toys’ as a topic which suggested potential for learning about how to ‘reduce and reuse’ products. Figure 3 presents an overall conceptual summary of the educator-generated topics. This figure also illustrates the point at which two topics were noted as connecting well-being and environmental education. These occurred where: (1) ‘toys’ as incentives for buying food products connected with learning about ‘reduce and reuse’ as an environmental topic; and, (2) ‘growing food’ as an activity supported by the composting connected with eating fresh produce as an ‘everyday food’.
Discussion

The findings suggest that educators are able to consider young children’s popular-culture interests as a basis for generating viable topics for content learning associated with well-being and environmental education in the early childhood curriculum. In this project, 20 topics were generated by educators in response to children’s interests in popular-culture characters, and in role-playing ‘going to McDonalds’. Of interest to this study is how the educators generated these topics in response to the range of food products associated with children’s interests to foster an extensive programme promoting children’s learning about well-being and environmental education. Here, well-being involved...

Figure 3 Conceptual summary of educator generated topics specific to well-being and environmental education in the early childhood curriculum when planning from children’s observed popular-culture interests with a specific focus on food-products
understanding the role of incentives in purchasing energy-dense and nutrient-poor foods, learning to ‘read’ nutritional panels on packaged food, conceptualising sugar content as ‘teaspoons’ and relating the number of teaspoons of sugar in different foods to various amounts of exercise.

These topics revealed further potential for educators to consider alternative food choices with children, and so led to consideration of ‘sometimes’ and ‘everyday’ foods. Here, the initial popular-culture interest capitalised on children’s existing funds of knowledge with respect to their engagement with popular-culture inspired food products, and continued to build on these funds as the topics also connected with the children’s everyday practices, such as considering which ‘sometimes’ foods they had in their lunchboxes, and how many of these foods were brought to the centre on a weekly basis. We suggest that this approach to well-being education provides a stronger connection to children’s daily lives than intervention approaches to healthy eating and exercise imposed on children and educators with messages about what they ‘should’ eat or how they should exercise (Hesketh and Campbell 2010; Marco, Zeisel, and Odom 2014). This is because the topics generated by the educators connected directly with the children’s existing interests. The topics also continued to build on the children’s funds of knowledge in terms of their daily experiences and practices as they explored over the 6-week implementation period. It is well known in early childhood education that creating strong connections between children’s interests and existing
knowledge promotes learning (see for example, Bertram and Pascal 2002; Gmitrova, Podhajecká, and Gmitrov 2009; Siraj-Blatchford et al. 2002).

Likewise, commencing with children’s popular-culture interests allowed educators to generate a series of topics associated with environmental education. These topics were slightly more extensive than the well-being topics, including consideration of the packaging issues associated with popular-culture inspired food products and how these compared with more readily compostable products. Here, educators focused on topics such as recycling, rubbish, food scraps, decomposition, compost, worms and growing food. These topics, while typical of those canvassed in early childhood environmental education, have not previously been identified in relation to children’s interests in popular-culture, particularly as these pertain to food products. Rather, such environmental education topics in early childhood education tend to form a programme of activity, or response to the issues of environmental sustainability in the early years. We believe that generating these topics from young children’s popular-culture interests has the potential to increase children’s critical engagement with a range of sustainability practices, because children may be able to create stronger connections between their decisions and the likely environmental consequences of these decisions (e.g. consuming a highly packaged food item and needing to recycle the packaging).

Interestingly, the results of our study indicate two points at which well-being and environmental education topics connect with each other. These include ‘incentives’ as a well-being topic paired with the
environmental topic ‘reduce/reuse’; and ‘growing food’ as an environmental topic paired with ‘everyday food’ as a well-being topic. Here educators focused on the extent to which children liked toy incentives, and the consequent relationship of toy incentives with children’s desire to consume energy-dense food. Educators and children then considered whether or not toy incentives could be reused, or the consumption of toy incentives reduced by rejecting them altogether. Likewise, growing food was an environmental topic connected with everyday foods. Here, the idea of growing food was a topic followed by educator consideration of composting. The foods grown by educators and children were vegetable-based and so readily connected with the topic of eating ‘everyday’ foods. The topic of ‘everyday foods’ was in turn considered in relation to the ‘sometimes’ foods represented by energy-dense food products. These two connections suggest potential for understanding well-being and environmental education in early childhood as more closely related than perhaps previously thought.

Thus, the problem of how best to respond to children’s interests in popular-culture and the impact of 360° marketing on their food choices may in fact lie in an integrated approach to curriculum provision. Integrated curriculum formation is acknowledged pedagogical approach in early childhood education used to build young children’s content knowledge (Arthur et al. 2015). Researchers outside early childhood education have acknowledged potential for well-being and environmental education to be integrated (Jensen 2004; Mogensen 1997), yet what this looks like in the context of early years’ provision has not been clearly
identified and is therefore not well understood. In our study, toy incentives, reduce/reuse, growing food and everyday foods suggest topics for integrating these content areas in early childhood education.

**Conclusion**

How to build on young children’s popular-culture interests in the early childhood curriculum has long been a problem for educators. This is because children’s popular-culture interests are not always recognised as viable informants for content generation. This problem has increased in recent years as children’s engagements with popular-culture have become complicated by their exposure to 360° marketing and participation in multimodal environments. Popular-culture inspired food products comprise a significant aspect of this marketing and multimodal experience. This means children are often interested in consuming food products that are energy-dense, nutrient-poor and highly packaged. This interest can contrast with educators’ curriculum imperatives in terms of fostering young children’s healthy eating patterns and engagement in sustainability practices. However, little is known about the range topics associated with healthy eating and environmental education that educators can generate from children’s popular-culture interests as these pertain to food products. In this paper, we have identified up to 20 such topics generated by educators seeking to build on children’s popular-culture interests from a funds of knowledge perspective. These findings suggest potential for increasing the relevance of both well-being and environmental education for young children in early childhood settings by connecting with their existing interests and knowledge base with respect
to popular-culture and their daily food practices. In addition, our results also suggest that an integrated approach to well-being and environmental education may be possible where topics associated with each content area crossover. This indicates that the issue of popular-culture inspired food products in the early childhood setting does not have to be a problem for educators in so much as it may represent a significant opportunity for content learning in two areas of contemporary importance to young children – that of healthy weight maintenance/obesity prevention and sustainability. Further research should now focus on the range of pedagogical strategies (e.g. learning experiences) developed and implemented by early childhood educators when engaging young children, and the extent to which these strategies align with existing play-based approaches in early childhood curricula.
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CHAPTER 5 — Play-Based Curriculum Formation and the Integration of
Wellbeing and Sustainability in Contemporary Early Childhood
Curriculum

Abstract

Wellbeing and sustainability are critical areas of contemporary early childhood curriculum provision. Young children growing up in minority post-industrialised societies face a range of complex issues associated with healthy eating, exercise and sustainability that relate to their own wellbeing and their relationships with the human and other-than-human in the age of the Anthropocene. Conceptual knowledge about wellbeing and sustainability is core to informing young children’s capacity to make agentic decisions in these areas. This paper examines the range of activities generated by early childhood teachers with the aim of engaging children in integrated learning about wellbeing and sustainability concepts using play-based approaches towards curriculum formation. A conceptual framework for integrating these core areas of the early childhood curriculum derived from the findings is presented and discussed.
Introduction

Wellbeing and sustainability are critical content areas in twenty-first century early childhood curriculum provision. Wellbeing refers to the physical, mental and emotional health of young children (Statham & Chase, 2010). Sustainability, in the new Anthropocene epoch (Crutzen & Brauch, 2016) is concerned with the capacity of children to live alongside both the human and other-than human in ways that respect the ecological needs of all (Taylor, 2013). Early childhood education has long occupied itself with the emotional and physical health of children, and viewed outdoor play, at least from a humanist perspective, as a means of connecting children with nature. However, the globalisation and digitalisation of an anthropocentric society has placed new demands on curriculum. The content areas of wellbeing and sustainability now require a more in-depth focus on the development of children’s conceptual knowledge than has previously occurred. This is because conceptual knowledge is known to drive young children’s decision-making (Gelman and Kalish, 2006). Living and growing up in contemporary society demands of young children complex decision making about wellbeing and sustainability, such as healthy eating, engaging in physical exercise, making sustainable life choices about the consumption of toys, clothing and food and understanding human and other-than-human relationships. However, in practice, the achievement of this in-depth focus is difficult for teachers to achieve with children because there is little in the way of research pointing to the integration of these content areas of the
curriculum within a play-based approach to curriculum formation as typically used in early childhood education. This problem is compounded by the recent turn toward the notion of intentional teaching in the early years. In this paper, we therefore address the question: What range of activities do teachers generate to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation?

**Why Wellbeing and Sustainability?**

The youngest of today’s children live in a society that is markedly different - socially, ecologically and culturally, from that of previous generations. This statement should not be considered provocative. Rather, it is a statement central to sociocultural theory. This tenet being: every generation is transformed by the knowledge and cultural practices of the previous generation such that the newest generation occupies a different developmental niche to the one that preceded it (Davydov & Kerr, 1995). The current social conditions experienced by many children are the result of knowledge developments in the 1950s regarding solid state physics. Solid state physics enabled the invention of the transistor which led to the creation of the microprocessor. The microprocessor is the ‘chip’ that digitises information (Riordan, Hoddeson, & Herring, 1999). Digitised information gave birth to what Japanese sociologist, Yoneji Masuda (1985) famously described as the information society. The information society is characterised by the globalisation of information, ideas and economic forms of social and cultural participation by people –
chief amongst these, the consumption of digital media that promotes engagement with popular forms of culture and its associated products and merchandise.

Very young children in contemporary post-industrialised minority societies are involved in near constant acts of consumption as a form of social, cultural and ecological participation. These acts include consuming popular culture using digital technologies to access digital media, and engagement with an associated range of food products (Albon, 2015; Peters et al, 2014), toys, clothing and other merchandise (Cook, 2014). Some researchers described this level of consumption as ‘toxic’ for children’s development (House, 2012; Palmer, 2015). Frank Furedi describes the toxic perspective as the ‘diseasing of childhood’ (2008, p. 13). Toxic views of contemporary childhood hold that digital media and technology use promotes sedentary activity and exposes children to high levels of advertising for junk foods (Sadeghirad et al., 2016; Soos et al., 2014). The increased consumption of high-calorie, nutrient poor foods and lower levels of physical activity by children are associated with rapidly rising levels of childhood obesity world-wide (Sahoo et al., 2015). In addition, less time spent in the outdoors reduces opportunities for children to develop relationships with or as nature that are non-human centred (Malone, 2016), and are therefore considered to desensitise children to the Earth. Any and all of these elements of toxicity may well be true. However, we contend that a perspective of toxicity runs counter to the sociocultural idea that the children of any generation occupy a
cultural niche created by the knowledge, cultural and ecological practices of the past generation (Albon, 2015). Like Furedi (2008), we believe that claims of toxicity are unhelpful for addressing the real-world experiences of young children, and therefore are of little use from an educational perspective. Sociocultural theory holds that children will draw on the cultural resources available within their social situation of development to enable growth and learning (Albon, 2015; Van Oers, 2008). Cultural resources do not in and of themselves discriminate as either productive or harmful for children’s development. A toxic approach fails to recognise the genuine cultural resources or ‘funds of knowledge’ (Moll & Spear-Ellinwood, 2012) available to children in contemporary contexts. A problem with taking a ‘toxic’ stance is that it romanticises development in terms of the past so that previous developmental progress is held as the norm over the line of development enabled by the cultural resources of the present. This places children in an unwinnable position in which they have available to them only the cultural resources of the present, but their development is defined as ‘healthy’ only in relation to the cultural tools of the past. Instead, more productive for children is a stance in which generational change is accompanied by an educational response to the cultural resources of the present.

Cultural theorist Raymond Williams (2001) tells us that ‘culture is ordinary’ (p. 11). Culture refers to the daily experiences and activities of people. For many minority world children, ‘culture’ is likely to involve using digital technologies, consuming digital media, playing with and
enjoying popular culture artefacts. It also possibly involves them in the consumption of food products that are unlikely to contribute to their overall physical health and wellbeing. However, alongside these ordinary daily experiences and activities are the existing cultural resources of society as located in existing knowledge about healthy eating and sustainable living. These cultural resources are what Dewey (1969) describes as the ‘branches of learning’ and Vygotsky as the ‘scientific forms of knowledge’ (1987) available to humankind. They are in essence, the content areas containing specific concepts about how to be healthy and live well in relationship with the human and other-than-human.

Neither the experiences and activities of day-to-day life, nor the discipline knowledge of any society should be considered superior to the other. They simply exist as co-evolving forms of culturally generated knowledge and practice. To single out particular practices (such as eating a sweet or playing a computer game) as ‘toxic’ (instead of eating an apple and climbing a tree) means that content knowledge can only ever be provided to children in a medicinal way to reduce the impact of ‘diseasing’ society.

Top-down approaches toward content provision that seek to deliver or ‘medicalise’ content knowledge for children are known to be inconsistent in their educational outcomes. Research shows little long-term behaviour change when content knowledge about wellbeing and sustainability is abstracted from social and cultural practice (Contento, 2008; Robinson, 2010). Instead, we argue that understanding culture as central to children’s engagement with the available cultural tools means
that content knowledge can be invested with meaning alongside children’s daily practices and experiences. When early childhood education deliberately attends to conceptual knowledge building with children about healthy eating, physical exercise and sustainability, informed decisions regarding their own lives can be made. Informed decision-making, or what we consider children’s ‘conceptual agency’ should be the basis for all education. The building of young children’s conceptual agency is significant because, while well-intended there is potential for more top-down approaches towards healthy eating and sustainability education to be enacted on children as form of political and socio-economic determinism that judges some forms of consumption as more worthy than others (Power, 2016) Education should always strive to enable children to engage critically and self-reflexively - that is to act with agency in their own social situation of development according to the available cultural resources (van Oers & Wardekker, 1999).

**Conceptual Knowledge Building**

There are two views on conceptual knowledge building upon which we draw in this paper. These are the notion of integration by Dewey (1969) and mature concepts by Vygotsky (1987). In this paper, we use Dewey’s thinking about integration as the analytical construct for the data analysis and Vygotsky’s ideas about mature concepts as the theoretical framework for enacting intentional teaching within a play-based approach towards curriculum formation.
Dewey on conceptual integration. Dewey (1969) understood knowledge from a social perspective as existing within particular branches of learning. These branches (or ‘content areas’) contain concepts that define them as qualitatively different from other areas. For example, mathematics contains the concept of one-to-one correspondence whereas geography contains the concept of location. According to Dewey (1969), the categorisation of concepts into different areas is a function of adult thinking that is consequently expressed via curriculum in the form of ‘studies’. Studies are useful for adults because the knowledge and learning of the past can be categorised to benefit the learning of people into the future. People are not forever tied to having to individually rediscover knowledge for the first time. Concepts as located within content areas provide ‘a certain general path or line laid out along which ideas naturally march, instead of moving from one chance association to another’ (Dewey, 1969, p. 21). Thus, content knowledge is necessary for human productivity. However, because content areas are a function of the adult mind, Dewey (1969) believed that is very difficult, if not impossible, for the child to learn the concepts associated with individual content areas outside of their own lived experience. The child, according to Dewey (1969) experiences life as:

“an integral, a total one. He passes quickly and readily from one topic to another, as from one spot to another, but is not conscious of transition or break. There is no conscious isolation, hardly conscious distinction. The things that occupy him are held together
by the unity of the personal and social interests which his life carries along (p. 5)"

Consider, as we described earlier, that the life experiences for a child growing up in a digitalized, globalized and anthropocentric society might well regularly include the consumption of energy dense, nutrient poor and highly packaged food products, reduced levels of physical activity and the consumption of material goods with high levels of cradle-to-grave environmental impact (Featherstone, 2007). As Dewey (1969) described, these life experiences are enacted by the child as an ‘integral one, a total one’ (p.5). There is no conscious transition or break between topics in eating a packaged food item or buying a toy that will later go to landfill. The child does not say to herself as she consumes a sweet treat emblazoned with her favourite movie character – ‘this is an issue of wellbeing’, and as she disposes of the wrapping ‘now I am thinking about waste reduction and the Earth’s resources’. Instead, wellbeing and sustainability co-exist in this moment. To work from an educative, rather than a toxic perspective, it best to understand that for the child in this moment, that choosing something to eat assimilates with the issue over-consumption. Therefore, to teach from an educative perspective means that wellbeing and sustainability should be considered conceptually integrated rather than as discrete content areas containing concepts that might be useful in real life. This is what Dewey (1969) meant by conceptual integration – the experience in the life of the child of the concept-embedding activities that knit together or ‘bond’ different content
areas. In the field of integrated studies, Dewey’s perspective may be best described as ‘multi-disciplinary’ (Choi & Pak, 2006; Hinde, 2005).

The problem for early childhood education, as we pointed out in the introduction to this paper, is that little is known about the range of activities teachers can provide in a play-based approach to curriculum formation that are likely to offer this form of conceptual bonding for children. For the purpose of this paper we conducted a systematic search of the literature using three databases. These were Academic Search Complete, Education Resources Information Centre (ERIC) and Education Source. The search terms included: ‘integrated concepts’, ‘multi-disciplinary curriculum’, ‘wellbeing’ and ‘sustainability’. ‘Early childhood’ and ‘early childhood education’ were added as Boolean phrases. After removal of duplicate articles, our search returned 165 results. However, most of these publications attended to early childhood education specifically intended as interventions for children with additional needs. Adding the term ‘integrated curriculum’ to ‘wellbeing’ and ‘sustainability’ returned only one result: our previously published pieces of work (Edwards et al., 2016). Thus, despite sustainability in early childhood education being increasingly recognized as significant for young children (Hedefalk, Almqvist, & Östman, 2015; Somerville & Williams, 2015), and wellbeing in terms of physical health (particularly the issue of childhood obesity) also attracting substantial attention (e.g. Australian Government Department of Health and Ageing, 2009; Bagdi & Vacca, 2005), there is very little research that specifically focuses on the
conceptual integration of these two concepts in terms of young children’s ‘bonding activities’.

**Vygotsky on concept development.** Vygotsky (1987) argues that there are two main forms of concepts. The first are what he calls ‘everyday’ concepts. These are the concepts experienced by the child during the course of her daily life. The second form are ‘scientific’ concepts. Scientific concepts provide the formal or verbalized explanation for world phenomena. For example: a child enjoys digging in the vegetable garden with her father. Her everyday concept of soil is that she digs in it with her farther to plant vegetable seeds. The scientific concept of soil is that it provides plants with the nutrients required for growth. According to Vygotsky (1987) neither everyday nor scientific concepts alone are useful for children. Instead, a concept only becomes powerful when the everyday concept moves up towards the scientific concept, and the scientific concept moves down towards the everyday concept. In this movement, the two forms of concepts merge and create a ‘mature’ concept (p. 169).

Mature concepts are powerful for children because they explain how and why the things they experience in their everyday world work. As Hedegaard (2007) explains, “the appropriation of concepts within a system of knowledge gives the child a possibility to use them consciously and intentionally” (p. 28). Following on from our earlier example: a child understands that the soil in which she digs grows food because it contains nutrients that living things need. The explanatory power invested in a
mature concept aids decision making. With a mature concept, a child knows what she does and why, for example: I will nourish the soil because I know that it provides the nutrients to grow the food I like to eat. Thus, the development of conceptual knowledge is important for young children because it promotes conceptual agency. Conceptual agency is directed towards enabling children’s participation in their current social situation of development (van Oers & Wardekker, 1999).

Achieving a mature concept is not a simple process. It occurs as adults deliberately foster the relationship between the everyday and the scientific with young children. Vygotsky (1987) describes the distance between the achievement of the scientific concept from the operation of the everyday concept as the Zone of Proximal Development (ZPD). It is what adults do with children within the ZPD that constitutes the “instructional process itself” (p. 169). The instructional process is necessary because the cultural nature of concepts – both of the everyday and scientific variety means that concept formation is “not an automatic habit” (Vygotsky, 1987, p. 169). Mature concepts cannot be achieved by children through rote memorization nor direct teaching. This is why top-down approaches towards healthy eating aimed at obesity prevention amongst young children are likely to be ineffective and generate little long-term behaviour change. Such approaches assume the delivery of scientific concepts to children about wellbeing in the absence of a carefully-built connection with the everyday concept. When this occurs, the content information represented by the concept simply by-passes the
child missing the fertile ground provided by the everyday concept. The same may be said of sustainability education that seeks to tell children about the enactment of sustainable behaviours without first connecting the justification of these behaviours to the child’s everyday concept of living in relationship with the human and other-than-human.

**Play-based Approaches to Curriculum Formation**

Western-European early childhood education typically employs a play-based approach to curriculum formation. Defined as what children do and experience in the early childhood setting, curriculum is therefore dependent on how and why play is used for learning (Johnson, 2014). Contemporary perspectives on play-based approaches to curriculum increasingly highlights the role of the adult in collective knowledge building with children (Dockett, 2010; Fleer, 2011; Wallerstedt & Pramling, 2012). This highlight derives from concern that traditional approaches (where the open-ended play of young children was highly valued), were failing to build young children’s conceptual knowledge in key areas of the curriculum. This is because the emphasis was placed on constructivist understandings of play which accentuated the child’s engagement and exploration with materials and ideas, over the co-construction of knowledge with adults during play (Bert Van Oers & Duijkers, 2013). The movement towards more adult engagement in play has been reflected in research now for almost a decade (e.g. Siraj-Blatchford, 2009) and is increasingly apparent in national early childhood
curriculum documents in the form of ‘intentional teaching’ (Epstein, 2006).

A problem with using play-based learning alongside the notion of intentional teaching is that it is difficult to define how play and teaching should be related (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2017). Wood (2010) and Trawick-Smith (2012) address this situation by describing three types of ‘pedagogical play’: 1) Open-ended play which typically involves children in the exploration of materials and ideas; 2) Modelled-play which involves children in the demonstration of materials and ideas by teachers; and 3) Purposefully-framed play which involves the co-construction of ideas between children and teachers using multiple resources, and in the creation of connections between children’s existing knowledge and new information. While the identification of these play-types has been useful, a mechanism for deploying them easily in practice has not previously been developed.

In our research examining play-based approaches to sustainability education in early childhood, we developed a Pedagogical Play-framework which aids teachers in the use of these play-types within their curriculum (Edwards et al., 2017). In our investigation with teachers we invited them to use the three play-types with children when teaching a variety of sustainability concepts. We engaged children and teachers in discussion about the different play-types to ascertain which was most useful for learning. Contrary to our hypothesis that purposefully-framed play would be most valuable, the teachers and children talked about all three types
being of equal value. They believed qualitatively different opportunities for learning and teaching were contained within the different play types: open-ended play was valued for its exploratory nature; modelled play for the opportunity for concepts to be demonstrated in action; and purposefully-framed play for affording the co-construction of knowledge between children and teachers (Edwards et al., 2017). In developing the Pedagogical Play-framework we therefore established two principles for using the three play-types: 1) All play-types are of equal pedagogical value; and 2) Play-types can be used in multiple combinations to support learning (Figure 1).

The Pedagogical Play-framework operationalizes the processes teachers may use with children within the ZPD, where mature concepts are created from the integration of everyday and scientific concepts. This is because open-ended play affords opportunities for engaging and experiencing materials and ideas at the everyday level. Modelled play promotes the presentation of a concept in action or “in collaboration with others” (Hedegaard, 2007, p. 246) as an alternative form of everyday activity. Purposefully-framed play deliberately connects scientific concepts to children’s everyday concepts using illustrative resources and materials (e.g. posters, books, videos) through discussion of children’s existing knowledge and experience. The finding that each play-type is considered equally valuable and can be used in multiple combinations frames the Pedagogical Play-framework as a practical mechanism for teachers. Using this mechanism, educators actively build children’s conceptual agency in a manner that aligns with play-based approaches to learning while also attending to the imperatives of intentional teaching.

Project Overview

Research question. The project on which we report in this paper attends to two clear areas where there is currently a lack of research: 1) the integration of wellbeing and sustainability activities in early childhood curriculum; and 2) the problem of realizing young children’s conceptual agency about healthy eating and sustainability using play-based learning. In this project attending to these two areas was achieved by working with teachers on the development and implementation of
integrated wellbeing and sustainability activities for pre-school aged children using the Pedagogical Play framework. Accordingly, the research question guiding the presentation and discussion of findings in this paper is: What range of activities do teachers generate to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation?

Definitions. The definitions of wellbeing and sustainability used in this project drew specifically on the Learning Outcomes of the Australian Early Years Learning Framework (EYLF) (Department of Education & Relations (DEEWR), 2009). The EYLF is the national curriculum document for the provision of early education to children aged birth to five years across Australia. The definitions used were as follows:

1) Wellbeing - ‘Children become strong in their social and emotional wellbeing. Children take increasing responsibility for their own health and wellbeing’ (DEEWR, 2009, p. 32). This is evident when children:
   - Show enthusiasm for participating in physical play
   - Show an increasing awareness of good nutrition
   - Show an increasing awareness of healthy lifestyles
   - Demonstrate spatial awareness and move around through the environment confidently and safely
   - Combine gross and fine motor movement and balance for complex motor skills and patterns of activity (adapted from DEEWR, 2009, p. 32).
2) Sustainability - ‘Children become socially responsible and show respect for the environment’ (DEEWR, 2009, p. 32). This is evident when children:

- Demonstrate an increasing knowledge and respect for constructed environments
- Demonstrate an increasing knowledge and respect for natural environments
- Explore, infer, predict and hypothesize in order to develop an increased understanding of the interdependence between land, people, plants and animals
- Explore relationships with other living and non-living things and observe, notice and respond to change
- Develop an awareness of the impact of human activity on environments and the interdependence of living things (adapted from DEEWR, 2009, p. 29).

**Method**

The study was conducted as a randomized trial after a feasibility analysis was completed (Morris, et.al., 2016). Using random cluster area sampling (Johnson & Christensen, 2013) twelve kindergartens were assigned to either a control or intervention group. There were six kindergartens in each group. All kindergartens provided children aged 4-5 years with 15 hours of education per week. The kindergartens operated under the management of a group called Early Childhood Management Services (ECMS).
Participants

This project involved both teacher and child participants. For the purpose of this paper, we report on the data pertaining only to the teacher participants to describe the range of activities teachers generated to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation. However, we provide participant details for both groups.

There were 12 teacher participants. All teachers were qualified at the Bachelor of Education (Early Childhood) level. The Bachelor of Education is a minimum three-year degree achieved at the university level. The qualification meets the definition of ‘educator’ as required to work in early childhood settings by the Australian Children’s Education and Care Qualifications Authority (Australian Children’s Education and Care Qualifications Authority, 2016). Teaching experience in the early childhood sector for the participating teachers ranged from two to fifteen years. Teachers were recruited via ECMS. Cluster Leaders at ECMS who were responsible for managing kindergartens in different areas of Melbourne invited teacher participation. Teachers interested in the project were provided with explanatory letters and consent forms. Teachers completed the consent forms and returned these to the Cluster Managers.

There were 305 child participants who were recruited via the participating teachers. All families with children attending a kindergarten with a participating teacher were provided with an
explanatory statement and a consent form. Explanatory statements and consent forms were individually supplied to families by teachers and by members of the research team. Research team members were present at each kindergarten during drop-off and pick-up periods. This enabled parents to ask for additional information about the project and what participation in the project entailed for their child. Parents providing consent for their child’s participation were invited to explain the project to their own child. In accordance with contemporary approaches to researching with children (Oulton et al., 2016), all children were consequently invited to provide assent for their participation using child-friendly forms. Great care was taken throughout the project to re-establish child assent at each point of data collection. This occurred by re-inviting children to participate, reminding them about the project and paying attention to children’s body language indicating an unwillingness to participate (Bourke & Loveridge, 2014). The project was conducted with full ethical approval from the Victorian Department of Education and Training and each of the three universities involved.

**Socio-economic and cultural diversity.** Kindergartens in the control and intervention groups were located in two areas of Melbourne, Victoria. The eastern region was located 15 kilometres from the Melbourne CBD. The western region was located 45 kilometres from the Melbourne CBD. Australian Bureau of Statistics data indicates that the eastern region is predominately high in socio-economic status. Cultural diversity in this region is predominately Australian with over 56% of people born in
Australia (Australian Bureau of Statistics (ABS), 2016b). Australian Bureau of Statistic data indicates that the western region is predominately lower to middle level in socio-economic status (Australian Bureau of Statistics (ABS), 2016a). Cultural diversity in the western region is low with 73% of residents being born in Australia; residents with other countries of birth include England, New Zealand and Malta. Australian Early Development Census data shows that children from the eastern region had predominately low levels of developmental vulnerability with 5.5% being vulnerable on 2 or more domains (Australian Early Development Census, 2016). Children from the western region indicated developmentally vulnerability in the physical and social domains. In addition, over 10% of children were vulnerable on two or more domains (Australian Early Development Census, 2016).

The intervention group comprised 7 kindergartens: 4 from the Western region and 3 from the Eastern region. The control group contained 5 kindergartens: 3 from the Western region and 2 from the Eastern region.

**Procedure**

Three Professional Learning Sessions were held for teachers. Teachers assigned to the control group attended only the first Professional Learning Session. Teachers assigned to the intervention group attended all Professional Learning Sessions and completed additional assigned tasks between each session. Professional Learning Sessions were hosted by members of the research team at ECMS
kindergartens. A Pedagogical tool kit was provided with different tools distributed across the sessions, including: 1) a Pedagogical Communication Strategy (Edwards et al., 2016); 2) a copy of the Pedagogical Play Framework (Edwards et al., 2017); and 3) a book describing the use of the framework in sustainability curricula Cutter-Mackenzie, Edwards, Moore, & Boyd, 2014. Control group teachers were provided with the full suite of professional learning at the conclusion of the intervention period.

**Professional Learning Session One.** The purpose of this session was to introduce the project to all 12 participating teachers from the combined intervention (n=7) and control (n=5) kindergartens. The introduction invited teachers to consider a case-study of a child’s day-to-day interactions with cultural resources, including digital media and popular-culture artefacts previously used in a pilot study (Edwards et al., 2016). Teachers were invited to discuss the case-study and identify potential wellbeing and sustainability issues in the lives of young children. Following this discussion, the project was outlined in terms of its intention to identify the range of activities teachers would generate to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation.

A member of the research team explained to the teachers that the project would be implemented as a randomized trial. The terms ‘control’ and ‘intervention’ were defined, and the teachers were provided with a
rationale for the pre-and post-data collection methods that would also be used with children. After the introduction to the project was completed, the control teachers departed the Professional Learning Session.

The remaining intervention teachers were then further introduced to their role in the project — to develop and implement a range of different activities intended to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation. Given the current dearth of research associated with the integration of wellbeing and sustainability in play-based approaches to curriculum this was not an easy task. Opfer and Pedder (2011) argue that the alignment of resources with problems likely to face teachers in practice is an effective means of engaging teachers in professional learning (Opfer & Pedder, 2011). We therefore supported teachers in this invitation with a resource booklet we had previously developed and trialled in a pilot-study, called the Pedagogical Communication Strategy (Edwards et al., 2016). The booklet outlined background content knowledge about wellbeing and sustainability and examined this knowledge in relation to children’s interactions with digital media and popular-culture. The booklet explicitly defined wellbeing and sustainability according to the Learning Outcomes documented in the EYLF (Department of Education & Relations (DEEWR), 2009). The session closed by inviting the educators to identify the children’s popular culture interests useful in a play-based curriculum that was proposed.
**Professional Learning Session Two.** The primary purpose of the second session was to build the capacity of educators in their content knowledge of wellbeing and sustainability. The secondary purpose was to refresh educators about the combined use of all play types. The session commenced with a presentation to the teachers by a member of the research team. The seminar detailed the range of conceptual knowledge associated with wellbeing and sustainability at a level appropriate for young children. This included concepts such as: healthy eating, healthy lifestyles, physical activity, understanding the relationship between living and nonliving things, and knowledge about natural and constructed environments. This seminar connected each of the concepts to the definition of wellbeing and sustainability used in the EYLF (DEEWR, 2009). Furthermore, the seminar explained the Pedagogical Play-framework and the work of Vygotsky (1987) regarding every day and scientific concepts in the formation of mature concepts to the teachers.

Before concluding the second Professional Learning Session a brainstorming period was held amongst the teachers. This period generated an initial list of potential activities for integrating wellbeing and sustainability concepts using a play-based approach. The teachers were provided with a four-week period of time to further develop these potential activities prior to the second Professional Learning Session.

**Professional Learning Session Three:** The primary purpose of this session was for the teachers to share their planned integrated activities with each other. Again, following Opfer and Pedder (2011), professional
learning of teachers is supported by opportunities for collaboration on common task with ‘like’ teachers. The secondary purpose of this session was to provide teachers with further access to resources for integrating wellbeing and sustainability concepts with a play-based approach to curriculum formation with ‘like’ colleagues.

Teachers were provided with an opportunity to discuss and share the content of the seminar as facilitated by a member of the research team. Following this discussion, the teachers shared their list of planned integrated activities. The activities were discussed according to the integration of wellbeing and sustainability concepts and the range of play-types evidenced in each. To further support the teachers in generating the activities two additional materials were made available. These were:

a) Examples of integrated activities using the Pedagogical Play-framework previously designed and implemented by teachers during the course of our pilot study for this project (see for example: Edwards et al., 2016); and

b) Copies of a book explaining the use of the Pedagogical Play-framework when teaching sustainability in the early years (Cutter-Mackenzie, Edwards, Moore, & Boyd, 2014) During the second Professional Learning Session the teachers were also provided with large visual art diaries. They were asked to record all of their planned learning activities in the diaries. In addition, teachers
were asked to make copies of their normal assessment and observational processes and to include these in the diaries. These processes included anecdotal records, Learning Stories (Carr & Lee, 2012) and digital photographs.

At the completion of the third Professional Learning Session, the teachers embarked on a six to eight-week period of implementation of their planned activities. During this time, regular contact was maintained with the teachers by the research team to support implementation. This included phone conversations with the research team, email contact, and access to a purpose designed website featuring additional information resources about the content areas of wellbeing and sustainability.

**Methods.** This project used mixed-methods with both the teachers and the children (Johnson & Onwuegbuzie, 2004). Data collection for the teachers was predominately qualitative and relied on the planned learning activities and forms of assessment documented in the teachers’ visual art diaries. Documentation of teacher planning and assessment processes is considered a form of teacher ‘resource’ creation appropriate for data analysis because they contain evidence of teacher thinking (Gueudet & Trouche, 2011). In addition to maintaining the diaries, the intervention teachers also participated in a final focus group interview at the conclusion of the intervention period. The focus group interview was audio-recorded and transcribed by a professional transcription company.
The transcription company operated according to approved ethical protocols.

Children were involved with data collection at three time points: baseline, post intervention and three months’ post intervention. Two sets of data were collected from children: 1) semi structured interview data; and 2) anthropometric measures, specifically height and weight. The interview was conducted in the kindergarten classroom with children after seeking child assent. The structured interview schedule used a collection of images and followed with a grouping task (the images included healthy foods, compostable items, packaged foods and non-healthy foods). The anthropometric measures were completed using a stadiometer and medical grade scales.

**Data analysis.** Data were analysed following an inductive approach. The purpose of an inductive approach is to “allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies” (Thomas, 2006, p. 2). While an inductive approach was used, we were cognisant that research themes in-of-themselves do not ‘freely’ emerge from data. Rather, researcher bias, subjectivity, shaping of the research question and the nature of the professional learning conducted with the teachers are all considered potential informants to the resultant analysis (Wood & Bennett, 2000). Data analysis followed the five-step protocol for an inductive approach outlined by Thomas (2006):
1) Preparation of raw data files: The visual art diaries of all six teachers were collated. Each page of the diaries was individually scanned to create an electronic set of data comprising a total of 239 pages with an average of 29.8 pages each.

2) Close reading of data: All 239 pages of the data were closely read by HM several times. In consultation with SE, the raw data were separated into groups according to the type of visual diary entry made by all six teachers. Resultant data groups included: Descriptions of planned activities; Indication of children’s interests connected with planned activities; and Evidence of linking the activities to the Learning Outcomes in the EYLF (DEEWR, 2009). Following the initial grouping of raw data by HE, the data were re-grouped by MO.

3) A ‘check on the clarity of groups’ was conducted (Thomas, 2006, p. 244), and an inter-rater reliability reading of 98% was achieved.

4) Creation of categories: The grouped data were systematically evaluated for evidence of integration. The definition of ‘integration’ used in this evaluation was that provided earlier in this paper in line with the thinking of Dewey – as concept-embedding activities that knit together or ‘bond’ different content areas. Instances in each set of grouped data that met this definition were coded as examples of wellbeing-and-sustainability activities.
5) Attending to un-coded and overlapping data: All grouped data were re-coded by the first author using the same definition of integration as used in the creation of categories (e.g. as in Step 3). Any data remaining un-coded after this process was not considered further. Overlapping data were refined into single examples of integrated wellbeing-and-sustainability activities.

6) Refinement of category system: The definitions of wellbeing and sustainability taken from the EYLF (Department of Education & Relations (DEEWR), 2009) were used to isolate core concepts associated with each discipline area. The core concepts were those listed in the EYLF definitions as evidence of children’s learning (e.g. ‘Develop an awareness of the impact of human activity on environments and the interdependence of living things’ p. 29). To represent the concepts as integrated each core concept was placed in a table. The ‘wellbeing’ core concepts were listed in columns and the ‘sustainability’ core concepts were listed in rows. This representation allows us to create an integrated conceptual framework for ‘wellbeing-and-sustainability’ into which the activities generated by teachers could be mapped (e.g. Table 1).
Table 1 Integrated conceptual framework for ‘wellbeing-and-sustainability’

<table>
<thead>
<tr>
<th>‘Wellbeing’ core concepts</th>
<th>‘Sustainability’ core concepts</th>
<th>Physical activity</th>
<th>Awareness of nutrition</th>
<th>Awareness of healthy lifestyles</th>
<th>Spatial awareness and moving in the environment</th>
<th>Complex motor skills and patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of constructed environments</td>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of natural environments</td>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interdependence between land, people, plants and animals</td>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship between living and non-living things</td>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact of human activity on the environment</td>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All data categorized as ‘integrated’ during step 3 were consequently mapped into the table. Mapping was conducted according to the core concepts addressed by each activity. The mapping illustrated the range of activities teachers generated to support children’s engagement with concepts from the content areas of wellbeing and sustainability. Each mapped activity was then further color-coded according to the play-type used for its intended or enacted implementation with the children, these being the three play-types comprising the Pedagogical Play-framework. Open-ended play activities were coded yellow. Modelled-play activities were coded red and purposefully-framed activities coded blue. This color-
coding illustrated the play-based approach to curriculum formation used by the teachers. The final color-coded table therefore addressed our research question: What range of activities do teachers generate to support children’s engagement with concepts from the content areas of wellbeing and sustainability using a play-based approach to curriculum formation?

Limitations

This study contains two main limitations. First, the conduct of the intervention with teachers and children in only two areas of Melbourne limits claims about the everyday activities of children, their families and early childhood centres to a particular socio-economic and cultural context. Second, the main form of data generation for the teachers was the maintenance of the visual art diaries. Accompanying data, in particular the use teacher critical incident interviews reflecting on the range of activities generated would have provided greater insight into the processes of integrating wellbeing and sustainability content areas.

Findings

The findings identified a total of 47 integrated activities generated by the teachers to ‘bond’ children’s engagement with concepts from the content areas of wellbeing and sustainability (excluding duplicate activities). Of these 42 activities, eleven involved open-ended play; twelve modelled play; and the remaining 21 purposefully-framed play. Table 2 provides an overview of the integrated conceptual framework for
wellbeing-and-sustainability into which teacher generated activities were mapped and coded according to play-type.
### Table 2 Completed integrated conceptual framework for wellbeing-and-sustainability

<table>
<thead>
<tr>
<th>SUSTAINABILITY</th>
<th>WELLBEING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of constructed environments</td>
<td>Physical activity</td>
</tr>
<tr>
<td><em>Play corner:</em> gymnasium with weights, exercise bike, skipping ropes</td>
<td>Play corner: fruit and vegetable stall</td>
</tr>
<tr>
<td>Mini Olympics: based on children's interest in the 2016 Rio Olympics</td>
<td>Play corner: ‘MasterChef’ using playdough</td>
</tr>
<tr>
<td>Knowledge of natural environments</td>
<td>*Playing in the digging pit</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Examining a pumpkin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Interdependence between land, people, plants and animals</td>
<td>Digging holes to plant vegetable seeds</td>
</tr>
<tr>
<td>Relationships between living and non-living things</td>
<td>*Co-building a worm farm</td>
</tr>
</tbody>
</table>

Learning about bees: how we need them for healthy food production; reading books and discussion.
| Impact of human activity on the environment | Creating signs “Don’t climb in the vegetable garden” | Use of recyclable containers or nude food for snack/lunch; promotion of natural foods in lunchboxes | Collecting food packaging for one week Comparing decomposition of banana peel with a plastic packaging Using recyclable plates and cups instead of disposables | Sorting exercise: Classifying items into the four types of bins: blue-paper; yellow-plastic recycling; red-packaging; green-fruit/vegetable scraps for compost bin. |

Note * Indicates activity mapped to more than one integrated concept

Open-ended play: Promotes exploration of concept (Yellow)

Modelled play: Illustrates a concept in action by teachers with children (Red)

Purposefully-framed play: Co-develops a concept between teachers and children using a range of informational resources (Blue)
The most frequently bonded concepts from wellbeing and sustainability according to integrated activities generated by teachers were:

1. Knowledge of the natural environments and Awareness of nutrition: with activities focused on tasting food, eating vegetables harvested from the kindergarten garden and discussing ‘where does food come from?’

2. Knowledge of natural environments and Awareness of healthy lifestyles: with activities focused on walking, composting waste, creating a food rainbow with photographic images of naturally grown foods, discussing foods in the food rainbow, harvesting food from the kindergarten garden, discussing different types of markets (e.g. farmer’s market versus supermarket) and co-viewing a DVD about food, water and exercise

3. Interdependence between land, people, plants and animals and Awareness of nutrition: with activities focused on teachers and children co-preparing healthy snacks, cooking meals together, discussing different types of drinks (water and flavoured), discussing drink containers (re-useable and plastic waste) and the influence of popular-culture characters on drink container and drink choice

4. Interdependence between land, people, plants and animals and Awareness of healthy lifestyles: with activities focused on discussing the content information in a food pyramid poster, talking about different
types of markets (e.g. farmer’s market versus supermarket) and co-viewing a DVD about food, water and exercise.

5. Impact of human activity on the environment and Awareness of healthy lifestyles: with activities focused on collecting food packaging for a week, comparing the decomposition of banana peel with plastic packaging and using recyclable plates cups in the kindergarten instead of disposables.

Only one concept from wellbeing and sustainability indicated no recorded integrated activities by teachers. This was: Impact of human activity on the environment and Complex motor skills and patterns. The remaining bonded concepts for wellbeing and sustainability included at least one activity (e.g. Relationships between living and non-living things and Complex motor patterns which involved children in separating non-compostable items from waste for the kindergarten worm farm and/or compost bin).

**Discussion**

Mapping and coding the activities generated by teachers into the wellbeing-and-sustainability conceptual framework suggests that an integrated and play-based approach to engaging children in learning about healthy eating and environmental sustainability is possible. The activities presented in the conceptual framework, and their alignment with different play-types derived from the Pedagogical Play-framework attend to both Dewey’s (1969) ideas about conceptual knowledge...
development from an integrated perspective, and Vygotsky’s (1987) ideas
about the creation of mature concepts from the merging of everyday and
scientific conceptual knowledge. There is evidence of core concepts from
the discipline areas of wellbeing and sustainability being ‘bonded’ for
children by teacher generated activities. For example, the most
frequently generated activities appear to bond concepts associated with:
a) knowledge of natural environments, nutrition and healthy lifestyles;
and b) the interdependence of land, people, plants and animals, nutrition
and healthy lifestyles. This bonding occurred through consideration of
growing, tasting, cooking and talking about everyday foods as opposed to
more packaged or ‘supermarket’ available products. Interestingly, in
these bonded concepts the predominante play-types used by teachers was
purposefully-framed play. However, alternative play-types were
evidenced in activities that bonded further concepts, such as knowledge of
constructed environments, physical activity, nutrition and healthy
lifestyles. For example, the use of the home corner to provide open-ended
play about a ‘fruit and vegetable stall’, ‘drink shop’ and ‘gymnasium’
provided opportunities for the everyday exploration of concepts such as
exercise, everyday foods and recycling and drinking water. These
everyday concepts were then referenced in integrated activities for
knowledge of ‘natural environments’ and ‘interdependence’ such that
conversations from a purposefully-framed play perspective were possible
about which drink – flavoured or water children would choose over
another; the difference between a farmer’s market and a supermarket:
and/or co-viewing a video about healthy eating, exercise and drinking water. The combinations of play-types indicated against the integrated activities suggests the table should be read as a whole, and not as separate activities nor play-types. In this way, the table operates as a pedagogical tool that enables teachers to plan for young children’s engagement with conceptual knowledge from the content areas of wellbeing and sustainability from an integrated and play-based perspective.

Read holistically, the table illustrates how teachers may consider engaging young children in acquiring the content knowledge about wellbeing and sustainability that exists as a cultural resource alongside their engagement and consumption of cultural resources that may otherwise be considered ‘toxic’ for children’s development. As we argued earlier in this paper, an educative response to the supposed issue of toxicity is important because it builds young children’s learning from the ground-up by attending to their existing funds of knowledge (Edwards et al. 2016). This approach contrasts with the top-down provision of education about healthy eating and sustainability which are typically provided as a remedial response to concerns about toxicity. Top-down approaches are rarely effective over the long-term because they do not connect with young children’s life-worlds. Both Dewey (1969) and Vygotsky (1987) in their descriptions of young children’s knowledge development highlight the significance of the everyday in concept
formation – or what Williams (2001) understands as the ‘ordinariness of culture’ (Williams, 2001).

This holistic reading has two benefits for teachers. First, it illustrates how particular patterns of play-types consistent with the two principles of the Pedagogical Play-framework may be deployed. These principles hold that all three play-types of are equal pedagogical value and that all three play-types can be used in multiple combinations to support learning. Colour coding of the play-types in the activities generated by teachers for this study suggests that open-ended play was used to provide children with access to everyday concepts, as was modelled play. For example, the provision of play gymnasium in the home corner for open-ended play and/or collecting food scraps for composting as modelled play. Second, a holistic reading demonstrates the conceptual meeting points at which the integration of concepts from wellbeing and sustainability are most easily achieved, and those points were more thought may be necessary. The most frequently occurring activities were located in concepts that related natural environments with nutrition or healthy lifestyles. These concepts have what Dewey (1969) describes as a ‘certain general path, or line laid out along which ideas naturally march, instead of moving from one chance association to another’. Here, vegetable gardening as a form of ‘natural environment’ logically led teachers to consider healthy locally grown foods in terms of ‘nutrition’ and ‘healthy lifestyles’. In contrast, much can still be learned according to the concepts that remained un-bonded in the absence of any noted activity.
These concepts, such as the integration of Impact of humans on the environment and Nutrition nonetheless provide potential fertile ground for exploration with children – for example, what is the impact of mass produced food products on the environment? And, to what extent are these foods of nutritional value? In raising these points of currently ‘unmet’ conceptual integration there is possibility for teachers to generate further activities according to the play-types used in the Pedagogical Play-framework – thus expanding the educative possibilities of working to build children’s conceptual knowledge about wellbeing and sustainability over the provision of top-down approaches to education intended to impact children’s wellbeing and environmental sustainability in the 21st century.

**Conclusion**

Childhood obesity, increased levels of sedentary behaviour and environmental degradation are real issues for young children of today. In this paper, we have argued from a sociocultural perspective that the social situation of development in which these issues exist for young children is not well served from within a discourse of toxicity. Instead, we have shown using the works of Dewey (1969) and Vygotsky (1987) that young children’s daily life experiences provide an integrated and everyday basis for knowledge construction about wellbeing and sustainability according to children’s engagement with popular-culture, food products and merchandise. A significant problem for early childhood teachers wishing to avoid top-down approaches towards obesity
prevention and sustainability education in early childhood education remains the lack of research directed towards the integrated provision of wellbeing and sustainability education using play-based approaches to curriculum formation. In this paper, we have shown that it is possible for teachers to generate a range of activities that bond concepts from both the content areas of wellbeing and sustainability that are simultaneously located in a play-based approach to curriculum using the Pedagogical Play framework. In this way, an educative response to children’s contemporary life-worlds that seeks to purposively build young children’s capacity to act with agency inside of their own social situation of development is possible. Future research should now attend to the more formalized use of the wellbeing-and-sustainability conceptual framework as tool for pedagogical planning by teachers.
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CHAPTER 6 — Building Children’s Knowledge About Healthy Eating and Sustainability Using Play-Based Learning in Early Childhood Education Settings: A Randomised Trial

Abstract

This paper reports findings from a randomised trial that aimed to increase children’s related knowledge of healthy eating and sustainability following participation in teacher developed play-based learning experiences. The primary aim was change in children’s related knowledge of healthy eating and sustainability. Secondary aims included: increased fruit and vegetable intake, and decreased packaged/unhealthy foods intake. A tertiary aim was to explore changes in physical activity. 300 children completed a Healthy Eating and Sustainability (HES) assessment at three time-points. Intervention group children significantly increased their health and sustainability knowledge three-month post intervention compared to control, $F\ (1,298)\ 11.96,\ p=0.001; \eta^2\.039$; reduced their unhealthy food intake at immediate post, $F\ (1,217)\ 3.940,\ p=0.048; \eta^2\.018$; and increased their vegetable intake three-month post intervention, $F\ (1,212)\ 3.971,\ p=0.048; \eta^2\.018$. The findings contribute to pedagogical understandings about engaging young children in learning about healthy eating and sustainability in early childhood education settings.

Key words: healthy eating, sustainability, play-based learning
Introduction

This paper reports findings from a project examining the influence of teacher developed play-experiences on young children’s related healthy eating and sustainability knowledge when their digital life-worlds are recognized as a source for learning. Globally, overweight and obesity, and environmental sustainability are large and complex problems with related risk factors (Huang, Drewnowski, Kumanyika, & Glass, 2009) for young children including, diabetes, muscular-skeletal and motor disorders and respiratory problems, such as asthma. While these problems cannot be addressed with any single solution, we contend that providing young children with opportunities to understand the relationship between healthy eating and sustainability within the context of their early childhood education setting facilitates informed decision-making about their participation in society.

360-degree Marketing, Obesity Prevention and Curriculum Consequences

Between 1980 and 2013, global childhood overweight and obesity prevalence has grown 47.1% (Ng et al., 2014). While obesity rates in children are plateauing in many European countries, the United States and Australia (Australian Bureau Statistics, 2015; Wabitsch, Moss, & Kromeyer-Hauschild, 2014), they continue to grow in others — including, Brazil, China and India (Gupta, Shah, Nayyar, & Misra, 2013). While obesity comprises many complex social, community and family level factors it is known that 360-degree marketing contributes to the problem. This is particularly the case for many young children (Edwards,
The central concern with 360-degree marketing is that it increases young children’s consumption of highly packaged non-compostable, nutrient-poor and energy-dense food products (Skouteris et al., 2017), thereby promoting energy intake while contributing to excessive landfill. 360-degree marketing exposes pre-school aged children growing up in post-industrialized minority world societies to overt and covert forms of advertising for toys, clothing and food products within the realms of television programming, movies, games and apps which form young children’s digital life-worlds. While marketing to children is prohibited in many countries, including Canada (Raine et al., 2013), Australia (Advertising Standards Bureau), the United Kingdom (Hawkes & Lobstein, 2011), these laws largely single out television advertising and currently fail to address the multiple media platforms which reach children.

The curriculum consequences of 360-degree marketing on young children are becoming more evident in early childhood education settings. Our own research (Edwards et al., 2013), and that of others (Dunn, Niens, & McMillan, 2014; Steinberg, 2014) shows that young children express interest in popular-culture characters and toys, clothing and food products associated with their digital life-worlds. These interests are expressed in children’s role play, their conversations with peers, in their clothing and in the range of food items they bring into the early childhood setting. Life in a digital cross-promotional world is no longer easily kept
at bay by the classroom door. This raises a dilemma for early childhood teachers — how can children’s interests in digital media and popular-culture be supported whilst maintaining a commitment to play-based learning as the dominant pedagogy of choice?

This question suggests an alternative means of thinking about curriculum provision in early childhood education such that children’s digital and popular-culture life-worlds are referenced in the curriculum for opportunities to learn about healthy eating and sustainability. This is particularly important given research has long shown the knowledge development in young children is a critical determinant in their decision-making (Gelman & Kalish, 2006; Halford, Wilson, & Phillips, 2010). Current social practices contributing to obesity and unsustainable relationships with the environment and the non-human suggest that capacity for decision making is increasingly important for young children. We suggest this is particularly so with respect to children’s learning about the relationship between healthy eating and sustainable food practices (e.g. the consumption of locally-grown produce over packaged and mass-transported food products).

Theoretical Framework

This project was conducted within a sociocultural theoretical framework. Sociocultural theory positions knowledge as socially-situated and contextually relevant to young children’s life-worlds (Bodrova & Leong, 2003). A sociocultural perspective understands young children’s experiences of 360-degree marketing as a marker for knowledge
construction about healthy eating and sustainability. The socio-culturally related notion of ‘funds of knowledge’ (Moll, Amanti, Neff, & Gonzalez, 1992) argues that young children’s knowledge is most effectively developed when strong connections between children’s social and contextual experiences in the home and community are made using play-based approaches towards learning (Hedges, 2015). Funds of knowledge represents a ‘ground-up’ approach to knowledge formation because it capitalizes on existing experiences in children’s life-worlds as a basis for learning.

In this project, young children’s digital life-worlds were recognized as central to their engagement with digital media and popular-culture as manifest in their choices about food products and approaches towards sustainability. Thus, the cultural presence of food products and/or young children’s interest in popular-culture play as related experiences of 360-degree marketing were taken as the starting point for knowledge construction. We previously established that such food products and popular-culture play was increasingly evident in kindergartens (Edwards et al., 2013). Teachers reported being unsure of how to pedagogically respond to these funds of knowledge because the food products in particular had health and sustainability consequences for children. The sociocultural framework used in this project contrasts with typical approaches to obesity research intervention in early childhood. These usually rely on top-down approaches in which children are ‘taught’ about healthy eating abstracted from their daily life experiences (Hardy, King,
Kelly, Farrell, & Howlett, 2010). Environmental education research in early childhood education is more typically aligned with a funds of knowledge perspective. It has a history of drawing on young children’s experiences in the natural world as a basis for engaging sustainability education in the early years (Somerville & Williams, 2015). In recent years, early childhood education for sustainability has moved towards the notion of ‘common worlds’ (Pacini-Ketchabaw & Kummen, 2016) whereby respect for the relationship between the human and the non-human displaces Cartesian perspectives of humans in relation to the environment. Top-down approaches towards obesity prevention show little long-term impact on rising rates of childhood obesity in post-industrialized societies (Roberto et al., 2015), while grounded approaches towards sustainability education are known to increase environmental knowledge by young children (Hedefalk, Almqvist, & Östman, 2015).

From a sociocultural perspective, teaching children about healthy eating and environmental education is the not the same as building knowledge about healthy eating and sustainability from the lived experience of the child’s social and cultural context. Arguably, contextualized knowledge has more meaning for young children’s informed decision-making.

A socio-cultural orientation towards ‘play-based learning’ as means of knowledge building about healthy eating and sustainability was taken. Vygotsky’s concepts of imagination (Vygotsky, 2004), Zone of Proximal Development (ZPD) (Vygotsky, 1976) and mature concepts (Vygotsky, 1987) were used. These concepts align with three main play-types
considered productive for knowledge acquisition in early childhood education (Pyle, De Luca & Danniels, 2017), including: open-ended play, modelled play and purposefully-framed play (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2016). Open-ended play relates to Vygotsky’s (2004) description of the role of imagination as a psychological function. Vygotsky (2004) argues that imagination acts as a conduit between the cultural resources of the child’s life-world and the expression of these resources in the child’s play. Through open-ended play, children are able to explore and create multiple combinations of cultural resources that are consequently expressed within their play (e.g. using digital media as a narrative resource for role-playing Spiderman or Frozen). Modelled-play draws on Vygotsky’s (1976) ideas regarding the ZPD whereby modelling of a knowledge concept by an older peer and/or adult within a play-scenario supports the achievement of the concept by the child (e.g. an adult counting the number of candles on a cake made by a child in the sandpit during a ‘birthday’ play scenario). Purposefully-framed play connects with Vygotsky’s (1987) theorisation regarding mature concepts. Mature concepts are developed by children when an adult supports the integration of a child’s everyday experience with a ‘scientific’ explanation for how and why things work (e.g. hand washing removes germs from our hands to reduce the risk of becoming ill). Purposefully-framed play involves children and adults in co-constructed conversations drawing on informational resources to build mature concepts.
Aims

The primary aim was to evaluate the effect of teacher-designed play-based learning experiences on 4-year-old preschool children’s related knowledge of healthy eating and sustainability. The secondary aim was to evaluate the effect of the play-based learning experiences on children’s eating habits. A tertiary aim was to explore changes in physical activity. There were two hypotheses: 1) that intervention group children would exhibit increased related knowledge of healthy eating and sustainability immediately after and sustained three-month post intervention; and 2) intervention group children would exhibit increased fruit and vegetable intake, decreased intake of highly-packaged nutrient-poor food products.

Method

Study Design and Ethics

A randomised trial was conducted between February 2015 and December 2016 in Victoria, Australia. The trial was granted permission to be conducted by the Victorian Department of Education and Training. Ethics was approved by Human Research Ethics Committees of Deakin University, Australian Catholic University and Southern Cross University (HREC 2013-220, HREC201439V and HREC ECN-14-001, respectively). This paper follows the CONSORT checklist for reporting randomised trials (Schulz, Altman, & Moher, 2010) (Available on request). Children were invited to participate in the data collection procedures using a child-centred approaches according to standard research protocols (Oulton et al., 2016). The predetermined risk for
unintended harm was low and no harms were reported by children, parents or teachers.

Randomisation

All eligible kindergartens within selected Local Government Areas (LGAs) were invited to participate. LGAs were the unit of randomization. Those with either a low or high Socio-Economic Index for Areas (SEIFA) scores were randomly selected to achieve equal representation. An uninvolved researcher completed random permutations of 1 for intervention and 2 for control using a computer algorithm, where assignment of one kindergarten to a group forced the closest agreeable centre into the opposite group. Two socio-economically diverse regions of Melbourne were involved: Western and Southern. While early childhood teachers could not be blinded to their trial group allocation, data were collected by researchers who were blinded. Parents were also blinded to their child’s kindergarten group allocation.

Participants

All participants were recruited from sessional kindergartens within the purview of our partner organisation — Early Childhood Management Services (ECMS). 14 Intervention Group (IG) (minimum three-degree Bachelor of Education) teachers and 11 Wait-list Control Group (WCG) (also degree qualified) teachers from 12 separate kindergartens (seven IG; five WCG) participated. 305 parent-child dyads comprising 4-year-old children were recruited. The final sample was 300 dyads as five children declined assent.
Recruitment

All teachers from nominated kindergartens were invited to participate and informed consent obtained. All eligible parents of children in 4-year-old kindergarten (over 18 years, and can read and write in English) were personally invited to participate by the researchers at the kindergarten service. Funding limitations necessitated the English language requirement. Consent was obtained from parents for both themselves and their child to participate. See Figure 1.
Randomised (n=305 parent child dyads)

Enrolment

Allocated to intervention (n=172)
Received allocated intervention (n=168)
Did not receive allocated intervention (n=4: Child refused at assent)
128 parents returned T1 questionnaire

Allocated to Wait-list control (n=133)
Received usual care (n=132)
Did not participate (n=1: Child refused at assent)
113 parents returned T1 questionnaire

Allocation and Baseline (T1)

Follow-Up (T2)

Lost to follow-up (n=3; child either absent or left the preschool)
Discontinued intervention (n=0)
109 Parents returned T2 questionnaire

Lost to follow-up (n=2; child either absent or left the preschool)
Discontinued intervention (n=0)
109 parents returned T2 questionnaire

Follow-Up (T3)

Lost to follow-up (n=4; child either absent or left the preschool)
Discontinued intervention (n=0)
110 Parents returned T3 questionnaire

Lost to follow-up (n=10; child either absent or left the preschool)
Discontinued intervention (n=0)
104 Parents returned T3 questionnaire

Analysis

Analysed Child data (n=168)
Analysed Parent Questionnaire 136
Excluded from analysis (n=32: parents who did not return any time point)

Analysed Child data (n=132)
Analysed Parent Questionnaire 120
Excluded from analysis (n=12: parents who did not return any time point)

Figure 1 Consort Flow Diagram
**The Intervention**

The protocol for the intervention has been previously published (Skouteris et al., 2014). Teachers were invited to identify children’s interests in digital media popular-culture characters as a fund of knowledge. Teachers consequently developed play-based learning experiences related to these interests intended to build children’s related knowledge about healthy eating and sustainability. In this task teachers were supported by: a) access to a Pedagogical Communication Strategy previously developed and trialed in a published pilot-study (Morris et al., 2016; Skouteris, Rutherford, Edwards, & Cutter-Mackenzie, 2013); b) participation in three Professional Learning Sessions hosted by the researchers [Session 1: Using the Pedagogical Communication Strategy; Session 2: Using the three play-types; Session 3: Brainstorming play-based learning experiences]; and c) admittance to a dedicated website containing content information about healthy eating and sustainability. The Pedagogical Communication Strategy and all website material were aligned with the Learning outcomes in the Early Years Learning Framework (EYLF), in particular Outcomes 2 and 3 (DEEWR, 2009). Data pertaining to the range of play-based learning experiences generated by the teachers is reported elsewhere (Edwards et al., under review).

Teachers were encouraged to follow best-practice procedures where practically feasible. These were: 1) implementing the play-based learning experiences early in the scheduled kindergarten session when children
are most cognitively alert; 2) using a combination of the identified play-types (open-ended; modelled and purposefully-framed play); 3) implementing the play-based learning experiences at least 1-2 times per week for approximately 6 weeks; and 4) using a range of life-world resources in the play-based learning experiences.

**Wait-list control group.** The WCG continued with their usual play-based learning experiences. The teachers were provided with the three Professional Learning Sessions at the conclusion of the intervention.

**Outcome Measures**

The data collection procedure for both primary and secondary outcomes occurred at three time points: baseline or Time 1 (T1) (March and April 2015, 2016); immediate post or Time 2 (T2) (July and August 2015, 2016); and three-month post intervention or Time 3 (T3) (November and December 2015, 2016).

**Primary outcome.** The primary outcome was measured using a ‘Healthy Eating and Sustainability’ (HES – previously published as Healthy eating And Sustainability or ‘HAS’) assessment comprising three tasks for eliciting children’s knowledge about healthy eating and sustainability. These were: 1) a sorting task; 2) a practice task for establishing children’s knowledge connections; 3) a healthy eating and sustainability connection task. Task 1 and task 3 used eight images of objects and/or activities associated with healthy eating and sustainability concepts, including: decomposing fruit and vegetables; a Peppa Pig ice-cream package; carrots; children running; empty McDonald’s fry’s
container; a droplet of water; children watching a McDonalds advertisement on television; and domestic rubbish bins. Task 2 used three images: a cup; a clock and two bottles of milk. The HES assessment was trialled and readily completed by a small sample of preschool aged children external to the main study.

All children completed the HES assessment at a table located within the kindergarten classroom in view of the teacher. For task 1: two placemats were placed in front of the children showing a large green circle and a large red circle. It was explained that the green circle meant ‘Go, do or eat that’ and the red circle meant ‘Stop, don’t do or eat that’. The children were given each picture and invited to consider placing it on either the green or red circle. Children were not invited to share their reasoning for placements at this stage to reduce the time burden of the assessment. For task 2: children were invited to indicate which images they understood to belong (the cup, clock and milk bottles). A ‘correct’ response was recorded as pairing the cup and bottles of milk. The purpose of this task was to inform children’s capacity for the third task. Only 1% (3) of children were ‘incorrect’ at all three time points on task 2. No significant differences existed between trial groups at any time point for task 2.

For task 3: all eight images were randomly placed in front of the child. The researcher invited the child to consider if any pictures belonged together. When the child made a selection of images, the researcher inquired why they belonged together. After the explanation, the images
were returned to the child with the others. This process continued until the child indicated that all combinatorial options were exhausted.

**Secondary outcomes.** A validated Eating and Physical Activity Questionnaire (EPAQ) (Bennett, de Silva-Sanigorski, Nichols, Bell, & Swinburn, 2009) with low burden (5 minutes for completion) was used with parents. Parents were invited to complete this questionnaire at each of the three time points concurrent to their child's data collection. The EPAQ has three sections: 1) sedentary and physical activity 2) beverage consumption; and 3) consumption of healthy and unhealthy foods. 44 of 300 parents did not return the questionnaire at any time point and were withdrawn. Of the remaining 256 parents, 187 returned all three time points, 50 returned two and 20 returned only one. See Figure 1 (Schulz et al., 2010).

**Demographics**

Demographic questions were attached to the baseline EPAQ requesting parental information including: age, height and weight, education, country of birth and combined level of income. Questions about the participating child were also asked including: country of birth and birth order. Objective measures of children’s height and weight were collected prior to the HES assessment. Children’s shoes, hats and bulky jackets were removed. Height was measured using a stadiometer (handy height scale, model PE087) and standardized digital scales were used to measure weight (Charder, model MS-3200).
Sample Size Calculation and Statistical Analyses

Sample size calculations were based on previous work with Australian children aged 2-4 years (Mathews et al., 2009). This project was powered for the secondary outcome, specifically vegetable consumption, given this outcome requires the largest sample to detect a change over time, compared to other dietary outcomes and/or children’s knowledge connections. As no quantitative dietary recommendations for children < 4 years existed at the time of development, a 25% increase in vegetable consumption was considered a minimum target (Campbell et al., 2008). One hundred parent/child dyads were necessary to detect a 25% difference in vegetable consumption between the Intervention and Wait-list control groups, significant at alpha=0.05, with a power of 0.8. Accounting for 20% attrition, a final sample of 250 was required, 125 children in each group. This was achieved with 168 IG, and 132 WCG children.

Changes in knowledge and dietary outcomes were determined through repeated measures Analysis of Variance (ANOVA). Multiple imputation of the EPAQ data was used to address missing values. Children’s Body Mass Index (BMI) was calculated for exploratory purposes as the brief window of measurement was unlikely to present significant changes. The LMSgrowth (Pan & Cole, 2012) statistical package was used in these BMI calculations. All statistical analyses were completed using IBM SPSS version 24 (IBM Corp., Released 2016.).
Results

Demographic characteristics of the 241 parents who returned the baseline survey are presented in Table 1. There were no significant differences in demographic characteristics of the IG and WCG, except for father’s height, $F (1,233) = 9.546, \ p=.002, \ \eta_p^2=.039$. No significant differences were seen between age, gender, country of birth or BMI between the IG and WCG children.
Table 1 Demographics characteristics of parents and children

<table>
<thead>
<tr>
<th></th>
<th>Mother IG</th>
<th>Mother WCG</th>
<th>Father IG</th>
<th>Father WCG</th>
<th>Child (time 1 only) IG</th>
<th>Child (time 1 only) WCG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean (Standard Deviation (SD))</td>
<td>35.15 (4.92)</td>
<td>35.32 (4.93)</td>
<td>38.32 (5.69)</td>
<td>37.29 (5.31)</td>
<td>4.76 (0.36)</td>
<td>4.68 (0.37)</td>
</tr>
<tr>
<td>Country of birth: Australia%</td>
<td>72.4</td>
<td>70.3</td>
<td>74.8</td>
<td>61.8</td>
<td>90.6</td>
<td>94.6</td>
</tr>
<tr>
<td>Country of birth: Other%</td>
<td>27.6</td>
<td>29.7</td>
<td>24.4</td>
<td>36.4</td>
<td>9.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Height centimetres mean (SD)</td>
<td>162.57 (13.01)</td>
<td>163.00 (9.23)</td>
<td>161.18 (35.07)</td>
<td>173.35 (22.83)</td>
<td>108.37 (4.88)</td>
<td>108.57 (5.11)</td>
</tr>
<tr>
<td>Weight kilograms mean (SD)</td>
<td>70.47 (17.61)</td>
<td>68.49 (14.0)</td>
<td>84.82 (14.06)</td>
<td>87.55 (15.18)</td>
<td>19.12 (2.88)</td>
<td>19.38 (2.96)</td>
</tr>
<tr>
<td>*BMI- Thin and Normal weight%</td>
<td>52.1</td>
<td>56.3</td>
<td>31.6</td>
<td>22.3</td>
<td>73.1</td>
<td>61.8</td>
</tr>
<tr>
<td>BMI- at risk for Overweight%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>18.6</td>
<td>28.2</td>
</tr>
<tr>
<td>BMI- Overweight%</td>
<td>24.8</td>
<td>27.2</td>
<td>50.0</td>
<td>51.5</td>
<td>4.8</td>
<td>6.9</td>
</tr>
<tr>
<td>BMI- Obese%</td>
<td>23.1</td>
<td>16.5</td>
<td>18.4</td>
<td>26.2</td>
<td>3.6</td>
<td>3.1</td>
</tr>
<tr>
<td>Education%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High school only</td>
<td>29.5</td>
<td>33.7</td>
<td>35.5</td>
<td>40.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vocation/technical</td>
<td>13.1</td>
<td>5.8</td>
<td>21.5</td>
<td>20.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>All University</td>
<td>49.2</td>
<td>51.9</td>
<td>37.2</td>
<td>34.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>8.2</td>
<td>8.7</td>
<td>5.8</td>
<td>4.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Combined Family income%</td>
<td>IG</td>
<td>WCG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low: &lt;$25,000-$65,000</td>
<td>28.1</td>
<td>27.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium: $65001- $105,000</td>
<td>31.4</td>
<td>29.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High: $105,001- $145,000+</td>
<td>40.5</td>
<td>43.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
IG- Intervention Group;
WCG- Wait-list Control Group
**Primary Outcome: HAS Assessment**

All scores from the first task were recoded and summed to produce a total correct score. The minimum possible score was 0 to 8 correctly sorted. ANOVA’s showed that there were no significant differences between groups at any time-point.

Two determinations were made during the screening process of the HES knowledge connections from task three: 1) Did the child’s grouping of images indicate knowledge of healthy eating and sustainability; and 2) Did the child’s explanation demonstrate reasoning behind their groupings? Three researchers (Authors HM, SE and HS) individually and then collectively determined if each of the groupings met these determinants. Ten commonly connected groupings and variants on the same explanation were identified (See Table 2). For the purposes of analysis, groupings 7 and 8, and groupings 9 and 10 were combined. An ‘other’ category was also established for instances where children placed three or more images together.

Between the IG and WCG, there were no significant differences for the most commonly connected groupings at T1 and T2. For T3, four groupings were significant for the IG including McDonalds French fries box and the children watching a television advertisement for McDonalds [F (1,298) 10.33, p=.001; \(\eta^2_{p} .034\)]; decomposing fruit and vegetables with water/carrots and water [F (1,298) 6.221, p=.013; \(\eta^2_{p} .020\)]; decomposing fruits and vegetables and bins/carrots and bins [F (1,298) 7.333, p=.007, \(\eta^2_{p} .024\)]; Other [F (1,298) 5.693, p=.018; \(\eta^2_{p} .019\)]. See table 3.
### Table 2 Common connections and their explanations

<table>
<thead>
<tr>
<th>Grouping Number</th>
<th>Pictures</th>
<th>Children's Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>McDonalds Fries box; TV advertising for McDonalds</td>
<td>They're watching an ad for McDonalds</td>
</tr>
<tr>
<td>2</td>
<td>Children running; Carrots</td>
<td>Running and eating carrots are healthy for our bodies</td>
</tr>
<tr>
<td>3</td>
<td>Carrots; Composting fruit and vegetables</td>
<td>Carrots can go in the compost</td>
</tr>
<tr>
<td>4</td>
<td>Water droplet; Children running</td>
<td>Running makes you thirsty and you need a drink of water</td>
</tr>
<tr>
<td>5</td>
<td>Peppa pig ice cream packaging; Rubbish bins</td>
<td>The wrapping or the stick from the ice cream can go in the recycling bin</td>
</tr>
<tr>
<td>6</td>
<td>McDonalds Fries box; Rubbish bins</td>
<td>The box can go in the recycling bin</td>
</tr>
<tr>
<td>7</td>
<td>Composting fruit and vegetables; Water droplet</td>
<td>The worms in the compost need water</td>
</tr>
<tr>
<td>8</td>
<td>Carrots; Water droplet</td>
<td>Carrots need water to grow</td>
</tr>
<tr>
<td>9</td>
<td>Composting fruit and vegetables; Rubbish bins</td>
<td>Compost belongs in a compost bin</td>
</tr>
<tr>
<td>10</td>
<td>Carrots; Rubbish bins</td>
<td>Carrot peels goes in the bin</td>
</tr>
<tr>
<td>11</td>
<td>Other</td>
<td>Various</td>
</tr>
</tbody>
</table>
Table 3  Trial Group comparison of Healthy Eating and Sustainability groupings

<table>
<thead>
<tr>
<th>Common Connections</th>
<th>Intervention group mean</th>
<th>Wait-list control group mean</th>
<th>P value</th>
<th>Partial eta squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>McDonalds Fries Box; Television</td>
<td>.11</td>
<td>.02</td>
<td>.001*</td>
<td>.034</td>
</tr>
<tr>
<td>Children running; Carrots</td>
<td>.08</td>
<td>.05</td>
<td>.261</td>
<td></td>
</tr>
<tr>
<td>Carrots; Compost</td>
<td>.15</td>
<td>.20</td>
<td>.339</td>
<td></td>
</tr>
<tr>
<td>Water droplet; Children Running</td>
<td>.15</td>
<td>.14</td>
<td>.795</td>
<td></td>
</tr>
<tr>
<td>Compost or Carrots; water droplet</td>
<td>.20</td>
<td>.09</td>
<td>.013*</td>
<td>.020</td>
</tr>
<tr>
<td>Peppa Pig Box; Rubbish Bins</td>
<td>.13</td>
<td>.10</td>
<td>.474</td>
<td></td>
</tr>
<tr>
<td>McDonalds fries box; Rubbish Bins</td>
<td>.11</td>
<td>.11</td>
<td>.988</td>
<td></td>
</tr>
<tr>
<td>Compost or Carrots; Bins</td>
<td>.23</td>
<td>.10</td>
<td>.007*</td>
<td>.024</td>
</tr>
<tr>
<td>Other</td>
<td>.19</td>
<td>.06</td>
<td>.009*</td>
<td>.023</td>
</tr>
</tbody>
</table>

The IG saw a significant difference for the McDonalds French fries box and the children watching an advertisement for McDonalds on television across all time points [Wilks’ Lambda= .926, F (2,166) 6.638, P=.002, multivariate ηp² =.074]; Running and the water droplet [Wilks’ Lambda= .900, F (2,166) 9.181, P=.0001, multivariate ηp² =.100]; and Compost and/or carrots and water [Wilks’ Lambda= .943, F (2,166) 5.008, P=.008, multivariate ηp² =.057]. Both the IG and the WCG saw an increase in the carrots and compost images [Wilks’ Lambda= .959, F
(2,166) 3.566, P=.030, multivariate ηp²=.041; Wilks’ Lambda= .926, F
(2,130) 5.166, P=.007, multivariate ηp²=.074] respectively (Table 4).

Table 4 HES groupings differences within each trial group

<table>
<thead>
<tr>
<th>Intervention group means (T1, T2, T3)</th>
<th>P value</th>
<th>Partial eta²</th>
<th>Wait-list control group means (T1, T2, T3)</th>
<th>P value</th>
<th>Partial eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td>McDonalds Fries Box; Television</td>
<td>.02, .04, .11</td>
<td>.002*</td>
<td>.074</td>
<td>.06, .03, .02</td>
<td>.156</td>
</tr>
<tr>
<td>Children running; Carrots</td>
<td>.07, .05, .08</td>
<td>.661</td>
<td>.06, .08, .05</td>
<td>.436</td>
<td></td>
</tr>
<tr>
<td>Carrots; Compost</td>
<td>.07, .12, .15</td>
<td>.030*</td>
<td>.041</td>
<td>.07, .14, .20</td>
<td>.007*</td>
</tr>
<tr>
<td>Water droplet; Children running</td>
<td>.04, .13, .15</td>
<td>.0001*</td>
<td>.100</td>
<td>.08, .11, .14</td>
<td>.224</td>
</tr>
<tr>
<td>Compost or Carrots; water droplet</td>
<td>.09, .15, .20</td>
<td>.008*</td>
<td>.057</td>
<td>.11, .11, .09</td>
<td>.801</td>
</tr>
<tr>
<td>Peppa Pig box; Rubbish Bins</td>
<td>.11, .13, .13</td>
<td>.802</td>
<td>.11, .17, .10</td>
<td>.234</td>
<td></td>
</tr>
<tr>
<td>McDonalds fries box; Rubbish Bins</td>
<td>.12, .11, .11</td>
<td>.949</td>
<td>.14, .09, .11</td>
<td>.454</td>
<td></td>
</tr>
<tr>
<td>Compost or Carrots; Rubbish Bins</td>
<td>.17, .21, .23</td>
<td>.324</td>
<td>.17, .15, .10</td>
<td>.254</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>.13, .21, .19</td>
<td>.215</td>
<td>.16, .11, .06</td>
<td>.064</td>
<td></td>
</tr>
</tbody>
</table>
A total HES ‘grouping score’ was formulated to capture children’s knowledge about healthy eating and sustainability following the play-based learning intervention. The HES grouping score was calculated by counting a ‘grouping’ once regardless of repetition. The total score was created by removing duplicates from T2 that were present in T1, and removing duplicates from T3 that were present in T1 and T2. No significant differences in the total HES grouping score were present between trial groups at T1 or T2. At T3, the IG had a greater total grouping score than the WCG \[ F(1, 298) = 11.96, p=.001; \eta^2 = .039 \] indicating significantly greater knowledge groupings than the WCG. The IG exhibited significant differences in total HES groupings between T1 and T2; T1 and T3 but not between T2 and T3 [Wilks’ Lambda 0.87. \( \text{F}(2,165) = 12.00, p=.001; \eta^2 = .127 \)]. No differences were found at any time for the WCG.

**Secondary Outcome: Eating Habits**

72.2% of parents returned all three time points and 14% did not return any time point. All statistics were derived from the original, non-imputed data. Two significant differences between the IG and WCG were found at baseline only: healthy foods \[ F(1, 237) = 6.488, p=.011, \eta^2 = .026 \] which was largely driven fruit intake \[ F(1, 236) = 6.710, p=.010, \eta^2 = .028 \]. At T2, the IG consumed significantly less unhealthy foods than the WCG \[ F(1, 217) = 3.940, p=.048; \eta^2 = .018 \]. At T3, the IG demonstrated a significantly more vegetables serves than the WCG \[ F(1, 212) = 3.971,
There were no other significant differences between trial groups for the remaining EPAQ variables.

Imputed data were used to determine any differences within trial groups. Repeated measures ANOVA’s could not be applied because of the statistical package used (van Ginkel & Kroonenberg, 2014), therefore paired samples t-tests were conducted. The WCG demonstrated a significant increase in unhealthy food serves between T1 and T2 (t=-2.404 (12947), p=.016), largely driven by a significant increase in packaged snacks (t=-2.991 (5149), p=.003). The WCG showed a significant decrease in screen time total minutes between T1 and T2 (t= 2.199 (2969), p=.028), however a significant increase in screen time minutes occurred between T2 and T3 (t=-2.143 (11520), p=.032).

**Third Outcome: Physical Activity**

At T1, a significant difference between the IG and WCG was found for the frequency of being taken somewhere for physical activity [F (1,238) 5.564, p=.019, $\eta_p^2 = .023$]. This was not sustained.

**Discussion**

In this paper, we have outlined the details of a project examining the influence of teacher-developed, play-based learning experiences on young children’s related healthy eating and sustainability knowledge when their digital life-worlds are recognized from a funds of knowledge perspective as a source for learning. The HES assessment suggests that young children are able to engage in related knowledge building about
healthy eating and sustainability via such play-based learning experiences. This is evidenced by the intervention group producing significantly more knowledge groupings at T3 than the wait-list control group. Building on young children’s funds of knowledge using the three play-types suggests a potential way forward for teachers to engage with the related health and sustainability issues generated by 360-degree marketing in their settings. This is an important contribution because it suggests that teachers do not need to remain pedagogically challenged by the seeming contradiction between young children’s engagement in digital life-worlds and the ways in which this may manifest in the classroom in the consumption of highly-packaged and nutrient poor food products. Rather, a pedagogical response to the issue of rising childhood obesity and increased environmental degradation may be possible such that young children’s knowledge of healthy eating and sustainability is built by teachers via play-based learning experiences.

Positive changes were evidenced for healthy eating outcomes for children over time – specifically increased vegetable consumption by IG children at T3 and less unhealthy foods consumed at T2. This suggests potential for engaging the issue of obesity from a ground-up and play-based approach such that children’s related healthy eating and sustainability knowledge is built from within their experiences of 360-degree marketing rather than attempting to teach children about healthy eating and sustainability as separate content areas. This finding is
contrary to existing top-down approaches towards obesity prevention research in early childhood (Hardy et al., 2010).

The finding regarding physical activity indicated little change between each group at T2 and T3. This is possibly a consequence of the Professional Learning Sessions in which physical activity did not feature as strongly as either healthy eating and/or sustainability. It is possible that teachers therefore did not embed physical activity within the play-based learning experiences for children to the same extent as the related knowledge about healthy eating and sustainability.

**Strengths**

To our knowledge, this project contributes new insight regarding young children’s engagement with 360-degree marketing as a play-based source for related knowledge building about healthy eating and sustainability in early childhood. Several methodological strengths support the findings regarding young children’s related healthy eating and sustainability knowledge: 1) an appropriate sample size to determine statistically significant differences between the IG and WLC groups was achieved; 2) an IG and WCG from both low and high socio-economic regions provided a balanced representation indicating improved generalisability for metropolitan regions [in Melbourne, Australia]; 3) the play-based learning intervention utilised three play-types strongly located in the theoretical work of Vygotsky (e.g. imagination, ZPD and mature concepts).
Limitations

This project indicates methodological limitations. Task 1 did not seek children’s explanations for placing images in the green or red circle. This reduced any broader understanding of the child’s reasoning consequently provided in task 3. Modifications should invite children’s explanations for placement of the images in task 1 in accordance with current research practices with young children (Legare, 2014). This methodological adjustment would also be consistent with the sociocultural framing of the project as related to children’s funds of knowledge. This adjustment would extend the duration of the HES assessment beyond its current fifteen-minute time frame requiring attention to participation burden.

Conclusion

Young children today are growing up in complex environments in which issues of obesity and environmental sustainability feature – often in response to their exposure to 360-degree marketing. This project suggests potential in acknowledging children’s life-worlds as a source for play-based learning about healthy eating and sustainability to facilitate children’s decision-making about healthy eating and sustainability.
Funding

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Acknowledgements

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doi:10.1111/cch.12344


The development of childhood obesity occurs within a complex system of influencing factors that exert both short and long-term risks. Factors that are most proximal to the child are typically most influential. A recent model describing these determinants relating to obesity development in children was developed by Harrison et al (2012). Their “Six-Cs” model identifies cell (genetic characteristics), child, clan, community, country and culture as influencing factors and uniquely places the child as an active agent in his or her own development of obesity (Harrison et al., 2011). We believe that Childhood Education may be a significant seventh ‘C’ in this model. A recent Cochrane Review and international health agencies have identified Childhood Education as key in delivering obesity prevention strategies (Centers for Disease Control and Prevention, 2016; Waters et al., 2011; World Health Organization, 2012), through education, capacity building and policy. However, pedagogical development in obesity prevention remains limited for young children.

Significant areas for intervention are identified when the complex system of obesity development is overlaid onto the context of contemporary childhood. In particular, engagement with digital
technologies and the subsequent exposure to 360-degree marketing (Skouteris Edwards, Skouteris, Rutherford, & Cutter-Mackenzie, 2013) can lead to increases in the consumption of highly-packaged foods, which tend to be nutrient-poor and energy-dense, and decreases in children’s levels of active play. These, among other factors such as decreased play spaces and walkability in neighbourhoods, increased traffic congestion, increased costs of higher quality foods, access to healthy foods to name a few, place children at increased risk of excessive weight gain and associated poor health outcomes (Rutherford, Biron, & Skouteris, 2011). In addition, the consumption of highly-packaged food products normalises for young children inappropriate environmental sustainability behaviours through the generation of unnecessary waste (Skouteris, Do, Rutherford, Cutter-Mackenzie, & Edwards, 2010). Fostering young children’s capacity to make their own informed decisions about food, active play and environmental responsibility through Childhood Education enables resistance to obesogenic environments and its pressures (Edwards et al., 2016).

**Leveraging Early Childhood Education Through the Foundation Laid by Parents**

Parents are often the main target or focus of Early Childhood (EC) obesity prevention interventions (Knowlden & Sharma, 2012). This is despite the fact that EC educators spend significant time with preschool children and have the capacity to actively build children’s knowledge concepts. EC educators understand parents as the ‘first teacher’ of young
children. Working with parents, educators seek to understand and build on young children’s existing funds of knowledge: the knowledge and skills with cultural and historical relevance that are available to a child within the family home (Moll, Amanti, Neff, & Gonzalez, 1992). This is achieved by early childhood educators working closely with families and children to identify children’s existing knowledge and interests. Play-based learning interventions in EC settings that are built from these ‘funds of knowledge’ are more likely to develop children’s knowledge concepts about healthy eating and sustainability. This is because children’s family-initiated funds of knowledge are of inherent interest to them (Hedges, Cullen, & Jordan, 2011). In contrast, ‘top-down’ interventions that are directive, pre-prescribed and rigid, often fail to connect with children’s home and community experiences or their interests (Ebbeck, Yim, & Lee, 2013). We acknowledge that these interventions are sometimes needed particularly when educators’ themselves require access to information and resources about healthy eating, active living, and sustainability. However, in addition to not connecting with children’s home and community experiences, these ‘top-down’ interventions may not maximize the potential impacts as: 1) they do not build the capacity of educators or provide ownership of the curriculum being delivered; and 2) they do not skill young children to be knowledgeable and active agents of their own wellbeing. This is especially important for children living in disadvantage who have the most to gain from quality Childhood Education (Roberts, 2015).
A Solutions Approach to Obesity Prevention Derived from New Knowledge

Over the last five years, we have created a new knowledge base about obesity prevention and sustainability education in early childhood (Skouteris Edwards et al., 2013; Skouteris et al., 2014). This knowledge emphasizes the relationship between children’s funds of knowledge and the building of learning experiences for children based on these funds. Our work has resulted in a teacher ‘tool-kit’ that helps educators build these learning experiences about healthy eating, active play, and sustainability. The tool-kit includes: (1) a pedagogical communication strategy for aligning healthy eating, active play, and sustainability education with the Learning Outcomes from the Australian Early Years Learning Framework (Department of Education, Employment and Workplace Relations, 2009); (2) a book regarding the teaching of sustainability education in early childhood settings (Cutter-Mackenzie, Edwards, Moore, & Boyd, 2014); (3) a series of animated Professional Learning modules canvassing the main content necessary to teach healthy eating, active play, and sustainability in early childhood; (4) a Pedagogical Play-framework for embedding content information about healthy eating, active play, and sustainability into the play-based approach to learning used in early childhood education (Edwards et al., in press); and (5) exemplars of best practice approaches to teaching healthy eating active play, and sustainability in early childhood (Edwards et al., 2016). We have shown that play-based learning interventions that
combine the messages of healthy eating, active play, and sustainability are feasible to deliver in 4-year-old preschool classrooms (Edwards et al., 2016; Morris et al., 2016). These play-based interventions are feasible in these classroom because EC educators identify children’s funds of knowledge and use these funds to build children’s everyday concepts (self-deducted working theories about the world) into scientific or mature concepts about healthy eating and sustainability (Vygotsky, Rieber, & Carton, 1987). For example, a child may develop an everyday concept of soil by playing in a digging pit. A scientific concept of soil is that it provides plants with the nutrients necessary for growth. A mature concept would be when the child understands that healthy everyday foods can be grown in the soil available at kindergarten, at home or in a community garden – but only to the extent that the soil is nurtured. Mature concepts represent higher-order thinking processes, and therefore have explanatory power for children that enable quality decision-making. Following on for our example, a child with a mature concept of soil appreciates that it must be protected from environmental degradation to ensure that healthy food for eating can be grown. This process is aided by the malleability of knowledge and behaviour development in the early years that can also impact the modifiable risk factors of obesity and over-consumption and act as another mechanism for obesity prevention (Huston, Wright, Marquis, & Green, 1999; Parsons, Power, Logan, & Summerbelt, 1999)
Early Childhood Education: The Change Agent in Children's Lives-
Supporting Knowledge Development and Agentic Decision-Making

Current generations are inheriting an earth with significant sustainability and wellbeing issues that are a consequence of modern lifestyles. Developing children’s agentic decision making abilities and knowledge has spill-over effects with evidence suggesting children drive familial sustainability behaviour change (e.g., increased composting, recycling, turning off electronic appliances, decreased car use) (Davis, 2008). Research into developing mature concepts in young children for obesity prevention has never been undertaken. The potential effects for health and sustainability knowledge within the family are noteworthy. Actively building young children's knowledge concepts about healthy eating and sustainability using play-based learning, represents an unprecedented opportunity for health and Childhood Education to work in partnership to generate health gains for young children during the formative preschool years.
References


early years: a funds of knowledge approach. *Early Years, 36*(1), 33-50


CHAPTER 8 — Obesity Prevention Interventions in Early Childhood Education and Care Settings with Parental Involvement: A Systematic Review

Abstract

Partnering Early Childhood Education and Care (ECEC) and the home together may be more effective in combating obesogenic risk factors in preschool children. Thus an evaluation of ECEC obesity prevention interventions with a parental component was conducted, exploring parental engagement and its effect on obesity and healthy lifestyle outcomes. A search revealed 15 peer-reviewed papers. Some studies demonstrated positive weight changes and secondary outcomes of changes in physical activity and healthy eating were reported in most studies; study quality ranged from fair to good. Four findings were linked to weight changes: (1) when educational material is consistent across settings; (2) capacity building of parents (3) parents encouraging their children to drink water; (4) parental satisfaction and participation. A partnership between parents and ECEC may be a powerful force in the prevention of paediatric obesity. A better understanding of collaborative parental engagement is needed.
Introduction

Early childhood overweight and obesity is a major health concern that affects almost 23% of preschool children in the United States (Ogden, Carroll, Kit, & Flegal, 2014) with similar rates in Canada (Shields, 2006), Europe (Cattaneo et al., 2010) and Australia (Australian Government Departments of Health and Ageing, 2008). Little is known about the adverse health outcomes directly attributable to obesity in the preschool years (Goodell, Wakefield, & Ferris, 2009); in contrast, those in later childhood are well documented. The physical and psychological outcomes of obesity in childhood include heart risk factors (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007), pre-diabetes and type 2 diabetes (Hannon, Rao, & Arslanian, 2005; Li, Ford, Zhao, & Mokdad, 2009), orthopaedic problems (Wills, 2004), obstructive sleep apnoea (Narang & Mathew, 2012), negative body image (Cinelli & O'Dea, 2009; McCabe & Ricciardelli, 2003; Ricciardelli & McCabe, 2001), stigma (Puhl & Latner, 2007), stereotyping (Hill & Silver, 1995) and depression (McCabe & Ricciardelli, 2003).

Clearly, there is an urgent need for effective childhood obesity prevention strategies (Dehghan, Akhtar-Danesh, & Merchant, 2005; Lobstein, Baur, & Uauy, 2004). Conceptual models defining the influences of childhood obesity have been developed to inform these strategies. These include the socio-ecological model of predictors of childhood overweight first proposed by Davison and Birch (Davison & Birch, 2001), that was further revised into the Six C’s model by Harrison...
and colleagues (Harrison et al., 2011). Relating these models specifically to preschool children reveals that the most important settings where behaviours, policies and habits can be modified are the home and the early childhood education and care (ECEC)\textsuperscript{4} environment (OECD, 2001a).

To date, preschool childhood obesity interventions have predominantly been conducted in a single setting – either within the home or an ECEC centre. Given that the majority of parents of preschool children enrol their children in ECEC (OECD, 2014), an obesity prevention strategy designed for implementation within this setting will reach a significant number of children (Larson, Ward, Neelon, & Story, 2011). Despite this fact, relatively few interventions have been conducted in the ECEC setting (Waters et al., 2011). One recent review identified only 18 interventions conducted within childcare, preschool and head start programs (Larson et al., 2011). The reviewed studies addressed nutrition, physical activity (PA) or sedentary behaviours through specialised curriculum or environmental changes to policy, practices or playgrounds. Positive changes in dietary, sedentary and/or PA outcomes were frequently achieved in these studies however only five included a weight outcome measure with two reporting a reduced risk for obesity (Larson et al., 2011). Parent or home-based interventions were found to produce some changes in obesity promoting behaviours (Skouteris et al., 2011), however, in one study no reduction in weight gain or BMI was

\textsuperscript{4} Please note that this paper is using the Organization for Economic Co-operation and Development (OECD) definition of Early Childhood Education and Care (ECEC)
reported (Monasta et al., 2011). Two reviews concluded that changes in child BMI was only achieved when ECEC interventions included a parental component. This suggests that multi-setting interventions may achieve greater success (D’Onise, Lynch, Sawyer, & McDermott, 2010; Lanigan, Barber, & Singhal, 2010; Showell et al., 2013). As such, the partnering of the two proximal forces (parents and educators) and their settings may strengthen obesity prevention intervention outcomes in preschool children (Lanigan et al., 2010; Showell et al., 2013).

To our knowledge, no systematic review has explored the ways parents have been engaged in ECEC obesity prevention interventions for preschool children. Therefore, the overall aim of this systematic review was to evaluate the success of childhood obesity prevention interventions delivered in ECEC services that included a parental component. The specific research questions that informed this review were:

1. How have parents been incorporated into childhood obesity interventions conducted in ECEC settings and to what extent, if any, does their involvement impact the outcomes of the intervention?

2. What are the methodological limitations of ECEC childhood obesity prevention interventions that have included a parental component?

3. What recommendations can be made for future research?
Method

Eligibility Criteria

The year 2000 was chosen as an appropriate starting point for data collection to ensure that the most current and relevant interventions were reviewed. However, for completeness a search was conducted to make sure that no eligible studies were missed from the 1995 starting point when paediatric obesity preventions began (Nixon et al., 2012). This search revealed that no studies conducted between 1995 and 2000 met the eligibility criteria. Eligible studies were published in English and focused on preventing obesity or its risk factors, not treating obesity. Eligible studies required both an ECEC and parental component with single setting interventions being excluded. Interventions starting in elementary school were excluded; however, interventions conducted on elementary school grounds where a preschool was present were included. Other areas where obesity prevention may occur, such as primary care clinics, after school care or other non-formalised care were excluded. Protocol, feasibility and pilot studies were also excluded.

Search Strategy

In August 2014, a systematic search for suitable articles was conducted using several databases: Academic Source Complete, CINAHL, Global Health, ERIC, Health Source, Medline and PsychInfo. This strategy sought to maximise the possibility of finding all relevant papers published in the past 14 years. The variety of terms used to describe ECEC for a young child who is not in school were searched: this included
the words nursery, kindergarten, preschool, childcare, pre-primary school, day care and long day care. These terms were combined with obesity, overweight, obese, adiposity, prevention and intervention when placed in the search engine. Preschool and childcare were searched using both a space and a hyphen. A total of 1064 papers were returned and their titles and abstracts read. To ensure that every relevant paper was found, an examination of reference lists was conducted revealing a further 12 abstracts.

Selection Process

After examining the abstracts of returned papers, duplicates and irrelevant abstracts were removed leaving a total of 44 papers that were read in their full text. Of these, 28 were excluded with reasons (see Table 1, Appendix F), leaving 15 papers for inclusion in this review (see Figure 1 for PRISMA flow diagram). Papers were identified by one author (HM) and reviewed by authors HM and HS; any uncertainty about their inclusion was resolved via discussion. A detailed search strategy for Medline is included in the appendix (See Appendix F).
Figure 1 PRISMA flow diagram
Quality Assessment

The quality assessment was conducted using methodology designed by Downs and Black (Downs & Black, 1998) (see Table 2). This quality assessment has been identified as being useful for the evaluation of both randomised controlled trials (RCT) and non RCT’s and is also an effective tool for use in systematic reviews (Deeks et al., 2003). Studies are given an overall score for quality after the completion of a 27-item checklist; this checklist includes study quality (10 questions), external validity (3 questions), study bias (7 questions), confounding and selection bias (six questions) and one question evaluating power. Each item is given a 1 for Yes, 0 for No, and 0 for unable to determine with one question about reporting having the option of scoring two points. A maximum of five points can be earned for the last question about statistical power.

However, in accordance with a previous study (Samoocha, Bruinvelds, Elbers, Anema, & van der Beek, 2010), question 27 was modified and allocated a score of 1 or 0 to indicate if statistical power was present or not, and the following rubric was used to assess quality: <14 points = poor; 15-19 points = fair; 20-25 points = good; and 26-28 points = excellent.
### Table 2 Downs and Black Checklist

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Results 1= Yes; 0=No; 0*=Unable to determine
Results

Study Description

Table 3 includes details of each study in relation to: overall aim, a parental aim if present, setting, sample, overall intervention description including parental intervention specifics, theoretical underpinnings, attrition, outcome measures including parental measures if present, and findings. A table was also created to show the main outcome variables in each study (see Table 4). Fifteen studies were included from a number of high and middle income countries around the world including Australia (de Silva-Sanigorski et al., 2011; Zask, Adams, Brooks, & Hughes, 2012), Switzerland (Puder et al., 2011), USA (Dennison, Russo, Burdick, & Jenkins, 2004; Fitzgibbon et al., 2005, 2006; Natale, Lopez-Mitnik, Uhlhorn, Asfour, & Messiah, 2014; Story et al., 2012; Yin et al., 2012), Belgium (De Coen et al., 2012), Germany (Bayer et al., 2009; Bock, Fischer, Hoffmann, & Renz-Polster, 2010), China (Hu et al., 2010), Columbia (Cespedes et al., 2013) and Scotland (Reilly et al., 2006). Two studies have multiple papers explaining the study and evaluation; one of these studies has different first authors (Adams, Zask, & Dietrich, 2009; Zask et al., 2012) and the other has the same first author (Natale et al., 2014; Natale et al., 2013). The intervention with multiple papers and different first authors will be referenced using the paper with the evaluation data (Zask et al., 2012). One study was omitted due to its use of the same data from another study that is included (Burgi et
Most studies were RCTs (Dennison et al., 2004; Fitzgibbon et al., 2005; Natale et al., 2014), several were cluster or group RCT (Fitzgibbon et al., 2006; Story et al., 2012) (Bayer et al., 2009; Bock et al., 2010; Cespedes et al., 2013; De Coen et al., 2012) with two studies defining their design as single blinded (Puder et al., 2011; Reilly et al., 2006). Three studies utilised a quasi-experimental design (de Silva-Sanigorski et al., 2011; Yin et al., 2012; Zask et al., 2012). While one study defined their design as a prospective cohort, a more correct description of the study design is a cluster RCT (Hu et al., 2010). Three of the four North American ECEC interventions were conducted either solely or predominantly in Head Start centres (Fitzgibbon et al., 2005, 2006; Yin et al., 2012). Nine studies informed their intervention with theoretical underpinning (See Table 3)
<table>
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<th>Author</th>
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<th>Design</th>
<th>Main Intervention</th>
<th>Main Findings</th>
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<td>De Silva-Sanigorski</td>
<td>To evaluate a community intervention to prevent the development of childhood obesity.</td>
<td>Design: Repeat cross-sectional, quasi-experimental design</td>
<td>Intervention: 8 project objectives with comprehensive activities were developed. E.g. Building capacity and reducing obesogenic risk factors</td>
<td>IG: Significantly less 2-year-old children were overweight or obese at follow-up compared with baseline levels (P=0.05). In the 3.5-y old intervention sample, there were significant reductions in weight, BMI, and zBMI at follow-up (P =0.05). Significantly lower number of TV and DVD average viewing minutes were seen. Significant increases in fruit, vegetables, plain milk and water intake and a significant decrease in fruit juice consumption.</td>
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<td>No specific parental aim</td>
<td>Sample: All children aged 0–5 y (n=12,000) and their families.</td>
<td>Parental activities were included in some objectives</td>
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<td>Author</td>
<td>Main Study Aims</td>
<td>Design</td>
<td>Main Intervention</td>
<td>Main Findings</td>
</tr>
<tr>
<td>De Silva-Sanigorski</td>
<td>To evaluate a community intervention to prevent the development of childhood obesity.</td>
<td>Design: Repeat cross-sectional, quasi-experimental design</td>
<td>Intervention: 8 project objectives with comprehensive activities were developed. E.g. Building capacity and reducing obesogenic risk factors</td>
<td>IG: Significantly less 2-year-old children were overweight or obese at follow-up compared with baseline levels (P=0.05). In the 3.5-y old intervention sample, there were significant reductions in weight, BMI, and zBMI at follow-up (P =0.05). Significantly lower number of TV and DVD average viewing minutes were seen. Significant increases in fruit, vegetables, plain milk and water intake and a significant decrease in fruit juice consumption.</td>
</tr>
<tr>
<td>Australia</td>
<td>No specific parental aim</td>
<td>Sample: All children aged 0–5 y (n=12,000) and their families.</td>
<td>Parental activities were included in some objectives</td>
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<tr>
<td></td>
<td></td>
<td>Setting: Geelong Victoria 2004 to 2008</td>
<td>Parental awareness</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Length: 3 years</td>
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<tr>
<td></td>
<td></td>
<td>Attrition: low</td>
<td></td>
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<td></td>
<td></td>
<td>Theory: Socio-ecological model</td>
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<tr>
<td>Puder Switzerland 2011</td>
<td>To increase aerobic fitness and reduce BMI in mostly migrant preschool children.</td>
<td>Design: Cluster RCT (single blinded) Sample: 652 preschool children Setting: 40 preschool classes in areas with a high migrant population in the German and French speaking regions of Switzerland. Recruitment from November 2007 to January 2008. Intervention Length: one year including follow up. Attrition: Low Theory: None</td>
<td>Intervention: Children: Four, 45-minute PA sessions a week. 22 sessions on healthy nutrition, media use, and sleep. Fortnightly cards to take home. Healthy snacks promoted and only water offered. Teachers: two workshops and prepared lessons received in advance Parents: Three interactive information sessions were provided. Brochures, physical activity or nutrition activity cards, and</td>
<td>Aerobic fitness and BMI. Balance, motor agility, waist circumference, percentage body fat, eating habits, physical activity, media use, psychological health, sleep and cognitive abilities. Teacher and parental feedback.</td>
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<td>In 2006 and 2008 parent’s awareness was measured at 23% and 47%, respectively. In 2008, 926 family members attend a sweet drink demonstration IG: Post test showed: an increase in aerobic fitness at post-test (adjusted mean difference: 0.32 stages (95% CI 0.07 to 0.57; P=0.01), improved motor agility (v0.54 s, v0.90 to v0.17; P=0.004), changes in percentage body fat (v1.1%, v2.0 to v0.2; P=0.02), and waist circumference (v1.0 cm, v1.6 to v0.4; P=0.001). No difference in BMI was found (v0.07 kg/m², v0.19 to 0.06; P=0.31). Significant advantages in reported physical activity, media use, and eating habits were also found. 85% of parents attended at least one (of 3) information evening. &gt;90% saw the information cards.</td>
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<tr>
<td>Dennison</td>
<td>USA</td>
<td>2004</td>
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<tr>
<td>An intervention to reduce television viewing by preschool children.</td>
<td>Design: RCT</td>
<td>Control: Regular school curriculum. Parents of children in the control group had one information evening.</td>
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<tr>
<td>To influence parents through the children and take home educational materials and parent child activities.</td>
<td>Sample: Children aged 2.6 through 5.5 years. 77 children</td>
<td>Intervention: Program staff attended the intervention group once a week for one hour over 39 weeks. 32 sessions devoted to healthy eating and 7 sessions at reducing children’s television viewing.</td>
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<td></td>
<td>Setting: 16 preschool and/or day care centres in rural New York</td>
<td>Control: Activities about health and safety were provided and materials for home activities were mailed to parents. Eight monthly sessions were provided.</td>
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<tr>
<td></td>
<td>Length: 39 weeks total but 7 sessions specific to this component. Two intakes.</td>
<td>Anthropometric data</td>
<td></td>
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<tr>
<td></td>
<td>Attrition: high</td>
<td>Change in parent-reported child television/video viewing and measured growth variables.</td>
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<tr>
<td></td>
<td>Theory: None mentioned</td>
<td>IG: Television/video viewing reduced by 3.1 hours a week and a significant decrease in children watching television/videos more than 2 h/d (from 33% to 18%).</td>
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<td></td>
<td></td>
<td>A non-significant decrease in BMI was seen in the intervention group.</td>
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<td></td>
<td></td>
<td>No parental results.</td>
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</tbody>
</table>
| De Coen  
Belgium  
2012 | To evaluate the effect of a centre based intervention with multiple components on BMI, eating and physical activity behaviour. | Design: Cluster RCT  
Sample: Children aged 3–6 years from high and low SES communities over two school years (2008–2009 and 2009–2010)  
Setting: Flanders Belgium. 31 pre-primary and primary schools  
Length: Two Years including follow up  
Attrition: high  
Theory: The socio-ecological model in  
Parents were encouraged to read to the children daily and have a family mealtime without the TV on and stop TV for a week. Parents received brochures. A diary was kept by parents. | Intervention: Community engagement through organisations targeting medical businesses  
Schools: Materials and modules for class time. Adjustment of policy  
Posters with parent messages were given to parents, as were letters containing detailed information and a website. | zBMI  
Food frequency questionnaire.  
Structured physical activity Screen time  
PA and food intake of the child.  
No significant effects were found for zBMI in the total sample.  
IG: A significant effect for zBMI in the low-SES community (F=6.26; P=0.01) with a decrease in zBMI of 0.11. No other significant intervention effect was found. No parental evaluation |
A healthy eating and physical activity intervention designed to reduce gains in BMI in preschool minority children was evaluated.

**Design:** Cluster RCT

**Sample:** 336 children Year 1 and 331 at Year 2.

**Setting:** Twelve predominantly Latino Head Start centers

**Length:** 14 weeks

**Attrition:** low

**Theory:** Social cognitive theory was the primary framework with concepts from self-determination theory

**Intervention:** Trained educators delivered a 14-week curriculum including a 20-minute nutrition activity and 20 minutes of aerobic activity.

Parents received weekly newsletters mirroring the children's curriculum. Parents who completed and returned 12 homework assignments received a small monetary reward.

**Control:** Not stated

**BMI and changes in dietary intake and physical activity.**

Homework assignments

Post-intervention changes in BMI and zBMI were not significantly different between intervention and control groups (0.11 vs. 0.13 kg/m², \( p \approx 0.89 \) for BMI; and 0.07 vs. 0.05, \( p \approx 0.85 \) for zBMI). No significant differences between groups in reported frequency or intensity of exercise or in TV viewing were found.

About 54% of intervention parents completed at least one homework assignment.
The control parents received weekly newsletters that mirrored the curriculum with no homework assignments. Zask (2012) and Adams (2009) in Australia evaluated a child obesity prevention program.

To test the feasibility, implementation, and evaluation of a child obesity prevention program, a quasi-experimental design was used.

**Sample:** 560 children in 2006-2007

**Setting:** 18 preschools with 13 matched control preschools.

**Intervention:**
- Significant policy changes about drinking water and movement
- Structured twice weekly movement skill development
- Consistent messages for children about 'sometimes' and 'everyday' foods
- Puppets, staff in fruit and vegetable costumes, stories, role-play, growing, cooking, and taste testing
- Parent workshops on fussiness
- Four-page newsletters and the Family Feud/Food DVD were provided.

**Possible Parental Evaluation:**
- Lunchbox audit
- Not specifically related to the parental intervention.

**IG:**
- Movement skills (p<0.001), raw loco motor (4.54 average units) and object control (6.33 average units) scores improved significantly (p<0.001).
- A significant increase (p<0.001) in the mean fruit and vegetable serves in lunch boxes.
- The percentage of lunch boxes with no energy dense nutrient poor (EDNP) items increased significantly.
- The percentage of children who had two or more EDNP items in their lunch boxes significantly decreased.
- A significant reduction in zBMI was seen (-0.15, p=0.022).

**No significant effect on overweight prevalence (11.7% and 12.5% among controls at pre and post) with no changes in BMI.
<table>
<thead>
<tr>
<th>Bayer 2009 Germany</th>
<th>To measure improvements in physical activity and to change food and drink habits of preschool children</th>
<th>Design: Cluster RCT</th>
<th>Sample: 1318 and 1340 children</th>
<th>Setting: 64 Kindergartens in 4 Bavarian regions were randomly assigned as intervention or controls in a 2:1 ratio</th>
<th>Intervention Length: One year; 18 month follow up</th>
<th>Attraction: low</th>
</tr>
</thead>
<tbody>
<tr>
<td>No parental aim specified</td>
<td>Dissemination of new policies to parents along with lunchbox displays. Posters on “better foods” and “foods better left out” were on display all year.</td>
<td>Control: Waitlist condition</td>
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<td></td>
<td>Intervention: Kindergarten delivered curriculum: 30 min or more of vigorous physical activity, regular fruit and vegetable snacks, regular water and non-sugared drinks.</td>
<td>Food, drink, and diet</td>
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<tr>
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<td>Parents: Four newsletters over the year, twelve “TippCards” and a website was established. Two information evenings for parents</td>
<td>Anthropometrics and motoric testing</td>
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<td></td>
<td>An increase in the proportion of children with high fruit and vegetable consumption was seen after 6 months. Adjusted odds ratios of 1.59 (1.26: 2.01) and 1.48 (1.08: 2.03) after 18 months.</td>
<td>Prevalence of overweight/obese as well as motoric testing results were not statistically different between groups.</td>
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<tr>
<td></td>
<td>Teachers reported that the newsletters and “TippCards”</td>
<td>No parent evaluation</td>
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<tr>
<td></td>
<td>No parent evaluation</td>
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<tr>
<td></td>
<td>intervention respectively: 12.2% and 11.5% among intervention children).</td>
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</tbody>
</table>
Fitzgibbon
2005
USA

To assess the impact of a healthy eating and physical activity intervention on changes in BMI.

No parental aim specified

Theory: None mentioned

Design: RCT
Sample: 289 children at Year 1 and 300 at Year 2. September 1999 and June 2002.
Setting: 12 Head Start preschool programs in Chicago, Illinois.
Length: 14 weeks with 2 year follow up
Attrition: low
Theory: None mentioned

Control: Usual program
Intervention: 14-week intervention 20 minutes on a healthy eating concept and 20 minutes of non-stop physical activity.

Parents received weekly newsletters, information and a homework assignment.
A $5.00 grocery store coupon was provided for each completed and returned homework assignment.

Control: 14-week curriculum delivered once a week for 20 minutes.
Parents received weekly newsletters

zBMI
24-hour diet intake data
Parents evaluated of their child’s activities and television watching.
Number of returned home work assignments and the number of parents that read the newsletters were measured

were distributed to and read by the parents.

IG: significantly smaller increases in BMI compared with control children at 1-year follow-up, 0.06 vs 0.59 kg/m²; difference −0.53 kg/m² (95% CI −0.91 to −0.14), P = .01; and at 2-year follow-up, 0.54 vs 1.08 kg/m²; difference −0.54 kg/m² (95% CI −0.98 to −0.10), P = .02, with adjustment for baseline age and BMI.

Approximately 61% of the parents in the intervention group returned at least one homework assignment, and 88% reported reading the newsletters.
| Hu | To evaluate nutrition education in kindergartens and to increase healthy diet habits in children. | Design: Prospective cohort study  
Sample: 2102, 4 to 6-year-old preschoolers  
Setting: Seven kindergartens from Hefei, China.  
Intervention: Three, 30-minute physical activity session each week over 24 weeks. Nurseries put up posters focusing on increasing physical activity for 6 weeks.  
Attrition: moderate  
Theory: None mentioned | Intervention: Nutrition education were held once a month for 10 months. An illustrated book was given to all the children.  
Parents were given pamphlets with nutritional information and descriptions of healthy lifestyles.  
Control: No control group  
Anthropometric measures, child dietary behaviours, nutritional knowledge and attitudes of the parents  
BMI, physical activity and sedentary behaviour, fundamental movement skills and evaluation of the process.  
No parental measures | Nutritional knowledge mean scores of intervention parents increased significantly from pre-test to post-test (F=13.51, P=0.0001).  
IG: Saw significantly greater performance in movement skills tests than control children at six-month follow-up (P = 0.0027; 95% confidence interval 0.3 to 1.3).  
No significant effect between groups on BMI, | Insignificant weight changes were found. |

| Reilly | To measure a physical activity intervention on reduction BMI in preschool children | Design: Cluster, single blinded RCT  
Sample: 545 children  
Setting: Thirty-six nurseries Glasgow, Scotland | Intervention: Three, 30-minute physical activity session each week over 24 weeks. Nurseries put up posters focusing on increasing physical activity for 6 weeks.  
Parents were given pamphlets with nutritional information and descriptions of healthy lifestyles.  
Control: No control group  
Anthropometric measures, child dietary behaviours of parents  
BMI, physical activity and sedentary behaviour, fundamental movement skills and evaluation of the process.  
No parental measures | IG: Saw significantly greater performance in movement skills tests than control children at six-month follow-up (P = 0.0027; 95% confidence interval 0.3 to 1.3).  
No significant effect between groups on BMI, | |
<table>
<thead>
<tr>
<th>No specified parental aim</th>
<th>Intervention: Length: 24 weeks and a follow up at 6 and 12 months. Attrition: low. Theory: Health Education Model (parent component only).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yin 2012 USA</td>
<td>Families received materials about physical play at the nursery and home plus two simple health education leaflets.</td>
</tr>
<tr>
<td>To test an intervention promoting healthy weight gain and gross motor development in low-income preschool children.</td>
<td>Control: Usual curriculum</td>
</tr>
<tr>
<td>Design: quasi-experimental pre-test/post-test design</td>
<td>Intervention: 30–45 minutes of daily outdoor play. Teachers used music CDs and a dance DVD. Classroom activities were based on the Sesame Street Workshop Healthy Habits for Life resource kit. Food tasting activities and contests were undertaken.</td>
</tr>
<tr>
<td>Sample: predominantly Mexican-American children (n = 423). Setting: Head Start centres</td>
<td>Weight-based z-scores Raw scores of gross motor skills</td>
</tr>
<tr>
<td>Intervention length: 18 weeks including follow up. Attrition: Low</td>
<td>Children’s diet and physical activity behaviors at home.</td>
</tr>
<tr>
<td>Theory: theories of early childhood development however were not specified</td>
<td>Positive changes occurred in child z-scores for weight (one-tailed ( p &lt; 0.04 )) for age and gender in the combined centre and home intervention compared to comparison children at post-test. Larger gains in gross motor skills were found the combined centre and home (( p &lt; 0.001 )) group and the centre only intervention (( p &lt; 0.01 )). Children in both intervention groups showed increases in outdoor physical activity and healthy food.</td>
</tr>
<tr>
<td>Parents viewed posters with peer educators, completed a worksheet. Received a take home bag with</td>
<td>Average participation at the six peer-led parent</td>
</tr>
</tbody>
</table>
To test an intervention to reduce excessive weight gain.

**modify the home environment; reducing caloric intake, TV watching and to increase physical activity**

**Story 2012 USA**

<table>
<thead>
<tr>
<th>Design: Cluster RCT</th>
<th>Intervention: Teacher-led ‘action breaks’ were conducted in class. American Indian cultural activities were integrated. An ‘action toolbox’ to assist teachers in physical activity was provided. Snacks in the classroom were limited and students encouraged to drink water. Teachers were supplied with non-food rewards</th>
<th>Education sessions was high (M = 80%, SD = 7.9). Parents liked receiving information from the peer educators. The session format, schedule, and materials were appreciated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 454 children attending 14 schools</td>
<td><strong>BMI, percentage body fat, prevalence of overweight and obese children.</strong> Percentage of calories from fat, nutrient content in school meals, duration of physical activity at school and food intake at home.</td>
<td></td>
</tr>
<tr>
<td>Setting: Schools on the Pine Ridge reservation in South Dakota</td>
<td>Intervention length: 45 weeks total with follow up included. Attraction: Low Theory: None specified</td>
<td>No statistically significant weight or BMI changes were seen. A significant change in overweight prevalence was seen in the intervention group. A 13.4% incidence of overweight was seen in intervention children, with the control group showing an incidence of 24.8%, a difference of −11.4% (P = 0.033). Significant reductions in child intakes of sugar-sweetened beverages, whole milk, and chocolate milk were seen. Changes in</td>
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</table>
### De Bock Germany 2011

**To measure the effects of a pre-school nutrition intervention**

- **No specific parental aim**

<table>
<thead>
<tr>
<th>Design: Cluster RCT</th>
<th>Four family events including a meal and physical activities were provided. Messages were displayed and parents set goals. Parents received motivational phone calls from research staff and a quarterly newsletter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting: 18 pre-schools from three south German Baden-Württemberg regions.</td>
<td>Control: Not described</td>
</tr>
<tr>
<td>Sample: 348 healthy children aged 3–6 years</td>
<td>Intervention: Fifteen two-hour nutrition sessions were given over a six-month period.</td>
</tr>
<tr>
<td>Intervention Length: 6 months with 12 month follow up</td>
<td>Accelerometry measures BMI, percentage body fat, sleep quality, quality of life, and general health</td>
</tr>
<tr>
<td>Attrition: Low</td>
<td>Fruit and vegetable, water and sugared drinks consumption were measured</td>
</tr>
</tbody>
</table>

- **16.5 (SD 9.5) parents were present at the provided sessions.**

- **An increase of 0.22 points on the ordinal scale of fruit consumption compared with pre-test consumption and control (P=0.027).**

- **Intervention children achieved a change in vegetable consumption (P=0.027).**

- **Under half of the children and their families attended the first family night. At least one attempt was made to call parents.**

- **Length of school physical activity were not significant.**
Gómez's 2013

Aimed to design and implement a pedagogic, communicative research program.

Theory: Bandura's social cognitive theory and the trans-theoretical model in health promotion.

Setting: 14 preschools in Bogotá, Colombia

Sample: 1216 children aged 3-5 years, 928 parents, and 120 teachers

Intervention Length: 5 months' intervention with follow up at 6 and 18 months

Control: The control preschool continued with their usual curriculum. They received weekly notes to share with their children.

Knowledge, attitudes, and habits of children specifically related to healthy eating and living an active lifestyle. Changes in children's nutritional status, BMI.

Association between children's BMI and knowledge, attitudes, and habits.

Adjusted figures showed that intervention children had a 10.9% increase in weighted score, compared with 5.3% in controls. Children still showed a significant increase in weighted score (absolute difference of 6.38 units; \( P < .001 \)) 1 year after the intervention.

Parents had significant increases in scores for knowledge (\( P < .001 \)) and attitudes (\( P <.001 \)) when compared with the control group.
To increase healthy eating and physical activity of preschool aged children.

Design: RCT
Setting: Eight child care centres in Miami-Dade County, Florida
Sample: multi-ethnic children aged 2 to 5 years old (N = 307).
Intervention Length: 6 months, data were collected at baseline and at 3, 6, and 12 months.
Theory: socio-ecological model
Attrition: High

Menu changes. Parent involvement was measured through attendance at dinners and by the number of parent activities returned. Parents satisfaction measured

Mean BMI z-score increased in both groups but non-significantly less in the intervention group (0.60 to 0.76 in controls vs. 0.67 to 0.72 in intervention.

BMI significantly decreased among participating children ($r = -0.05, p < .0001$) as parents did the intervention at home.

IG: mean junk food consumption decreased from weekly to no consumption. Mean fresh fruit and vegetable consumption increased 60%. Juice consumption decreased 75%; and 1% milk consumption increased 90%.
included a visit from an injury prevention education mobile.

CG: Mean water consumption decreased 70% and junk food consumption doubled and increased 75%.

The more satisfied parents were with intervention the fewer soft drinks their child consumed at home ($r = -0.44, p < .001$), the less likely the child was to eat macaroni and cheese ($r = -0.34, p < .01$), French fries ($r = -0.25, p < .05$), salty foods ($r = -0.25, p < .05$), and fruit drinks ($r = -0.24, p < .05$). The association between at home activities completed and fruit juice was statistically significant. Parents who read more newsletters had children who consumed fewer fruit drinks ($r = -0.24, p < .01$) and participated in more minutes of physical activity per day.

Table 4 Main Targeted Intervention component

<table>
<thead>
<tr>
<th>Name</th>
<th>Capacity building of Agents</th>
<th>Screen Time</th>
<th>Healthy Behaviours: Physical Activity</th>
<th>Healthy Behaviours: Fruit and Vegetable intake</th>
<th>Healthy Behaviours: Reduction of Dense Nutrient Poor foods</th>
<th>Healthy Behaviours: Water</th>
<th>Environmental Change E.g. Physical or policy</th>
<th>Success of primary outcome measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>de Silva-Sanigorski</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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ECEC: Early Childhood Education and Care; P-Parents; ✓ - indicates that it occurred or was requested/encouraged in the intervention; x - indicates that it did not occur, or that it was not mentioned in the paper; ✓ x - indicates that some outcome measures were achieved and others not; NA - Not applicable
Main Targeted Outcomes

As per Table 4, the main targeted outcomes can be condensed into seven main areas: capacity building of agents, screen time, Physical Activity (PA), fruit and vegetable intake, reduction of energy dense, nutrient poor (EDNP) foods, increasing water consumption and environmental change. Four studies addressed all seven targeted outcomes (De Coen et al., 2012; Natale et al., 2014; Puder et al., 2011; Story et al., 2012) in both the home and ECEC setting. Capacity building of centre staff and directors was a high priority in the majority of studies (Bayer et al., 2009; Bock et al., 2010; Cespedes et al., 2013; De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Hu et al., 2010; Natale et al., 2014; Puder et al., 2011; Reilly et al., 2006; Story et al., 2012; Yin et al., 2012; Zask et al., 2012) and every parent received some form of educational material to read or interact with. The reduction of screen time was seen as a way to impact on sedentary lifestyles and was addressed in eight ECEC interventions (De Coen et al., 2012; Dennison et al., 2004; Fitzgibbon et al., 2005, 2006; Natale et al., 2014; Puder et al., 2011; Reilly et al., 2006; Story et al., 2012), and six parental components (De Coen et al., 2012; Dennison et al., 2004; Fitzgibbon et al., 2006; Natale et al., 2014; Puder et al., 2011; Story et al., 2012). Structured PA was included in all but two studies (Dennison et al., 2004; Hu et al., 2010) with increases in fruit and vegetable intake and reductions of EDNP foods being targeted in all but three studies (Bock et al., 2010; Dennison et al., 2004; Reilly et al., 2006). Increasing the consumption of water or
reducing soda and juice intake was included in a number of interventions (Bayer et al., 2009; De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Natale et al., 2014; Puder et al., 2011; Story et al., 2012; Yin et al., 2012; Zask et al., 2012). A change in environment within the ECEC service, including the built and/or policy environment was included in seven studies (Bock et al., 2010; De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Natale et al., 2014; Puder et al., 2011; Story et al., 2012; Zask et al., 2012).

**Methodological Quality**

The Downs and Black (Downs & Black, 1998) checklist was used to assess included studies for methodological quality. Six papers were fair and nine were good with no studies classified as excellent or poor. The scores ranged between 16 and 24; see Table 2.

**Parental Intervention**

The parental component of each study had a focus on education often about healthy eating and PA. Education to parents was delivered through newsletters (Bayer et al., 2009; de Silva-Sanigorski et al., 2011; Fitzgibbon et al., 2005, 2006; Natale et al., 2014; Story et al., 2012; Yin et al., 2012; Zask et al., 2012), brochures (Puder et al., 2011), pamphlets (Hu et al., 2010), letters (De Coen et al., 2012), posters (De Coen et al., 2012; Reilly et al., 2006; Yin et al., 2012), cards (Bayer et al., 2009; de Silva-Sanigorski et al., 2011; Puder et al., 2011) and take home bags (Reilly et al., 2006; Yin et al., 2012). Three studies supported the
parental intervention with an internet site (Bayer et al., 2009; Bock et al., 2010; De Coen et al., 2012). Family functions (Story et al., 2012), information nights (Puder et al., 2011), workshops (Cespedes et al., 2013; Zask et al., 2012), dinners (Natale et al., 2014) and school festivals (de Silva-Sanigorski et al., 2011) were also provided. A monetary reward for returning allocated homework was provided to parents in two interventions (Fitzgibbon et al., 2005, 2006). Only one study provided tailored advice to parents based on the questionnaire data they returned (De Coen et al., 2012).

Nine interventions did not state an aim for the parent component even though it clearly varied from the ECEC intervention (Bayer et al., 2009; Bock et al., 2010; De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Fitzgibbon et al., 2005, 2006; Puder et al., 2011; Reilly et al., 2006; Zask et al., 2012). Six studies (Cespedes et al., 2013; Dennison et al., 2004; Hu et al., 2010; Natale et al., 2014; Story et al., 2012; Yin et al., 2012) had separate parental aims with only two measuring outcomes to determine if the aims were met (Hu et al., 2010; Story et al., 2012). Two studies reported their aim was to influence parents either through their children (Dennison et al., 2004) or take-home activities (Dennison et al., 2004; Natale et al., 2014). A further two studies sought to alter the home environment (Story et al., 2012; Yin et al., 2012) with one study specifying parent report of food intake of the child as the outcome of the home intervention (Story et al., 2012). Two studies reported changes in nutrition knowledge and parental attitudes that were evaluated through
questionnaires (Cespedes et al., 2013; Hu et al., 2010). Three studies had no specified measurement of the parental component (De Coen et al., 2012; Dennison et al., 2004; Reilly et al., 2006). Parental involvement was used several times as a process evaluation measure i.e. to evaluate if the intervention had been conducted as intended (Bayer et al., 2009; Puder et al., 2011; Story et al., 2012; Yin et al., 2012). This included the distribution and reading of ‘Tipp cards’ (Bayer et al., 2009) as well as the attendance at family events and information sessions (Puder et al., 2011; Story et al., 2012). Parents were used to collect data about their child’s eating and PA habits (Bayer et al., 2009; Fitzgibbon et al., 2005, 2006). Five studies reported that parent involvement and acceptance of material was high and that the time spent on the intervention was acceptable (Bock et al., 2010; Dennison et al., 2004; Hu et al., 2010; Natale et al., 2014; Yin et al., 2012). A recent study examined the association between parent participation in the intervention and their child’s BMI finding a significant correlation (Natale et al., 2014). Six studies that did not achieve significant changes in BMI across all groups undertook a thorough evaluation of the parent component (De Coen et al., 2012; Dennison et al., 2004; Fitzgibbon et al., 2006; Puder et al., 2011; Reilly et al., 2006; Story et al., 2012). A number of studies concluded that adaption (De Coen et al., 2012), additional strategies (Dennison et al., 2004) or work (Story et al., 2012) was needed. An emphasis on changing behaviours was identified in one study as a possible factor that may have resulted in a significant outcome (Reilly et al., 2006). Moreover, it was
suggested that an increase in intensity may have avoided non-significant outcomes (Fitzgibbon et al., 2006; Puder et al., 2011; Reilly et al., 2006).

Compared to fostering healthy eating and PA, reducing screen time and encouraging water for drinking were less likely to be included in the parental interventions. Of the seven interventions that suggested parents recommend drinking more water (with or without a recommended reduction of soda and juice consumption), four were successful in achieving statistically significant reductions in child BMI (de Silva-Sanigorski et al., 2011; Natale et al., 2014; Yin et al., 2012; Zask et al., 2012). Conversely, of the seven studies that asked parents to reduce screen time, four did not achieve statistically significant changes in BMI measures (Dennison et al., 2004; Fitzgibbon et al., 2006; Puder et al., 2011; Story et al., 2012) and three achieved BMI changes in either whole (de Silva-Sanigorski et al., 2011) or subgroups only (De Coen et al., 2012; Natale et al., 2014). Only one of these studies failed to measure screen time as an outcome measure (Story et al., 2012) with the remaining measuring hours per day. Only half of these studies achieved part of their primary aims including nutrition changes (Natale et al., 2014), aerobic fitness (Puder et al., 2011) and a reduction in TV viewing (Dennison et al., 2004). Healthy eating and PA was targeted across all interventions with a small number omitting one or more components: PA (Hu et al., 2010; Reilly et al., 2006), reduction of EDNP foods (Puder et al., 2011) and increasing fruit and vegetable intake (Bock et al., 2010; Dennison et al., 2004; Reilly et al., 2006).
Two studies sought to alter knowledge, attitudes and habits of children and parents with the aim of modifying obesogenic behaviours (Cespedes et al., 2013; Hu et al., 2010). A focus on changing parental eating habits and attitudes to food preparation and planning was made in an intervention conducted in China (Hu et al., 2010). The knowledge and attitudes of parents significantly changed as did the prevalence of unhealthy diet related behaviours of children. Changes to the parents’ diet was seen in the intervention group with a concomitant change in children’s unhealthy dietary and lifestyle behaviours. Overall however, no significant difference was made in any weight measures. A Columbian study also aimed to modify the knowledge, attitudes and habits specifically towards healthy eating and living an active lifestyle (Cespedes et al., 2013). This change was sought in all study participants including preschool children, their parents and teachers. The primary outcome was achieved, specifically a significant change in knowledge, attitudes and habits over time for both parents and children although not for teachers. No significant connection between the children’s baseline BMI and their knowledge, habits and behaviours was found, moreover no significant difference between groups for BMI was found.

**ECEC Interventions:**

A reduction in overall or subgroup BMI changes was seen in a number of interventions (De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Fitzgibbon et al., 2005; Natale et al., 2014; Yin et al., 2012; Zask et al., 2012). Secondary outcomes were achieved in studies that could not
produce a change in BMI including a reduction in the incidence of overweight (Story et al., 2012), better movement skills (Reilly et al., 2006), improvement in fruit and vegetable intakes (Bayer et al., 2009; Bock et al., 2010), and a significant decrease in television viewing (Dennison et al., 2004). A large Swiss study achieved successful outcomes on aerobic fitness, motor agility, percentage body fat, waist circumference and benefits in other outcome measures including media use and healthy eating (Puder et al., 2011). Only one intervention was unable to achieve their primary or secondary outcome measures of BMI changes and modifications in diet and PA, concluding that the Latino community is difficult to reach (Fitzgibbon et al., 2006). This study was methodologically similar to the one conducted a year prior that did produce a statistically significant change in BMI (Fitzgibbon et al., 2005).

The interventions reviewed rarely planned for parental engagement to occur with the ECEC intervention regardless of the parental component. One way parents could have been engaged is through the curriculum delivered to their children. Unfortunately, parents were rarely provided with the curriculum that the children were receiving. In fact, only two of the 15 studies engaged parents with the actual ECEC curriculum (Fitzgibbon et al., 2005, 2006) with a further four studies providing some description of the information presented to the children (De Coen et al., 2012; Natale et al., 2014; Puder et al., 2011; Yin et al., 2012). This small amount of engagement around curriculum
Parent Engagement in Studies Producing a Change in BMI

The parent engagement methods used in obesity prevention interventions producing significant changes to BMI varied. In an Australian study the ECEC service engaged parents by providing education and support and also by encouraging them to develop policy and manage projects (de Silva-Sanigorski et al., 2011). Policy changes were an important addition to the intervention however the authors agreed that the building of the community’s capacity was the major contributor to the study’s outcomes (de Silva-Sanigorski et al., 2011).

Another Australian study connected parents and the ECEC centre through the lunchboxes that the children would bring each day (Zask et al., 2012). Parents were educated through posters and workshops with health professionals about the best foods to include in lunchboxes and ones to avoid. The children were also engaged in activities with health professionals. Parents were invited to participate in cooking classes and replicate a food tasting activity at home that was conducted in the centre. An American study also used the ECEC as the location for intervention by training volunteer parents to be peer educators (Yin et al., 2012). Parents were invited to another room by a peer educator when they dropped off or picked up their children. These educators then gave information, showed informative posters and helped parents finish an
information scavenger hunt. On completion they were given a story book and a take home bag.

Each of these engagement methods have involved communication strategies requiring parents, educators and even children to interact with each other. A few interventions described parent communication as the critical element for success with two studies concluding that continual communication was essential (de Silva-Sanigorski et al., 2011; Natale et al., 2014). Additionally, the quality of communication is important when working with parents from different ethnicities, with materials translated and tailored appropriately (Natale et al., 2014).

Parent satisfaction was evaluated in a few studies (Natale et al., 2014; Puder et al., 2011; Yin et al., 2012) however, only one study connected parent satisfaction with changes in child food intake (Natale et al., 2014). The children of parents who were satisfied with the intervention consumed significantly less fruit and soft drinks and ate less French fries, salty foods and macaroni and cheese (Natale et al., 2014). When parents actively participated, their children saw greater changes in healthy eating and physical activity than others. Unfortunately, the link between parent satisfaction and its effect on outcomes were not measured in the remaining studies.
Discussion

How Have Parents Been Incorporated into Childhood Obesity Interventions Conducted in ECEC Settings and to What Extent, if any, Does Their Involvement Impact the Outcomes of the Intervention?

The obesity prevention interventions reviewed here focused predominantly on the ECEC component and rarely fully engaged parents within their intervention. Providing parents with the information their children receive provides additional opportunities for children to consolidate their learning. This is supported by Vygotsky’s theory which suggests that child development occurs within the social context and the environment (Vygotsky, 1962). When the same material is applied in both the home and ECEC environments, the child’s development and understanding has the potential to be richer and more complex. As a result, three of the six studies that gave parents the same or a description of delivered material reported significant changes in BMI (Natale et al., 2014); (Fitzgibbon et al., 2005; Yin et al., 2012). These studies were also conducted over a long period allowing for consistency and frequent contact, which may have also assisted in achieving this outcome. Exploring new material over a period of time across settings is also supported by Bronfenbrenner and Morris’s (1998) theory of human development. This theory describes proximal processes (reciprocal experiences that occur regularly, over a period of time) that can effect child development (Bronfenbrenner & Morris, 1998). Interactive experiences with people who are influential to a child may alter their
weight development especially when these are guided by obesity prevention interventions.

Guided by social ecological theory, an Australian study gave parents ownership within the ECEC service through policy changes and parental project involvement (de Silva-Sanigorski et al., 2011). Among other objectives, the intervention aimed to increase the capacity of the community including parents, teachers and educators. This led to changes in the choices they made as individuals, which in turn altered the surrounding physical and social environment of the child providing healthier options and opportunities. Both Vygotsky and Bronfenbrenner identify the environment as a major contributor to child development (Vygotsky, 1962; Bronfenbrenner, 1979). Therefore, it is likely that improving parenting skills will also alter the outcome of new experiences.

Altering the obesogenic environment around the child can make significant changes in their food and drink intake and PA undertaken. Making these changes in one setting alone may not be strong enough suggesting that the home and ECEC service must be consistent and collaborative in these changes. ECEC services that made environmental changes in drink policies made considerable gains toward obesity prevention when also supported in the home environment (De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Natale et al., 2014; Yin et al., 2012; Zask et al., 2012). Sedentary behaviours and their contribution to obesity were more difficult to affect. Over half of the studies that requested parents reduce screen time did not produce a significant
change to child BMI (Dennison et al., 2004; Fitzgibbon et al., 2006; Puder et al., 2011; Story et al., 2012).

Across all the studies reported here, parent participation was often used to evaluate the intervention delivery (Bayer et al., 2009; Puder et al., 2011; Story et al., 2012; Yin et al., 2012) or to collect data (Bayer et al., 2009; Fitzgibbon et al., 2005, 2006). However, only one study actually examined whether parent participation lead to any changes in their outcomes (Natale et al., 2014). These researchers were able to demonstrate a significant change in BMI in those children whose parents fully engaged with the intervention. It is possible that parent satisfaction is linked with parent self-efficacy or one’s confidence in their parenting abilities (Bandura, 1997). That is, parental self-efficacy has been associated with positive changes in child behaviours and obesity outcomes and may explain this result (Coleman & Karraker, 1998; Grossklaus & Marvicsin, 2014; Jones & Prinz, 2005). Building self-efficacy, much like building capacity may be a critical dimension that has not been explored to its fullest extent in childhood obesity prevention strategies.

The findings of this review have revealed that parent engagement within an ECEC intervention is limited, however there are many opportunities for improvement. Four conclusions can be drawn from the findings present. Firstly, interventions that communicated with parents on classroom activities and content, often achieved their primary outcome measures. Newsletters were regularly used as the communication vehicle with effective studies providing them frequently. Secondly, capacity
building of parents, educators and communities is a contributor to positive changes to BMI outcomes (de Silva-Sanigorski et al., 2011; Zask et al., 2012). Thirdly, several successful studies that lowered or slowed BMI increases included major changes to ECEC water policies (De Coen et al., 2012; de Silva-Sanigorski et al., 2011; Zask et al., 2012). These were supported through parent activities including not packing sweet drinks in lunchboxes (Adams et al., 2009) or responding to an individualised report (De Coen et al., 2012). Unfortunately, most of the studies did not describe the specific activities parents did to increase water consumption or restrict sweet drinks. Future studies need to outline the ways parents increase water intake and decrease soft and sweet drink intake. Finally, parental interest, participation and satisfaction led to significant changes in child BMI, as found in one study (Natale et al., 2014) and may be a significant contributor to parent engagement in ECEC. Overall, it is important to adequately plan and examine ways that parents will be satisfied with the intervention thereby fostering engagement. Furthermore, ECEC educators have a role in inviting parent participation highlighting yet another reason for quality partnerships to be developed. It is very important to note that six studies acknowledged that superior parental engagement may have led to the successful achievement of their primary outcome measures (De Coen et al., 2012; Dennison et al., 2004; Fitzgibbon et al., 2006; Puder et al., 2011; Reilly et al., 2006; Story et al., 2012). However, if collaborative efforts are to be made with the goal of childhood obesity prevention then greater
parental engagement within ECEC services needs to occur. The most ideal ways to do this have not fully been clarified and future research is needed.

**What are the Methodological Limitations of ECEC Childhood Obesity Prevention Interventions That Have Included a Parental Component?**

High attrition was a factor in four studies (Cespedes et al., 2013; De Coen et al., 2012; Dennison et al., 2004; Natale et al., 2014). One of these studies ran their intervention across two years experiencing difficulty in keeping participants (Dennison et al., 2004). Their evaluation of participant loss found that change of preschool, siblings born, job loss and parent separation or divorce explained a majority of attrition (Dennison et al., 2004). Regardless, they were able to achieve their primary outcome of a reduction in TV viewing, although not a significant change in BMI. Another factor that has impaired the internal validity of some studies is attendance. The requirement to attend functions, often at the preschool or kindergarten as part of the intervention was difficult for some studies. Three of the six interventions requiring some form of parental attendance did not produce changes in BMI (Cespedes et al., 2013; Puder et al., 2011; Story et al., 2012). Interestingly, the one study that measured parental compliance with the intervention and attendance at dinner events was able to demonstrate a change in BMI (Natale et al., 2014), suggesting a positive effect of parental engagement.
Weak parental components were identified by some studies as contributing to the poor outcomes (De Coen et al., 2012; Dennison et al., 2004; Fitzgibbon et al., 2006; Puder et al., 2011; Reilly et al., 2006; Story et al., 2012) and as previously stated were inadequately planned and evaluated. Additionally, some parental confounders were not identified and adjusted for (e.g. parental BMI) which may have impaired outcomes. Two studies reported parental BMI but did not include this in analyses (Fitzgibbon et al., 2005, 2006). While this confounder is an oversight, other confounders were measured and adjusted for in analyses including parental education (Bayer et al., 2009; Dennison et al., 2004; Fitzgibbon et al., 2005, 2006; Hu et al., 2010; Puder et al., 2011), migrant status (Puder et al., 2011), ethnicity (Natale et al., 2014), employment (Dennison et al., 2004), parental SES (De Coen et al., 2012) and maternal smoking in pregnancy (Bayer et al., 2009). Reporting bias (Bayer et al., 2009; de Silva-Sanigorski et al., 2011; Zask et al., 2012), sample bias (de Silva-Sanigorski et al., 2011; Yin et al., 2012), social desirability bias (de Silva-Sanigorski et al., 2011) were also cited as possible study contaminants. Logistical issues that are faced in remote areas including weather and phone reception were also identified in one study (Story et al., 2012). In addition, the RCT design is difficult to do well in public health settings and as such is a possible limitation of the evaluated studies (Bonell et al., 2011).
What Recommendations Can Be Made for Future Research?

In recent years, a number of protocols for obesity prevention interventions in preschool aged children have been published demonstrating the importance of early childhood obesity prevention. However, the care and consideration that has gone into the development of the parent component or the collaboration across settings is difficult to determine. Future interventions must adequately plan, implement and evaluate any parental intervention that is conducted in conjunction with an ECEC service. Furthermore, factors that can affect participation within the preschool population must be accounted for during planning, prior to implementation to keep attrition low.

Conclusion

Overweight and obesity in the preschool years is a problem affecting over 20% of preschool children in many western countries (Australian Government Departments of Health and Ageing, 2008; Ogden et al., 2014). Ecological models of childhood obesity development point to parents and ECEC educators as having significant influence on a children’s healthy weight development and maintenance. Engaging parents and ECEC educators to work in partnership may lead to effective outcomes and assist the preschool population with achieving a healthy weight. The best ways to engage this partnership and share the areas of responsibility are still to be determined.
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CHAPTER 9 — Understanding Parents’ Knowledge Connections Between Healthy Eating, Physical Activity and Sustainability Awareness

Introduction

Approximately 107.7 million children globally experience overweight and obesity (The GBD Obesity Collaborators, 2017). Obesity prevention strategies that include the development of healthy lifestyle behaviours during the formative preschool years are necessary (Lobstein et al., 2015). Factors that both protect from and promote obesity development in young children have been conceptualised in an ecological model. Harrison et al. (2011) identified six ‘C’s that are critical spheres of influence in a child’s weight development: The Cell, Child, Clan, Community, Country and Culture (Harrison et al., 2011). Each sphere has factors that produce or protect against obesogenic risk. A seventh ‘C’, Childhood education has been proposed because of the role it plays in developing children’s knowledge and skills (Skouteris et al., 2017). Developing multifactorial solutions to the obesity crisis should engage multiple spheres of influence and specifically include the child. Engaging multiple sectors and settings with a common goal of obesity prevention, may effectively reduce the future incidence of obesity in children.

Early childhood education and care should be targeted for obesity prevention in young children because it fosters young children’s social and academic, behaviours and skills (Anderson et al., 2003). Longitudinal data have consistently shown that engagement in early
childhood education produces positive long-term social and health outcomes (Anderson et al., 2003; Bakken, Brown, & Downing, 2017; Heckmann, 2011; Yoshikawa, 1995). Furthermore, in recent years, early childhood education has been identified for its potential contribution to obesity prevention (Waters et al., 2011; World Health Organization, 2012). Given that popular culture interests affect children’s play, and the food, toys and clothing children bring into early childhood service (Edwards, Skouteris, Rutherford, & Cutter-Mackenzie, 2013), a pedagogical solution using the educator’s expertise was developed that combined the messages of Healthy Eating and environmental Sustainability (HES) (Skouteris et al., 2014). An evaluation of the intervention found that it was feasible to deliver (Morris et al., 2016), and effective in increasing children’s knowledge of HES concepts (Morris et al., Submitted).

The success of the intervention notwithstanding, the absence of parental involvement was an identified limitation (Morris et al., Submitted; Morris et al., 2016). This may be problematic because rigorous longitudinal evidence tells us that parents are critical to fostering children’s educational and developmental outcomes (Castro et al., 2015; Ma, Shen, Krenn, Hu, & Yuan, 2016; Van Voorhis, Maier, Epstein, & Lloyd, 2013). Leveraging the success of parental involvement in education may be the key to sustained and long-term change in obesity prevention strategies conducted within early childhood education settings.
A recent systematic review explored parental components that were part of obesity prevention interventions conducted in early childhood settings (Morris, Skouteris, Edwards, & Rutherford, 2015). The findings revealed that four factors of parental involvement are associated with weight changes in children: (1) consistency of educational material across the home and education settings; (2) building the knowledge and skill capacity of parents about the concepts promoted in the intervention; (3) parents encouraging their children to drink water; and (4) parental satisfaction and participation in the intervention program.

In order to address points (1) and (2), the overall goal of the current study was to examine parental understanding about the combined messages of healthy eating, active play and sustainability concepts. Limited research has explored the understanding of health from the perspective of parents with preschool aged children and none were found regarding sustainability. However extensive research about early childhood educator’s pedagogy and practices regarding education for sustainability is available (see for example, Edwards & Cutter-Mackenzie, 2011).

To the author’s knowledge, no previous research has explored the knowledge connections parents make for health and sustainability concepts, as was done in the current study. Hence, the primary aim, that attends to point (2) (building the knowledge and skill capacity of parents), was to understand the knowledge connections parents provide for the
concepts of healthy eating, physical activity and sustainability.
Knowledge connections were defined here as a statement that joins two or more concept areas together, for example, healthy eating and sustainability concepts can be connected by vegetable gardens being an environmentally sustainable practice that produces food that is healthy to eat. A secondary aim, attending to point (1) (consistency of educational material across the home and education settings), was to understand parents’ perceptions and experiences of early childhood education in fostering children’s knowledge in this area.

Method

Design

A qualitative research methodology was employed in the current study. As noted above, this methodology has previously been used to facilitate the understanding of parents’ perspectives on health concepts. However, the limited qualitative research available with parents of preschool aged children and no understanding of parental knowledge connections between concepts, necessitates this study.

Participants

Ten primary caregiver parents ( nine mothers, one father) of preschool children participated in semi-structured interviews in their home, lasting approximately 45 minutes; saturation of responses was reached with the ten participants and, as such, no further recruitment was needed. The participants lived in an area of low socio-economic
disadvantage (profile.id, 2016) in Melbourne, Australia and were aged between 35 and 45 years. All the parents had a child attending 4-year-old kindergarten and at least one child attending primary (elementary) school.

**Recruitment**

The only inclusion criterion was that participants were a parent of a preschool aged child regardless of birth order. Parents were recruited from a convenience sample (a kindergarten and primary/elementary school in a south-eastern suburb of Melbourne, Victoria) with the understanding of the possibility of bias (Gravetter & Forzano, 2015).

**Interview protocol**

A semi-structured interview schedule was developed (Galletta & Cross, 2013) and trialled with one parent prior to being used with all ten participating parents. Participants were invited to relate their answers to what they say and do with their preschool child only. The questions open-ended and specifically invited parents to consider the connections between healthy eating, physical activity and sustainability, see Table 1.
Data extraction

All interviews were audio recorded, transcribed verbatim and anonymised producing the data corpus (Braun & Clarke, 2006). The transcripts were analysed using a modified version of the six phases in thematic data analysis described by Braun and Clarke (2006). A minor

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<td>What is your understanding of sustainability and its connection to healthy eating?</td>
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<td>Do you think about these connections when making food purchases? Please explain</td>
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<td>What language do you use when talking about foods?</td>
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<td>What is your understanding of sustainability and its connection to physical activity? Please explain</td>
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<td>Do you think about these connections when making physical activity choices?</td>
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<td>What sort of practices do you do with your child to make these connections? If any?</td>
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<th>Kindergarten and educator questions</th>
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<td>What sorts of activities does your child’s kindergarten do to promote or educate about healthy eating, physical activity and sustainability?</td>
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<td>What can you tell me about the communication between you and your child’s educator about these concepts?</td>
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<td>Whose responsibility do you think it is to provide this knowledge about these concepts to your child? Why?</td>
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modification to Phase 6 (producing the report) was made, with concept maps produced in its place. A concept map — a visual representation of information (Novak & Gowin, 1984), is a superior method to a report for the demonstration of relationships between concepts.

The following steps were applied to extract the data: 1) data familiarisation; 2) generation of initial quotes and concepts; 3) searching quotes for concepts; 4) reviewing of concepts; 5) defining and naming of concept groups; and 6) mapping of the data (Braun & Clarke, 2006). Each step was conducted by two researchers, the PhD student and her supervisor (HM and HS). Data familiarisation was completed by reading the transcripts three or more times to immerse each researcher in the available data. The researchers then systematically generated a list of interesting quotes that contained concepts and knowledge connections during the data familiarisation process. A thorough search for relevant concepts was guided by what was found initially. The researchers’ lists were compiled and duplicates removed. Similar concepts were grouped together and labelled. Concepts were compiled into conceptual silos, for example all healthy eating concepts were under the healthy eating banner. Finally, a concept map from the identified concepts was created (Novak & Gowin, 1984). Particular interest was paid to the knowledge connections across conceptual silos (Joseph & Alberto, 2010). The concept map was inputted into a computer program called XMind 2013 (v3.4.1.2). XMind is a mind mapping software package that is freely obtainable on the internet, and was chosen for its ease of use and ability to clearly
present information. While it is a program that is used widely across many businesses, companies and disciplines, to the author’s knowledge, it has never been used in early childhood qualitative research.

**Results**

Connecting the concepts of healthy eating, physical activity and sustainability was a challenging task for parents, however eight knowledge connections were identified. The compartmentalisation of each concept area (e.g. thinking of healthy eating alone) was offered in explanation by one parent for this difficulty (P05)\(^5\).

**Concept Map**

Three concept maps in total were produced: Figure 1 depicts the entire concept map of all knowledge connections provided and the additional concepts produced (see Appendix G). Figure 2 depicts the knowledge connections between healthy eating and sustainability concepts only; Figure 3 focuses on the knowledge connections between physical activity and sustainability concepts. Healthy eating and physical activity concepts are indicated in blue; sustainability concepts

\(^5\) Please note that each knowledge connection has been characterised by an example quote reproduced verbatim (as indicated by a participant (P) and the order they were interviewed, e.g., P01 is the first parent interviewed).
are indicated in green. A knowledge connection was indicated using a solid dark coloured line.
Figure 2 Healthy eating and sustainability knowledge connections
The Knowledge Connections Between Healthy Eating and Sustainability

A total of six knowledge connections between healthy eating and sustainability were found; these are outlined below.

1) Fruit and vegetable produce and farming. Parents viewed farming as a sustainable practice that requires a responsible used of land. The outcome from this practice is fruit and vegetable produce that is healthy. The more environmentally friendly the farming methods, the healthier the produce becomes.

2) Fruit and vegetable produce and packaging. The parents who were interviewed were also the food purchasers for the family. They have
observed that fruits and vegetables are being packaged in plastic for the convenience of purchasing. The waste of the excess packaging was weighed against the time saving convenience it afforded.

3) Fruit and vegetable produce and vegetable gardens. Vegetable gardens were thought of as activities to participate in, either at home or kindergarten. Gardening was expressed a special activity that provides an opportunity to identify and consume healthy and fresh produce. Chickens were also considered by some parents. A number of parents identified vegetable gardens as an activity that was current within their child’s kindergarten.

4) Food production locations and food transportation. The location of food production and manufacture was a significant issue for parents. Specific countries were identified as having polluted lands and oceans which do not lead to healthy foods. The transportation of foods both nationally and internationally leading to air pollution was also identified.

5) ‘Nude food’ and purchased plastic containers. Nude food is food not derived from a package, specifically fruits and vegetables. A number of kindergartens have a policy that requires parents to send their children to kindergarten with this type of food. The lack of packaged foods requires parents to purchase plastic containers with sections to accommodate the different types of food to be included.

6) The 6th knowledge connection was about the antithesis of healthy eating — store bought foods or packaged foods. These were
discussed as unhealthy options that were linked to packaging which contributes to landfill.

The most relevant quotes from which these connections were devised and represented in Figure 2 are included in Table 2.

Table 2. Healthy eating and Sustainability Quotes

<table>
<thead>
<tr>
<th><strong>Fruit and vegetable produce and farming.</strong></th>
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<tbody>
<tr>
<td>“but I know that all the pesticides and crap they’re putting on to fruit and vegies can’t be good for you. In terms of buying food I am now more focused on organics more than I’ve ever been” (P09)</td>
<td></td>
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<tr>
<td>“Climate change might effect the growing of food and therefore it effects the price in the supermarket If it’s sustainable. When I think sustainable I think agriculture, and then I link that to food and price and what’s available.” (P07)</td>
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<table>
<thead>
<tr>
<th><strong>Fruit and vegetable produce and packaging</strong></th>
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<tbody>
<tr>
<td>“I feel guilty when I buy those pre-packaged apples because I think, what a waste.” (P 07)</td>
<td></td>
</tr>
<tr>
<td>“I always buy Australian and try and minimise the packaging, but I buy the apples too [in packaging]. The baby cucumbers. It’s time and money, it just comes down to that” (P08)</td>
<td></td>
</tr>
<tr>
<td>“at our home everything possible is bought without any plastic. And goes through a multilevel composting system including the egg shells” (P06)</td>
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<table>
<thead>
<tr>
<th><strong>Fruit and Vegetable produce and vegetable gardens.</strong></th>
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<tbody>
<tr>
<td>“Both the kinder and school have vegetable gardens. The children do cooking as a special activity and then they’ll use the produce that they have grown as one of the ingredients.” (P05)</td>
<td></td>
</tr>
<tr>
<td>“we plant our own vegetable garden. So, there is an activity around planting and thinking environment and thinking green, and then the obvious eating it fresh and healthy sort of connects. (P09)</td>
<td></td>
</tr>
<tr>
<td>“we grow a lot of our vegetables ourselves. We have chickens in the back yard and they lay us eggs. Our focus as our family is really around our garden. (P06)</td>
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</tbody>
</table>
“Kitchen gardens are good and using food from the garden shows a connection.” (P04)

“I’ll say granny’s grown this, it’s healthy” (P08)

Food production location and transportation.

“I look for where they [vegetables] come from, if they come from China I’m not buying them. It kind of bothers me why we would buy Chinese vegetables when we can buy Australian vegetables. And again, all the research says its healthier and better and good for the environment.” (P09)

“once again going back to growing things, the air, and how so much car driving and truck driving, you are putting back into the earth so you can compensate. Growing offsets the omissions” (P10)

“I always buy Australian” (P08)

Nude food to reduce packaging

“with their lunch, the intent is that you don’t give them anything with any packaging, so each class can win this Golden lunchbox award. What that does is that it forces the parents to invest in Tupperware and things. You don’t want your child to be the one that makes the whole class miss out on the award.” (P05)

“They [kindergarten teachers] showed us, one term. All the rubbish at the end of the day was collected to show us how much they got in one term. Then the next term we did, Tupperware loved us, because we bought those containers with the sections and we had a rubbish free lunch. And they showed us the difference because term one was like this [arms open wide] and term two was like this. Not nearly as much rubbish.” (P07)

Store bought packaged foods compared to produce

“Her version of fruit used to be the ‘pantry fruit’. Then I worked out quickly that if you are going to have fruit then it is better to have the real thing. So, their lunch boxes are filled with only fresh, washed, mostly organic and fresh as it can be and seasonal as it can be. (P09)

“*child* wanted a roll up (a highly processed fruit strap) and want to take them to school and I refuse to buy them because they are
The Knowledge Connections of Physical Activity/Active Play and Sustainability

The production of knowledge connections between physical activity/active play and sustainability was difficult for all parents. Most parents (n=8) required a prompt when considering these concepts, and the predetermined notion of active transport (e.g., walking instead of driving for transport) was employed. However, due to prompting, active transport was not included as a knowledge connection. Regardless parents preferred to discuss the barriers to it rather than thinking of different knowledge connections. In total, only two knowledge connections were produced; these are outlined below.

1) Active play/physical activity and outdoor parks: Parents reframed ‘sustainability’ to only consider nature and the outdoors. Children’s participation in nature was considered an opportunity to play in a playground, walk the dog and be physically active.

2) Home duties and manual labour: A number of home duties require physically undertaking a task rather than using assistive technologies. An active consideration to reduce energy consumption is discussed. Table 3 includes the most relevant quotes from which these connections were devised.
Parents were asked about their child’s kindergarten, the educators and their reinforcement of the integrated messages between healthy eating, physical activity/active play and sustainability. The qualitative data were centralised around three main topics as listed below.

1) Sustainability practices within the kindergarten. The kindergarten has a number of curriculum activities that support the messages of sustainability. Composting, worm farms, and recycling were all identified.

2) Food policies supporting healthy eating. An extensive number of food policies were identified by parents, such as, eating the healthy food

### Kindergarten Practices and Educator Influence

1. **Active play/physical activity in outdoor parks.**
   “we do a lot of going to the park... they are interacting and playing with their natural environment. Playing games with that. We never leave a footprint, never leaving rubbish behind. So they have a sense of play outdoors, gardens parks” (P09)

   “We’re lucky here because you can walk the dog into beautiful parkland and have a lifestyle to walk your dog or have a play in the park.” (P07)

2. **Home duties and manual labour.**
   “I think of hanging out the washing and doing the dishes. But it depends on if I have the time and energy.” (P04)

   “I hate winter when I have to put [the washing] in the dryer because it feels like its wasting.” (P10)
first, no sharing, nude food, and only healthy foods to be included in the lunchbox.

3) Educator impact. Parents identified the educators as having a considerable impact on their children’s knowledge. In addition, parents believed their children perceived the educators as being more knowledgeable than themselves.

Table 4 includes relevant quotes from which these connections were devised.

<table>
<thead>
<tr>
<th>Table 4. Kindergarten Practice and Educator Influence Quotes</th>
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<tbody>
<tr>
<td><strong>Sustainability practices within the kindergarten</strong></td>
</tr>
<tr>
<td>“they are very environmentally aware. They’ve got compost and vegies and they’ve got herbs. So, they’re very good at that and he’ll come home and tell me.” (P08)</td>
</tr>
<tr>
<td>“yeah, everything is labelled. They have a good system there. They probably get a lot more [knowledge] from the kindergarten than from me as I just do it [composting].” (P06).</td>
</tr>
<tr>
<td>“The kindergarten has a composting system and they make compost with it. So for me it is more about healthy eating rather than environmental sustainability.” (P06)</td>
</tr>
<tr>
<td><strong>Food policies supporting healthy eating</strong></td>
</tr>
<tr>
<td>“At kinder they are not allowed to have any pre-packaged food at all. At snack, they must have fruit. Its peer pressure but in a positive way as all kids are eating the same thing.” (P03)</td>
</tr>
<tr>
<td>“my kids will go to kinder with nude food” (P06)</td>
</tr>
<tr>
<td>“He only asks for healthy food at kinder for his lunch box. But at home it’s different. I’ll say do you want a homemade muffin and he’ll say that he’s not allowed that. And he doesn’t want it. It’s a kinder thing.”(P08)</td>
</tr>
</tbody>
</table>
“So even if he has some sort of bikkies, and they’re not allowed to have so yeah, his snack has to be fruit or vegies, no yoghurt.” (P10)

“Our kinder has a policy of eating the healthy food first and that is throughout the kinder” (P02)

“I’m happy that I’m not getting pressured about the lunchbox ingredients because the kinder has a no food sharing policy” (P01)

**Educator impact**

“Oh, he’ll definitely listen to them [his educators] more than us. They’ll go out and plant seeds and put left overs in the compost. He’s doing it with his friends.” (P01)

“What the teacher says has more influence that what is said at home because it reinforces what is said at home and not remembered, but the teacher is in a role of power or is more knowledgeable” (P01)

“My kids are remembering stuff from kinder and bringing that information home.” (P02)

**Discussion**

The aim of this study was to qualitative explore parents’ understandings of the connections between healthy eating, physical activity and sustainability. Interviews with parents of preschool children identified nine knowledge connections in total. While the total number of knowledge connections is small, saturation was achieved, defined as no new connections being identified (Fusch & Ness, 2015). The capacity of parents to make these connections seems limited. This identifies the need to increase parents’ understanding of the related nature of healthy eating, physical activity and sustainability.

On the whole, parents made knowledge connections related to daily household activities, including food shopping, lunch box preparation, and
home duties. Most parents (n=7) admitted they rarely, if ever, shared their knowledge connections with their children. This suggests that: (1) parents may not understand or be interested in the impact that sharing knowledge has on their children’s learning; and (2) parents may rely on educators to fill this gap. However, it is more likely that lack of time and parenting / household pressures is contributing to this phenomenon, as it does for healthy eating and physical activity (Dwyer, Needham, Simpson, & Heeney, 2008). Indeed, it was noted by parents that early childhood educators were their children’s likely source of knowledge of health and sustainability concepts. Building the capacity of parents to understand their role as educators but also as collaborators with their child’s kindergarten teachers is warranted.

The finding that two of the nine knowledge connections were related directly to the kindergarten practices or policies (nude food and vegetable gardens), indicates that some kindergarten messages are reaching parents. Regardless of the method of knowledge transmission, whether by children, newsletters or direct communication with educators, the capacity for a consistent message across the home and kindergarten setting is possible. This attends to the first finding from the systematic review that consistent messages across settings was a factor in producing weight changes in preschool children (Morris et al., 2015). Therefore, the engagement of parents in curriculum activities within the kindergarten may be a useful way to increase these consistent messages.
The systematic review into parent components added to early childhood obesity prevention interventions, also found that building the capacity of parents about messages like healthy eating and physical activity led to weight changes (Morris et al., 2015). Determining parents’ existing knowledge connections between health and sustainability concepts yielded a foundational understanding of their existing capacity. The nine knowledge connections that were produced attends to the primary outcome. Parents identified three ways that the kindergarten supports the promotion of health and sustainability messages in children, attending to the secondary outcome. The importance of each knowledge connection cannot be overlooked, therefore, each one is below, discussed individually in the order they were presented in the results.

**Fruit and vegetable produce and farming.** Farming was spoken of as the commercial production of food. Farming methods used in the production of fruits and vegetables, in particular the use of pesticides was perceived as not being healthy. The use of chemicals in farming methods was considered an unsustainable practice. Organic produce grown without the pesticides, was for one parent the only alternative, likely to be healthier and grown with more sustainable farming practices.

Climate change was identified as a sustainability concept with a direct link to farming and healthy eating. Climate change produces adverse weather conditions like drought and flooding, which directly interrupts food growth (Wheeler & von Braun, 2013), impairing the supply of fruits and vegetables. This disruption ultimately produces a
change in the cost of produce effecting the family’s ability to purchase fruits and vegetables. The health impacts from nutrient deficiencies, reduced nutritional qualities has been quantified, and a threat to population health exists (Scheelbeek, Tuomisto, Bird, Haines, & Dangour, 2017).

**Fruit and vegetable produce and packaging.** In Australia, fruit and vegetables are increasingly being packaged in small portioned sizes for convenience of purchasing (Wills & Golding, 2016). This convenience was certainly noted by parents however it was also considered ‘a waste’ (P07). Excessive packaging has an impact on landfill, with 2.5 mega tonnes entering landfill nationally in 2014-15, equating to 107 kilograms per person (Department of the Environment and Energy & Blue Environment, 2016). One parent (P06) consistently makes purchases without plastics indicating that this is a habitual practice that is linked to her values. Unfortunately, time-poor parents often value the convenience of pre-packaged produce at the expense of the environment. Returning to ways that are more sustainable can be difficult because they are at the expense of time.

Food purchasing decisions about the packaged fruit vs the individual fruit, where the food was grown, frozen or fresh, are all made by the parent at the time of purchase. The habitual nature of these decisions is likely to preclude knowledge sharing about topics related to these decisions; e.g. food miles. The burden that time and money have on
these decisions cannot be overlooked as a significant moderator of parents’ behaviour.

**Fruits and vegetables grown in vegetable gardens.** Vegetable gardens were referred to as an activity conducted within the home or kindergarten setting for personal use. Six parents identified that vegetable gardens were a popular activity at their child’s kindergarten. This experience is becoming popular at kindergartens, as well as primary (elementary) and secondary (high) schools across Australia (Stephanie Alexander Kitchen Garden Foundation, 2017). Two parents (P06,09) said that they have their own vegetable garden, and another has a grandparent provide them with produce (P08). The comment that ‘granny’s grown this, it’s healthy’ (see table 2) is important here because the parent was sharing their knowledge, not only about the quality of the food but how it has been produced. The link between fresh and healthy ingredients that were produced in the vegetable garden that exists in the environment was also evident.

**Food production location and food transportation.** Where food is grown, manufactured or produced can have serious implications for human health. Australia is surrounded by lower income countries (Shorrocks, Davies, Lluberas, & Koutsoukis, 2016) with lower quality control standards for farming methods and food manufacturing. Heavy metals from contaminated land, in countries like China, are incorporated into the fruits and vegetables at levels beyond Australian standards (Zhao, Ma, Zhu, Tang, & McGrath, 2015). The transportation of food
produced in other countries, also contributes to air pollution and the use of fossil fuels to power machinery. At least three parents (P07,08,09) said they buy Australian, however only one stated that doing so is ‘healthier and better and good for the environment’ (P09).

**Nude food to reduce packaging.** The concept of ‘nude food’ or ‘waste free’ lunchboxes is becoming a common phenomenon in kindergartens around Australia (Boyd, 2015). The idea is that nude foods are healthy foods because they are not processed or packaged. Simply taking unhealthy food out of its packaging is not an acceptable alternative because the processed food also does not comply with their nutrition guidelines. A nude food policy also helps early childhood education services to comply with mandated national policies around healthy eating (Australian Children’s Education and Care Quality Authority, 2012). A number of parents identified the strict nature of the kindergarten food policies and made specific mention of the nude food policy (see Table 4, pp 335-6). The engagement between the kindergarten and the parents to engage in the nude food movement was limited. Only one parent experienced the impact from a pedagogical curriculum activity about waste and rubbish that was conducted in the kindergarten. In this activity, the educators collected a term’s worth of rubbish derived from processed foods in children’s lunchboxes. The impact was marked and led to the purchase of containers that reduce packaging and processed foods. Foods in packages are highly processed, often high in sugar, salt and fat — far from the healthy foods that young children should be eating (Elliott
& Conlon, 2015). Nude food policies encourage parents to provide foods that are healthy and the opposite of packaged foods. The downside to the nude food movement is the requirement to purchase and use reusable containers, the lightest and cheapest of which are made of plastic; while these are reusable, there is an environmental cost to their production.

**Store bought, packaged foods compared to produce.** Two parents identified the same food product as an example of store bought, foods that are not healthy. In this case, the store-bought food is a highly packaged, processed and energy dense food. The unhealthy and highly packaged nature of the food represents the connection between concepts. The ‘pantry fruit’ (P09) also known as the fruit rollup™ was defined as ‘full of sugar’ (P07), and as such, not a healthy option for a preschool child. Parent (09) simply made the connection that ‘if you are going to have fruit then it is better to have the real thing’ (P09). In this case, the highly processed and highly packaged food, full of preservatives to increase shelf life is not a healthy option.

**Active play/physical activity and outdoor parks.** The consideration of active play in parks with playgrounds as opposed to organised physical activity was considered by six parents. Parks and backyards were considered a natural environment. Within the context of this knowledge connection, parents reframed the environment to only consider nature and the outdoors. However, this knowledge connection has been included because it illustrates the flexibility parents can have when considering one large concept like sustainability. Active play in a playground and the
addition of pets in parks were also connected by parents. Without the availability of natural parks and wildlife reserves, children may not have a connection to their environment, and miss the connection that it needs our help (Louv, 2013). Parents can support this connection by taking children to parks for play but also explain and practice the idea of not leaving a footprint (P09).

**Home duties and manual labour.** Physically undertaking a task (rather than using power assisted technologies) is becoming a thing of the past. Two parents described the completion of home duties by hand rather than using technology as a way of being physically active and also supporting the environment by not using energy. To a preschool child these home duties are often role played both at home and at the kindergarten. Imaginative play such as this supports cognitive and linguistic skills (Bergen, 2002) and self-regulation practices (Singer, Golinkoff, & Hirsh-Pasek, 2006), all of which are required in the development of agency in children (Macfarlane & Cartmel, 2008). Being time poor and the reliance on the modern conveniences may have contributed to low number of parents who made this knowledge connection.

**Sustainability practices within the kindergarten.** Seven parents identified kindergarten learning activities that support the integration of healthy eating and sustainability knowledge, specifically worm farms, composting, vegetable gardens, cooking with produce, and recycling of food packaging. These play-based learning activities have seen an
increase in implementation within the kindergarten setting and allow for knowledge co-construction of these concepts (Davis & Elliott, 2003; Edwards & Cutter-Mackenzie, 2011). The practical nature of these activities is ideal to engage children in learning about these concepts.

Food policies. A focus on the kindergarten’s educative efforts around food was emphasised by the parents. The strong food based policies in place in all kindergartens, attenuated the types of foods placed in lunch boxes (Department of Health and Ageing, 2009). So much so that the children were guiding their parents as to what was placed in lunch boxes (See Table 4, quote from P08). This is an important example of the effect early childhood education can have on children’s actions on behalf of their own health. While it may be argued that the influence of peers and the approval seeking of authority figures may also be playing a role, the effect on the consumption of healthy foods remains unchanged. It serves as a demonstration of agentic behaviour in children, where their knowledge of lunchbox practices and policies has driven them to make a decision that advocates for their health. This action has then mediated their parents’ behaviour when packing the lunchbox.

Educator impact. When considering the educator in particular, parents perceived their children as placing the educators in a position of power. Parental perception of the impact from the kindergarten and their educators on their children was obvious. The kindergarten’s provision of curriculum activities such as worm farms or recycling programs to the children, places educators as direct knowledge brokers
and not the parents. This may explain why parents perceive that their children view the educators as ‘experts’. Parental lack of knowledge sharing, for example, one parent said “I just do it” (P06) when discussing composting, reinforces this view. The lack of information sharing by parents when completing tasks may impact on a child’s perception of their parent as a knowledgeable peer. This speculation however indicates that there is a gap in our understanding of how children perceive their knowledgeable peers, and how they incorporate information from different types of peers.

**Strengths and Limitations**

The findings of this study provide insight into the knowledge connections parents of preschool children make when relating the concepts of healthy eating, physical activity/active play and sustainability. Methodological limitations include the convenience sample which lacked socio-economic and cultural diversity. In addition, the questions prevented a thorough examination of the individual concepts which may have aided in clearer connections. Hence, the findings of this study must be interpreted with caution and further, more rigorous research, is clearly needed.

**Future research and implications**

Developing an effective parent component to be delivered in conjunction with an obesity prevention intervention in an early childhood setting is a challenging task. The research presented in this paper provides some foundational knowledge about how parents connect
healthy eating, physical activity and sustainability concept areas. The revelation that parents rarely engage with knowledge sharing about the concepts discussed highlights the need for two elements to be included in a future parent component: 1) that consistent and clear messages between the kindergarten and the home about curriculum are provided, as well as ways to reinforce messages at home and child development; and 2) that capacity building techniques are used to: a) improve content knowledge of the healthy eating, physical activity and sustainability concepts as it relates to preschool children’s curricula; b) improve parental understanding of their role as educators and critical support of early childhood education; and c) provide strategies and techniques for parents to effectively share their knowledge and collaborate with the kindergarten’s messages for the benefit of their child. There is value in a pedagogical approach towards obesity prevention and this is highlighted in the ecological models that underpin both education and obesity prevention. The qualitative evidence presented here can not only be used in the support of a parent component, but also support educators understand how parents engage with their children with these concepts.

**Conclusion**

The overall aim of this study was to understand how parents connect the concepts of healthy eating, physical activity and sustainability, and the contribution of the kindergarten in fostering these concepts in their children. A complete concept map of the combined messages of healthy eating, physical activity and sustainability that
parents make was produced. Parental linkage of health and sustainability concepts to their daily duties indicates that their engagement is superficial and reactive, rather than measured and decisive. Furthermore, parental identification of kindergarten curriculum activities as important in building children’s knowledge of health and sustainability concepts, indicates that early childhood education has a role in building academic awareness and agency in young children. Taking measures to pedagogically promote health and sustainability knowledge in early childhood is a positive step toward long term obesity prevention across the life course.
References


Feasibility of conducting a randomized trial to promote healthy eating, active play and sustainability awareness in early childhood curricula. *Early Child Development and Care*, 186(11), 1752-1764. doi:10.1080/03004430.2015.1131158


CHAPTER 10 — DISCUSSION

Summary of Findings

The overall aim of this thesis was to evaluate the efficacy of a pedagogical curriculum intervention delivered in the early childhood setting, to foster preschool children’s integrated knowledge of Healthy Eating and Sustainability (HES) concepts. While early childhood has been earmarked as a priority for obesity prevention strategies (World Health Organization, 2012), the body of evidence is still growing (Sonntag, 2017). There are gaps in our understanding about how to engage children, educators, and parents in obesity prevention during the formative preschool years (Morgan et al., 2016; Sharifi et al., 2015). The current thesis focused on the opportunity to increase our knowledge in this area.

The findings of the feasibility study for the early childhood curriculum intervention described in this thesis, were published and presented in Chapter 3; the curriculum intervention is feasible to deliver in 4-year-old kindergarten. Analysis of the curriculum developed during the feasibility study determined which activities produced changes in knowledge. The findings presented in Chapter 4 demonstrated that educators used children’s interests as the foundation for curriculum activities; in addition, the educators were able to incorporate content knowledge about healthy eating, active play and environmental sustainability in these curriculum activities. This new knowledge was included in the educator’s professional development training as part of
the randomised trial conducted in 2015 and 2016 to evaluate the efficacy of the intervention. Chapter 5 outlines the curriculum activities that educators planned and implemented in their classrooms during the randomised trial. These activities were imputed into an integrated conceptual framework (see Table 2, page 198), and used definitions of well-being and sustainability that aligned with the Early Years Learning Framework (Department of Education, Employment and Workplace Relations, 2009). Each activity was coded to indicate the activity’s type of play — open ended, modelled or purposefully framed play (Edwards, Cutter-Mackenzie, Moore, & Boyd, 2017). The evidence suggested that the curriculum activities ‘bonded’ wellbeing and environmental sustainability concepts together.

The main aim of the randomised trial, presented in Chapter 6, was to determine whether a curriculum intervention, compared to education as usual, led to: 1) increases in children’s related knowledge of healthy eating and sustainability; and 2) increases in fruit and vegetable intake, and decreased packaged/unhealthy food intake. The pedagogical curriculum intervention was effective in producing increases in children’s knowledge; increases in healthy eating were also found. The success of the intervention inspired a position paper advocating for early childhood education to be strongly considered as a setting for obesity prevention; this paper was presented in Chapter 7.

A limitation of the research conducted was the absence of parental involvement within the early childhood curriculum. Parental
involvement in early childhood obesity prevention interventions is considered an important component (Hesketh & Campbell, 2010; Nixon et al., 2012). In order to understand how to best incorporate parents into curriculum interventions within the early childhood education settings, a systematic review of obesity prevention interventions conducted in early childhood education settings with a parent component was conducted. The findings presented in Chapter 8 revealed that of the little research to date, four factors were shown to be important in obesity prevention, including: consistency of messages across the early childhood education setting and the home; building parent capacity of health and well-being concepts; high parental satisfaction with the project; and employing water only messages at home. To generate new knowledge in this area, an investigation into parents’ perceptions of the combined messages of healthy eating, active play and sustainability was conducted. Ten parents with preschool aged children participated in an interview. The findings were presented in a concept map with specific attention paid to the connections parents made across the concept areas.

General Discussion

The overall findings of this thesis are presented across five themes that represent the novel aspects of the research conducted, including: 1) early childhood education and health — interdisciplinary perspectives aligned to focus on healthy lifestyle knowledge and behaviours in young children; 2) leveraging a bottom-up approach to curriculum development for healthy eating and environmental sustainability; 3) integrating
health and sustainability messages within early childhood curriculum activities; 4) building a sense of agency in children for their own healthy lifestyle choices; and 5) understanding parental engagement and support of healthy lifestyle behaviour messages in early childhood education. Each of these themes are discussed henceforth.

**Early Childhood Education and Health — Interdisciplinary Perspectives**

**Aligned to Focus on Healthy Lifestyle Knowledge and Behaviours in Young Children**

Obesity development in children is a complex issue. A simplified explanation (see for example, Garrow, 1987), will fail to encapsulate the drivers, as well as risk and protective factors that are relevant to the development of obesity (Institute of Medicine, 2010). Ecological models have attempted to avoid this problem by capturing some of these factors that promote child weight development (Davison & Birch, 2001; Harrison et al., 2011). These models have been frequently used in intervention development, however their conceptualisation does not depict the fluidity of interacting factors or the feedback loops (where variable ‘a’ affects variable ‘b’ that then affects variable ‘a’) important in obesity development (see for example, Butland et al., 2007). A systems approach is particularly suited to the complex problem of obesity (Finegood, 2011) because it explores the context, relationships and interactions that make up a whole picture. A recent article identified five key efforts in implementing a systems approach to obesity prevention (Lee et al., 2017). One of these key factors is the collaboration of researchers and experts
from a variety of disciplines (Leischow & Milstein, 2006). As such, an interdisciplinary approach is useful in childhood obesity research (Huang, Drewnowski, Kumanyika, & Glass, 2009), because it is more likely to lead to innovative solutions to the problem of excessive weight gain in children (Leischow et al., 2008). The research in this thesis aligned health and early childhood education, responding to a call for research using interdisciplinary approaches in obesity prevention (Skouteris, Do, Rutherford, Cutter-Mackenzie, & Edwards, 2010). Aligning early childhood education and health towards the same goal accords with the evidence that education is linked to health outcomes (Feinstein, Sabates, Anderson, Sorhaindo, & Hammond, 2006; Grossman, 2004; Silles, 2009). Higher education is linked to positive health behaviours, using preventative health services, and avoiding risky behaviours (Englund, White, Reynolds, Schweinhart, & Campbell, 2015; Feinstein et al., 2006). In addition, higher levels of education are associated with lower body mass index in adults (Hermann et al., 2011), increases in fruit and vegetable intake (Feinstein et al., 2006), and more physical activity (Trost, Owen, Bauman, Sallis, & Brown, 2002). Early intervention with early childhood education, particularly for children who are vulnerable, yields similar impacts on health. Several longitudinal studies (Schweinhart, 2016) show that early intervention programs, such as Head Start, Abecedarian project, Child-Parent Centre and the High Scope Perry Preschool Project, produce positive academic and health outcomes (Englund et al., 2015). These outcomes emerge not only from preschool
participation that provides social, emotional and academic learning opportunities, but also from cognitive advances due to the education.

Participation in these early childhood education programs have led to a reduction in risky behaviours that impact on health in young adulthood, for example smoking, unsafe sex and alcohol abuse (Englund et al., 2015). In addition, they have led to an increase in a suite of health promoting behaviours like having adequate sleep, personal hygiene, exercise and nutritious food consumption (D’Onise, McDermott, & Lynch, 2010; Muennig, Schweinhart, Montie, & Neidell, 2009; Palfrey et al., 2005). The cost-benefit analyses of these programs are overwhelmingly positive. For every USD$1 spent, the child from the Perry Preschool Program will repay $12.90 (Belfield, Nores, Barnett, & Schweinhart, 2006), the Child-Parent Centre, $10.93 (Reynolds, Temple, White, Ou, & Robertson, 2011), Head Start $1.84 (Kline & Walters, 2016), and the Abecedarian project, $4 (Masse & Barnett, 2002), when they are an adult. Therefore, investment in early childhood education for health and societal outcomes is certainly warranted. Despite this, there has been little investment into research exploring early childhood education and its ability to teach healthy living concepts like healthy food choices, physical activity, and mental health. Relatively few obesity prevention interventions have been conducted in this setting (Zhou, Emerson, Levine, Kihlberg, & Hull, 2014), and even less have used the expertise of the educator to develop the curriculum (Morris, Skouteris, Edwards, & Rutherford, 2015).
Leveraging a Bottom-Up Approach to Curriculum Development for Healthy Eating and Environmental Sustainability

While parents are their child’s first educator (Department of Education, Employment and Workplace Relations, 2009), early childhood education professionals play a significant role in the lives of young children. Groups of children, like adults, produce a dynamic, lively culture as they interact and play (Department of Education, Employment and Workplace Relations, 2009). Harnessing this group culture is a skill that teachers use to increase the quality of educational experiences (Australian Children’s Education and Care Quality Authority, 2017; Pianta, Downer, & Hamre, 2016). Unfortunately, there has been little recognition of these skills in previous obesity prevention research conducted within this setting. As such, this previous research has not: utilised the existing knowledge and skills of early childhood educators; identified children’s interests which can be used pedagogically to garner engagement and learning retention; or built educators’ capacity about obesogenic factors that are particularly relevant to preschool aged children. The omission of these critical elements within early childhood research is the result of top-down researcher driven interventions (see the following systematic reviews for intervention examples: Sisson, Krampe, Anundson, & Castle, 2016; Zhou et al., 2014). Top-down interventions are researcher driven, where researchers deliver an intervention or materials are simply provided for the educator to teach (see for example (De Coen et al., 2012). The negative implications of top-down
interventions are significant because they do not identify or capitalise on children’s interests. Furthermore, they rarely build the capacity of the educator to incorporate their new knowledge in current or future classes. This can lead to little or no effect from the intervention (see the same example above; De Coen et al., 2012). The PhD research outlined here has overcome the pitfalls of a researcher-driven approach by using a bottom-up approach to intervention curriculum development. A bottom-up approach, in this case, is where the educators were supported to develop an intervention curriculum that responded to the children’s interests. This approach has positive implications for the educators’ professional practice because the methodology builds their capacity to apply their skills. The professional development seminars provided content knowledge on subjects including healthy eating and environmental sustainability; and educational theory including the funds of knowledge approach (Moll, Amanti, Neff, & Gonzalez, 1992) and Vygotsky’s theories on imagination (Vygotsky, 1980, 2004), every-day, scientific and mature concepts (Vygotsky, 1987), and play (Vygotsky, 1967; Vygotsky, 1987). This professional development was designed to foster application of this knowledge in their curriculum development. Using a bottom-up approach also meant that the educators could tailor their curriculum to the children’s interests, a strongly held practice in early childhood education (May, 2013). Furthermore, the funds of knowledge⁶ approach enabled

⁶The historical and cultural knowledge and skills of a household that a child can access (Moll et al, 1992)
educators to use children’s popular culture interests (by identifying them as a cultural experience), traditionally considered inappropriate for curriculum (Arthur, 2001) in a positive way. Precedence exists for the use of popular culture interests within curriculum (Hedges, 2011; Karabon, 2017), however, the current research is the first of its kind to use it for the purposes of fostering knowledge of healthy lifestyle behaviours.

**Combining Health and Sustainability Messages Within Early Childhood Education**

Health and environmental education are vitally important areas for children’s wellbeing and as such are specified in both the national and state curriculum guidelines (Department of Education, Employment and Workplace Relations, 2009; Department of Education and Training, 2016). Consistent with the way they are presented in these guidelines, both health and sustainability are taught in conceptual silos (Abernethy, 2016), that is, compartmentalised and without any conceptualisation that the areas may be linked. Teaching concepts in conceptual silos has a place, however there is no capitalisation on the holistic nature of concepts. Concepts do not exist in isolation, rather they are intricately connected to an array of similar and dissimilar concepts. Innovative teaching practices that capture this, help children to build problem solving skills that can be applied in a variety of contexts (Beane, 2016; Drake, 1998). Integrating topics within a curriculum is an innovative way to align multiple concepts or disciplines within teaching because it
can lead to new knowledge (Erickson, 2007). Integrated curriculum, where the topic of interest is taught together within the ‘usual’ kindergarten activities, has been utilised within early childhood education to teach science (French, 2004), mathematics (Fantuzzo, Gadsden, & McDermott, 2011) and information communication technologies (Mohammad & Mohammad, 2012). In line with these examples, research into integrated curriculum in the kindergarten setting has focused largely on STEM (Science, Technology, Engineering and Mathematics) subjects (Aldemir & Kermani, 2017; Tippett & Milford, 2017). This highlights a deficiency of a holistic approach to integrated education and a fear that it may lead to developmentally inappropriate practice (Gartrell, 2016), that is, teaching curriculum that is beyond the child’s developmental learning ability. Curriculum approaches that integrate the arts, social sciences, health, sustainability and other subject areas have merit. In the future, as well as today, being healthy and environmentally sustainable has major economic, social and psychological implications. Instilling healthy lifestyle behaviours that also support the environment is easier in young children than older children or adults (Goldfield, Raynor, & Epstein, 2002), as unhealthy behaviours are yet to be ingrained (Goldfield, Harvey, Grattan, & Adamo, 2012). The intervention described in this thesis, enabled educators to integrate health and sustainability messages within their curriculum, beginning this process.
Building a Sense of Agency in Children for Their Own Healthy Lifestyle Choices

The preschool years represent a time of considerable brain development (Brown & Jernigan, 2012). Early childhood educators nurture this period by providing play-based, curriculum learning activities that grow a child’s burgeoning concept of the world. These activities not only build knowledge, but also skills necessary in the expression of agency. Agency is defined as one’s understanding of their ability to initiate and execute actions with purpose to achieve goals (Hilppö, Lipponen, Kumpulainen, & Rainio, 2016; Mashford-Scott & Church, 2011). Preschool children exhibit agentic behaviours when bargaining for power and control (Markström & Halldén, 2009). Within the early childhood education setting, children are able to assert agentic behaviours to negotiate the social order, and also the regulations that confine them (Ebrahim, 2011; Markström & Halldén, 2009). Further, a play-based curriculum allows children to explore situationally dependent agentic behaviours as they arise within the play (Esser, Baader, Betz, & Hungerland, 2016). This is particularly important for the promotion of healthy lifestyle behaviours because situations that affect health continually arise within day to day life. These become opportunities for children to advocate on their behalf and take responsibility for their own health. As such, the intervention developed and trialled (see Chapter 3 and 6), sought to provide numerous opportunities for young children to explore health and sustainability knowledge in ways that would build
their agency. By playing in the fruit and vegetable market in the home corner, or trying pumpkin when they had never done so before (see Chapter 5), children were learning, making decisions and collaborating with peers. In addition, these children were learning to become leaders and in turn, become agents of change within their family and community (Burrows, 2017). There is growing evidence that children are able to impact the lives of the people around them through their knowledge and agentic behaviours. Children have been implicated as change agents for health (Burrows, 2017; Davó-Blanes & La Parra, 2013) and environmental sustainability (Walker, 2017). Primary/elementary school children are able to identify health problems in themselves and others, as well as propose solutions (Davó-Blanes & La Parra, 2013). In low income countries, children have improved their parent’s handwashing knowledge and behaviours (Bresee, Caruso, Sales, Lupele, & Freeman, 2016; Global Handwashing Partnership, 2015). Children also may be agents for healthy eating (Wingert, Zachary, Fox, Gittelsohn, & Surkan, 2014). Similarly, with sustainability issues, children have successfully affected changes in parental knowledge and behaviours about energy use (Hiramatsu, Kurisu, Nakamura, Teraki, & Hanaki, 2014) and nature conservation (Vaughan, Gack, Solorazano, & Ray, 2003). The potential for children to positively impact their families and communities as change agents is great (Percy-Smith & Burns, 2013). This potential was a consideration when developing the intervention presented in this thesis. The possibility now exists that young children can be agents of change for
both health and sustainability, because the intervention built their related knowledge of these concepts. Children can support both health and sustainability in a single decision they make, be it about food, toys or clothing choices. In a world where young children face pressures from 360-degree marketing, these knowledge and skills can be used to support their health, and that of the environment.

**Understanding Parental Engagement and Support of Healthy Lifestyle Behaviour Messages in Early Childhood Education**

The preschool years are an ideal time to instil healthy habits in children that support human and environmental health. Beginning this process in early childhood education settings is a priority (World Health Organization, 2012), however educators cannot do it all. Educators only spend an average of 18 hours per week (Australian Bureau of Statistics, 2015) with preschool children. Therefore, engaging parents to support the curriculum messages delivered in early childhood settings may engender their longevity. Indeed, parents and educators working together in partnership may be the key to obesity prevention interventions that have systemic (Nader et al., 2012), and long-term success (Hesketh & Campbell, 2010; Morris et al., 2015). The systematic review in Chapter 8 identified the elements of a parent component (run in conjunction with a kindergarten program) that were linked to weight changes in children. The small number of interventions to date (15) limited any definitive conclusions, however four findings were linked to weight changes in children. One finding was linked to the kindergarten,
specifically that a consistent message about the curriculum was needed across settings (home and kindergarten). The remaining three findings were about the elements of parent participation in the kindergarten intervention that led to weight changes. They included: building the capacity of parents about the health messages they were targeting; parental satisfaction and participation; and parent encouragement to drink only water. These findings have implications for future intervention development because it signals the specific requirements of a parent component that are likely to lead to weight changes. The development of a component that parents like and want to engage in, that also builds their knowledge capacity about obesity prevention, has yet to be achieved.

**Future Directions and Implementation**

There is a clear theoretical rationale for addressing healthy lifestyle behaviours and environmental sustainability within early childhood education to prevent or reduce obesity risk factors. In 2015, it was estimated at 107.7 million children experienced overweight and obesity globally, with poor diet and lack of physical activity as key drivers of this excessive weight. The significance of the early childhood period in preventing obesity cannot be overstated and is key to impacting future obesity (Cunningham, Datar, Narayan, & Kramer, 2017). The research presented within this thesis demonstrates the efficacy of a pedagogical intervention in increasing children’s knowledge and altering their food consumption. However, there were no outcome measures for obesity
variables (like body mass index), due to the short timeframe of the intervention and time restrictions of the PhD. Future research into pedagogical interventions should include obesity measures. The study design of the intervention has implications for its use in the future. The intervention was evaluated using a randomised trial that can be difficult to translate into a real-world context (Geng, Peiris, & Kruk, 2017). Therefore, modifications may be required to scale up and embed this curriculum intervention into the early childhood education sector.

Regardless, embedding effective obesity prevention strategies in care settings like early childhood education is needed (Waters et al., 2011). There are a number of potential avenues for future research following the completion of this thesis. The lack of parent involvement in the randomised trial needs to be addressed. The groundwork for a parent component to be developed has already been laid, with the findings from the systematic review and qualitative interviews, presented in Chapters 8 and 9. The development and trial of a parent component to be added to the existing intervention is warranted.

An implementation evaluation of the intervention to determine the barriers and enablers to scaling up and embedding the program state or nationwide should be conducted. This would provide a real-world examination of the intervention and determine its applicability as a sustainable program.

1. Continued collaboration with multidisciplinary experts and stakeholders to inform further implementation of the intervention.
The potential for the HES program to be embedded within early childhood education and care settings exists, however validation of the assessment and protocol would strengthen case to do so. As it stands, the best way to embed the program within existing programming remains to be seen.

**Conclusion**

The overall aim of this thesis was to determine if a pedagogical curriculum intervention delivered in the early childhood setting would develop young children’s knowledge of healthy eating and sustainability. The intervention achieved this aim, however a pathway was left open to strengthen the outcomes through engagement with parents. Taken together, future development of a parent component to be delivered in conjunction with an intervention in the early childhood setting, is warranted. Furthermore, scaling up of the intervention to be embedded in all early childhood education settings can be justified. Cost effectiveness research would strengthen this justification. Leveraging early childhood education to foster healthy eating and sustainability knowledge connections in preschool children for obesity prevention merits further research.


doi:10.1080/16823206.2011.568947


doi:http://dx.doi.org/10.1016/j.jhealeco.2004.04.001


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doi:10.1080/13549839.2012.729565


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# APPENDIX A — Authorship Statements

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conception of the project, the design of methodology or experimental protocol, data collection, analysis, drafting the manuscript, revising it critically for important intellectual content, etc.)

Heather Morris collected and analysed the data, drafted the manuscript and revised the manuscript critically for important intellectual content.

I declare that the above is an accurate description of my contribution to this paper, and the contributions of other authors are as described below.

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<td>Janet Williams-Smith</td>
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4. Description of all author contributions

5. Author Declarations
I agree to be named as one of the authors of this work, and confirm:

i. that I have met the authorship criteria set out in the Deakin University Research Conduct Policy,

ii. that there are no other authors according to these criteria,

iii. that the description in Section 4 of my contribution(s) to this publication is accurate,

iv. that the data on which these findings are based are stored as set out in Section 7 below.

If this work is to form part of an HDR thesis as described in Sections 2 and 3, I further

v. consent to the incorporation of the publication into the candidate’s HDR thesis submitted to Deakin University and, if the higher degree is awarded, the subsequent publication of the thesis by the university (subject to relevant Copyright provisions).

<table>
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<tr>
<th>Name of author</th>
<th>Signature*</th>
<th>Date</th>
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<tr>
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6. Other contributor declarations

*I agree to be named as a non-author contributor to this work.*

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<th>Name and affiliation of contributor</th>
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* If an author or contributor is unavailable or otherwise unable to sign the statement of authorship, the Head of Academic Unit may sign on their behalf, noting the reason for their unavailability, provided there is no evidence to suggest that the person would object to being named as author.

7. Data storage

The original data for this project are stored in the following locations. (The locations must be within an appropriate institutional setting. If the executive author is a Deakin staff member and data are stored outside Deakin University, permission for this must be given by the Head of Academic Unit within which the executive author is based.)

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If the publication is to be included as part of an HDR thesis, a copy of this form must be included in the thesis with the publication.
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If there are multiple authors, give a full description of HDR thesis author's contribution to the publication (for example, how much did you contribute to the conception of the project, the design of methodology or experimental protocol, data collection, analysis, drafting the manuscript, revising it critically for important intellectual content, etc.)

Heather Morris conceptualized the study, collected and analysed the data, drafted the manuscript and revised the manuscript critically for important intellectual content.

_I declare that the above is an accurate description of my contribution to this paper, and the contributions of other authors are as described below._

<table>
<thead>
<tr>
<th>Name and affiliation of author</th>
<th>Contribution(s) (for example, conception of the project, design of methodology or experimental protocol, data collection, analysis, drafting the manuscript, revising it critically for important intellectual content, etc.)</th>
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<tr>
<td>Heather Morris</td>
<td>Ms Morris conceptualized the study, collected and analysed the data, drafted the manuscript and revised the manuscript critically for important intellectual content.</td>
</tr>
<tr>
<td>Professor Helen Skouteris, School of Psychology, Deakin University</td>
<td>Professor Skouteris conceptualized the study and revised the manuscript for critical intellectual content.</td>
</tr>
<tr>
<td>Professor Susan Edwards, Learning Science Institute of Australia, Australian Catholic University</td>
<td>Revised the manuscript for critical intellectual content.</td>
</tr>
<tr>
<td>Dr Leonie Rutherford, Deakin University</td>
<td>Revised the manuscript for critical intellectual content.</td>
</tr>
</tbody>
</table>

4. Description of all author contributions

5. Author Declarations

_I agree to be named as one of the authors of this work, and confirm:_

xxvi. that I have met the authorship criteria set out in the Deakin University Research Conduct Policy,
xxvii. that there are no other authors according to these criteria,
xxviii. that the description in Section 4 of my contribution(s) to this publication is accurate,
xxix. that the data on which these findings are based are stored as set out in Section 7 below.

If this work is to form part of an HDR thesis as described in Sections 2 and 3, I further
xxx. consent to the incorporation of the publication into the candidate’s HDR thesis
submitted to Deakin University and, if the higher degree is awarded, the subsequent
publication of the thesis by the university (subject to relevant Copyright provisions).

<table>
<thead>
<tr>
<th>Name of author</th>
<th>Signature*</th>
<th>Date</th>
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<tbody>
<tr>
<td>Heather Morris</td>
<td></td>
<td>28/06/2017</td>
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<tr>
<td>Professor Helen Skouteris</td>
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<td>28/06/2017</td>
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<tr>
<td>Professor Susan Edwards</td>
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<td>29/06/2017</td>
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<tr>
<td>Dr Leonie Rutherford</td>
<td></td>
<td>28/06/2017</td>
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6. Other contributor declarations

I agree to be named as a non-author contributor to this work.

<table>
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<th>Name and affiliation of contributor</th>
<th>Contribution</th>
<th>Signature* and date</th>
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* If an author or contributor is unavailable or otherwise unable to sign the statement of authorship, the Head of Academic Unit may sign on their behalf, noting the reason for their unavailability, provided there is no evidence to suggest that the person would object to being named as author.

7. Data storage

The original data for this project are stored in the following locations. (The locations must be within an appropriate institutional setting. If the executive author is a Deakin
staff member and data are stored outside Deakin University, permission for this must be
given by the Head of Academic Unit within which the executive author is based.)

<table>
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<th>Data format</th>
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<th>Name of custodian if other than the executive author</th>
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<tr>
<td>Electronic and print</td>
<td>Deakin University, including archived data</td>
<td>N/A</td>
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This form must be retained by the executive author, within the school or institute in
which they are based.

If the publication is to be included as part of an HDR thesis, a copy of this form must be
included in the thesis with the publication.
APPENDIX B — Journal Permissions

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APPENDIX C — Ethics

Deakin University Human Research Ethics Approval

Human Research Ethics

Deakin Research Integrity

70 Elgar road
Burwood, Victoria
Postal: 221 Burwood Highway
Burwood Victoria
3125 Australia
Telephone 03 9251 7123
Facsimile 03 9244 6581
research-ethics@deakin.edu.au

Memorandum

To: Dr Helen Skouteris
School of Psychology

Bcc:

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 03 October, 2013

Subject: 2013-220

Promoting healthy eating, active play and sustainability awareness in early childhood curricula

Please quote this project number in all future communications

The application for this project was considered at the DU-HREC meeting held on 23/09/2013.
Approval has been given for Dr Helen Skouteris, School of Psychology, to undertake this project from 3/10/2013 to 3/10/2017.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition, you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au

Telephone: 03 9251 7123
Evidence of ethics approval from Victorian Department of Education and Early Childhood Development

From: Michaels, Youla Y [mailto:michaels.youla.y@edumail.vic.gov.au]
Sent: Thursday, 12 January 2012 10:19 AM
To: Helen Skouteris
Cc: Leonie Rutherford
Subject: 2010_000966 – submission of completed report

Dear Dr Skouteris

Our records indicate that your research project titled Promoting obesity prevention and environmental sustainability in early childhood contexts was due for completion by 31 December 2011.

The Department of Education and Early Childhood Development reminds researchers that one of the conditions of approval was the provision to the Department of a report on the research findings at the conclusion of the study. You may wish to use the template provided on our website to do this.

The Department’s online Research Register provides the project title, aim, research questions and the report. The Research Branch is keen to share findings from these projects within the Department and with the general public. Your project record indicates that you agreed to your study and report to be made visible to the public. When you send in your report, please advise if the visibility status has changed.

Please forward your report to the research mailbox quoting the Project ID 2010_000966 in the subject line.

In the future, if you wish to have any publications arising from your study included in the DEECD Research Register, please send them as PDFs to the research mailbox and quote the project ID number.

Regards
Youla

Youla Michaels | Project Officer | Education Policy and Research Division
Level 3, 33 St Andrews Place, East Melbourne VIC 3002
T: 03 9637 2707 | F: 9637 3299
E: michaels.youla.y@edumail.vic.gov.au
W: www.education.vic.gov.au

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from the use of any attached files our liability is limited to resupplying any affected attachments. Any representations or opinions expressed are those of the individual sender, and not necessarily those of the Department of Education and Early Childhood Development.

From: Helen Skouteris [mailto:helen.skouteris@deakin.edu.au]
Sent: Tuesday, 17 January 2012 10:40 PM
To: Michaels, Youla Y
Cc: Helen Skouteris
Subject: RE: 2010_000966 – submission of completed report

Dear Youla,

Happy new year!

Thank you for your email. I have attached the report as needed. I would like to ask permission to extend the permission to conduct this research until end of 2015. Together with colleagues, I am applying for an Australian Research Council Discovery grant to continue with Phase 2 and Phase 3 of the project because we ran out of funds to support these Phases. If the grant is successful it will be for three years from start of 2013 to end of 2015.

Is that okay?

Kind regards and best wishes for 2012.

Helen

---------------------------------
Helen Skouteris, PhD, MAPS
Associate Professor
School of Psychology
Deakin University
221 Burwood Highway
Burwood, Victoria 3125
Australia
Ph: 61-3-9251 7699
FAX: 61-3-9244 6858

From: "Michaels, Youla Y" <michaels.youla.y@edumail.vic.gov.au>
Date: 18 January 2012 at 9:49:45 am AEDT
To: Helen Skouteris <helen.skouteris@deakin.edu.au>
Subject: RE: 2010_000966 – submission of completed report

Dear Helen

Extension approved.

Cheers
Youla

Youla Michaels | Project Officer | Education Policy and Research Division
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Educator

Plain Language Statement

Date: March 2016
Full Project Title: Promoting healthy eating, active play and Sustainability awareness in early childhood curricula.
Researchers: Dr Helen Skouteris and Dr Leonie Rutherford (Deakin University), Dr Suzy Edwards (Australian Catholic University) and Dr Amy Cutter-Mackenzie (Southern Cross University)

1. Your Consent
You are invited to take part in this research project being conducted by researchers from Deakin University, Australian Catholic University and Southern Cross University.

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision regarding your participation.

Once you understand what the project is about and if you agree to take part, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project.
You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

2. Purpose and Background

360-degree marketing’ is the term given to the media environment that sees young children exposed to multiple forms of advertising for high calorie foods and consumable toys, clothing and products.

The overall aim of this project is to determine the best way for educators to respond to young children’s interests in digital media and to better understand how these interests influence children’s food choices, the sustainability consequences of consuming over-packaged foods and the impact of digital media on children’s play.

The researchers will provide educators with a teaching document that provides information about how to develop lessons/curriculum that help children learn more about healthy eating, activity play and sustainability; this teaching document was developed by the researchers in consultation with early childhood educators, parents and preschool children.

The specific aim of this project is to determine whether the lessons/curriculum designed by the educators, in response to the teaching document provided to them, lead to increases in children’s knowledge about healthy eating, active play and the sustainability consequences of their food and toy selections.

3. Participation in the Research Project

Your preschool/childcare centre has agreed to participate in this research.

If you agree to participate in this study, you will be randomly allocated to one of the following groups.

**Intervention group**

You will be asked to: -

- Use a strategy developed by the researchers to design a curriculum intervention that integrates content knowledge about healthy eating, active play and sustainability awareness.
- Attend an online ‘Orientation to the Project’ webinar session where you will be introduced to the strategy.
- Implement your curriculum intervention with children
- You will be provided with ‘Intervention Implementation Checklist’ and asked to record all components/elements associated with your curriculum intervention. This will include date, time, and duration of the intervention;
the number of times the intervention or iterations of the intervention were implemented and Early Years Learning Framework Learning Outcomes aligned with the intervention.

- Conduct a booster session 6 weeks after implementation of curriculum interventions, whereby children will be exposed to an abridged version of the intervention.
- Some educators will be invited at 6 months after intervention to take part in a phone interview to obtain information in relation to barriers associated with educator use of the strategy.

**Wait-list control group**

You will be asked to:

- Deliver your preschool/childcare class as normal. The children will receive the same care, teaching and learning experiences that you usually provide. You will conduct the intervention program at 7 months after the initial intervention is implemented.

You will not receive payment for participation in this study.

4. Possible benefits

Participating in the research will help us:

- Raise awareness of healthy eating, active play, and the sustainability consequences of children’s food and toy selections in early childhood educational settings.
- Create improved long-term outcomes for children’s health, wellbeing and the environment.
- Help early childhood educators develop approaches to teaching that engage with children’s digital media interests

5. Possible Risks

There are no anticipated risks involved in this research study.

6. Privacy and Confidentiality of Information

Any information obtained in connection with this research project that can identify you will remain confidential and will only be used for the purpose of this research project. It will only be disclosed with your permission, except as required by law. You can be assured that you will not be identified by name in any way in the reporting of our results in publications and conference presentations.

Any information we collect from you that can identify you, including audio-taped material, will remain confidential and will be stored in a locked cabinet within the
School of Psychology at Deakin University for a minimum of 5 years from the date of publication.

7. Information regarding Final Results of the Project

A summary of the findings will be made available to organisations that have an interest in this research, such as Australian State Departments of Education and Health and the Federal Department of Health and Ageing. The results of this research will be written as reports and publications and will be accessible on academic websites hosted by the researchers. Papers will be presented at appropriate relevant conferences.

Drs Skouteris, Rutherford, Edwards and Cutter-Mackenzie will monitor the project.

8. Right to Withdraw from Participation

Participation in any research project is voluntary. *If you do not wish to take part, you are not obliged to.* If you decide to take part and later change your mind, you are free to withdraw from the project *at any stage.* Any information obtained from you to date will not be used and will be destroyed. Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your relationship with Deakin University, Australian Catholic University or Southern Cross University in any way.

Before you make your decision, Dr Helen Skouteris will be available to answer any questions you have about the research project. You can ask for any information you need. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project, please notify Dr Helen Skouteris.

9. Contact Details and Information

If you would like any further information concerning this project or if you have any problems which may be related to your involvement in the project you can contact the principal researcher Associate Professor Helen Skouteris in the School of Psychology, Deakin University, 221 Burwood Highway, Burwood, Victoria, 3125, on 9251 7699 or

email: helen.skouteris@deakin.edu.au

10. Complaint.
If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:
The Manager, Office of Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581; researchethics@deakin.edu.au
Alternatively, you may contact:

For research in schools
Education Policy and Research Division
Division Office for Policy, Research and Innovation
Portfolio Coordination Department of Education
and Early Childhood Development
Level 3, 33 St Andrews Place
GPO Box 4367
Melbourne 3001
03 9947 1892
research@edumail.vic.gov.au
early.childhood.research@edumail.vic.gov.au

For research in early childhood settings
Research Branch
Data, Outcomes and Evaluation Division
Office for Children and Education
Department of Education
Level 1, 2 Treasury Place
GPO Box 4367
Melbourne 3001
03 9637 3629

Please quote project reference number: 2013-220.
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Educator

Consent Form- Participant Copy

Date: March 2016
Full Project Title: Promoting healthy eating, active play and sustainability
Researchers: Dr Helen Skouteris and Dr Leonie Rutherford (Deakin University), Dr Suzy Edwards (Australian Catholic University) and Dr Amy Cutter-Mackenzie (Southern Cross University)

I have read and understood the attached Plain Language Statement.

I freely agree to participate in this project, according to the conditions in the Plain Language Statement.

I have been given a copy of the Plain Language Statement and Consent Form to keep.

The researcher has agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant’s Name (Printed):
........................................................................................................ Name of Kindergarten Centre (Printed):
........................................................................................................
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Educator

Consent Form- Researcher’s Copy

Date: March 2016
Full Project Title: Promoting healthy eating, active play and sustainability awareness in early childhood curricula.

Researchers: Dr Helen Skouteris and Dr Leonie Rutherford (Deakin University), Dr Suzy Edwards (Australian Catholic University) and Dr Amy Cutter-Mackenzie (Southern Cross University)

I have read and understood the attached Plain Language Statement.
I freely agree to participate in this project according to the conditions in the Plain Language Statement.
I have been given a copy of the Plain Language Statement and Consent Form to keep.
The researcher has agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant’s Name (Printed)
.............................................................................................................................................. Name of Kindergarten Centre (Printed):
Participant’s Signature: .................................................................
Date: ........................................

Professor Helen Skouteris
School of Psychology, Deakin University
221 Burwood Highway, Burwood, Victoria, 3125
(03) 9251 7699 or email: helen.skouteris@deakin.edu.au

Please return this completed and signed consent form
TO: Educator

Revocation of Consent Form

(To be used for participants who wish to withdraw from the project)

Date: March 2016
Full Project Title: Promoting healthy eating, active play and sustainability
Researchers: Dr Helen Skouteris and Dr Leonie Rutherford (Deakin University), Dr Suzy Edwards (Australian Catholic University) and Dr Amy Cutter-Mackenzie (Southern Cross University)

I hereby wish to WITHDRAW my consent to participate in the above research project and understand that such withdrawal WILL NOT jeopardise my relationship with Deakin University, Australian Catholic University or Southern Cross University.

Participant’s Name
(Printed):........................................................................................................................................
Signature......................................................... Date
........................................................................

Please mail or fax this form to:
Professor Helen Skouteris
School of Psychology, Deakin University
221 Burwood Highway, Burwood, Victoria, 3125
Fax: (03) 9244 6858
Confidentiality Agreement

I, ________________________________ (educator’s name) from ____________________________________________________ (early childhood service) have agreed to participate in the research project titled “Promoting healthy eating, active play, and sustainability awareness in early childhood curricula: Addressing the Ben 10 problem”. I understand that participating in this project means that I am being invited to use the pedagogical statement designed for this study titled “Generating new knowledge in early childhood education: Aligning contemporary health, wellbeing and sustainability issues with research into children’s play”. I understand that this is a confidential document and agree not to share, distribute or disclose the content of this document with any other educator apart from those that are participating with me in the study.

Signature___________________________ Date

_________________________________

Email address

_________________________________
Children’s Assent Form

Hello. We are Mandy, Heather and Emily. We work at a university and we like finding out about what children your age think. .............................................. (teacher’s name) and us will be working together and we want to know if you would like to work with us too.

Please answer “yes” or “no” by circling the “happy face” or the “stop sign” under each statement.

You can help me stand on a scale and write down my weight.

![Scale]  ![Happy Face]  ![Stop Sign]
This choice is okay. Thanks. You can give the form back now.

You can measure my height and write down how tall I am.

![Height Measurement]  ![Happy Face]  ![Stop Sign]
This choice is okay. Thanks. You can give the form back now.
You can show me some pictures and ask me some questions about them. You can use a voice recorder to record my answers.

This choice is okay. Thanks. You can give the form back now.

YOUR FULL NAME:

....................................................................................................................................................

THANK YOU.
Generating New Knowledge in Early Childhood Education: Aligning Contemporary Health, Wellbeing and Sustainability Issues with Research into Children’s Play

Helen Skouteris, Deakin University
Leonie Rutherford, Deakin University
Susan Edwards, Australian Catholic University
Amy Cutter-Mackenzie, Southern Cross University
Executive Summary

Play is traditionally understood in early childhood education as a providing a vehicle for children’s learning and operates as a framework for curriculum decision-making.

Contemporary research into children’s play in social context increasingly emphasises three main areas of interest:

1] the relationship between children’s outdoor play experiences and their understandings of sustainability.

2] the impact of digital media and technologies on children’s engagement with popular culture and play-based interests.

3] reduced opportunities for outdoor and physical based play associated with more sedentary technology-based play activities.

A challenge for early childhood educators is to consider how traditional understandings of play can be aligned with contemporary research into these issues as a basis for curriculum provision in early childhood education.

This educational statement aligns these three areas of research with Learning Outcomes from the Early Years Learning Framework (DEEWR, 2009) to suggest several recommendations for further research and practice into the relationship between children’s health and wellbeing and the provision of play-based pedagogy in early childhood education.
Introduction

Children's play is commonly understood to form an important part of how early childhood educators plan learning experiences for young children. In the Australian Early Years Learning Framework (DEEWR, 2009) 'play' is described as a practice that informs what educators do with young children:

"Play provides opportunities for children to learn as they discover, create, improvise and imagine. When children play with other children they create social groups, test out ideas, challenge each other's thinking and build new understandings. Play provides a supportive environment where children can ask questions, solve problems and engage in critical thinking" (DEEWR, 2009, p. 5)

Traditional understandings of play in early childhood education value opportunities for children to explore different types of materials and experiences so they can use these to learn about the world (Wood & Attfield, 2005). This is why experiences such as water and sand play, paint, collage, block building and role play are a feature of early childhood classrooms.

Children's play is also a topic of interest to many researchers who are not usually associated with early childhood education. These researchers are interested in how children's play is influenced by the social contexts of which children are a part.

Social contexts means thinking about many aspects of children's experiences, including how their societies and communities operate economically, how people in their communities communicate, what is valued in their communities and the nature of the physical landscapes in which children live (Rogers, 2010).

---

Voices from the field

You can't let your kid go riding up and down the street because it is not safe. They might get run over. So the opportunities that we had, or have grown up with, in a lot ways, children simply don't have any more in their home environments.

I think the basic things of being able to play in a garden space and get stuff out and play with things are important.

We can help provide that environment for children when they may not get it at home simply because it is not there.
Contemporary social contexts and experiences

Research exploring how children's play is influenced by their social contexts has started to identify some aspects of children's contemporary experiences that might also be relevant to early childhood education. Amongst the most important of these is how the access some children now have to digital technologies has increased their consumption of digital media.

Digital technologies include many things such as smart phones, iPads™, computers, televisions, handheld console games and the access to the internet. Digital media includes the type of television programmes, DVDs or movies children might watch, as well as the type of games they might use on smartphones or participate in on the internet (Edwards, Henderson & Mirkhill, 2010).

Research shows that increased access to digital technologies means children are exposed to ‘360 degree marketing’ (Shor, 2004). ‘360 degree marketing’ is when children are exposed to advertising for foods, toys, clothing, technologies and other items across different forms of media that increase the chances they will want to buy and consume what is being promoted to them.

Some researchers argue that this means children's play is changing because they are influenced by what they watch on television or DVDs, and they then want to buy the toys and merchandise associated with the programmes (Langer, 2005). Such toys might have a period of limited popularity and then are discarded by children.

This raises other environmental concerns associated with a product's life cycle from-cradle-to-grave (this is from raw material extraction, administering, production, supply, consumption, repair, disposal or recycling). Other commenters are concerned that children's use of digital media reduces the opportunities they have for active outdoor experiences which constrain their experiences of the natural environment (Louv, 2005) and increases their levels of sedentary activity (Swinburn et al., 2008).

There is also concern that increased media use and ‘360 degree advertising’ exposes children to promotions for high calorie foods that can contribute to excessive weight gain (Rutherford, Brown & Bittman, 2011). This concern has implications for early childhood educators in relation to what might come into, or become a part of, the early childhood classroom. For example, children might be interested in a particular character from a television program.

They might want to role play this character in their early childhood setting. They might enjoy consuming high calorie foods (such as dairy snacks) associated with the character for their lunch. When the snack is finished the packaging it comes in needs to be disposed.

Sometimes a movie released for children becomes popular, and characters from the movie are sold as ‘figurines’ in the meal packs provided by fast food companies. Children can become interested in collecting a series of these figurines which can become unwanted once the movie is no longer popular, or the fast food company stops that particular promotion and starts a new one.

For children, families and educators this can raise important questions. For example, what happens to all the food packaging and plastic toys? And what are the implications of the waste for environmental sustainability?

Environmental sustainability, childhood obesity and digital technologies/literacy are issues of contemporary concern that are increasingly relevant for early childhood education. However, a difficulty for early childhood educators is how children's experiences and interests in their social context can be related to play and play-based learning in early childhood education. This is because a core feature of early childhood education is about helping young children to engage with and make sense of their social settings.

You can read some comments educators have made about what these contemporary issues mean for early childhood education in the boxes called 'Voices from the field'.

**Voices from the field**

You know there’s the one child who has got the Ben10™ body on the t-shirt and it only takes one child. So nobody could be wearing; they could be wearing their polar fleece at kinder, but the one kid will go ‘check it out, my single’ and this starts the play off.

So even if you don’t project that suggestion [that they could play Ben10™], the play will turn because I think, I always think the boys are out there, you’ve got to be challenging them all the time or they’re at a loss.

The play will stop all of a sudden and they’ll just transfer to Ben10™. We have all these children that would have the Ben10™ yoghurt and they probably have the apple puree, and they have BBQ Shapes™ (savoury biscuits). We always say ‘we make the healthy choice first, where’s the fruit with the skin? So they pull it out and eat that and go ‘can I eat the Shapes now’?
Integrating environmental education, obesity prevention and digital technologies in early childhood education

Early childhood educators need to make decisions about what they believe and value about children’s play (Yelland, Lee, O’Rourke & Harrison, 2008).

Some educators will believe that early childhood education should be a place where children can have play experiences that are free from the influence of digital media and digital technologies. They might believe that early childhood education provides children with opportunities for lots of outdoor play that helps them to experience the environment and have lots of physical exercise.

Other educators might believe that the play experiences children have in their homes and communities should be explored in the early childhood classroom. They might see educational opportunities if asking children why they like to play Ben 10™, or wear Ben™ clothes and what they think happens to the packaging of their Ben 10™ yoghurt.

Each of these approaches would have educational value for young children. The first approach would relate to a more traditional understanding of children’s play in early childhood education. The second approach would connect with understandings coming from contemporary research into children’s play and include knowledge that comes out of three main areas of research, including environmental education, childhood obesity and digital technologies/literacy (Edwards, Skouteris, Rutherford & Cutter-Mackenzie, 2012).

The strong connections these research areas have to three of the EYLF Learning Outcomes are very useful because educators can use these to think critically about children’s play and possibly integrate the three areas of research within the curriculum (Figure 1.0).

**Voices from the field**

I had some children bring in some Spiderman toys a couple of years ago and once upon a time I would have said ‘put it in your bag’.

I was in a very different space then and so by this time I was able to say ‘Ok, great, so you like Spiderman, how does he move?’ and started this whole conversation and by the end of the term they had made Spiderman masks, they had made him clay, they had painted him, they had done every single possible thing you could think of, or not think of, because they came up with amazing ideas about Spiderman.

It was really eye opening to me to see how limited I had been and when we just opened the door and allowed things to occur, what could happen.
Integrating environmental education, obesity prevention and digital technologies in early childhood education

For example, if children are interested in a particular character such as Ben10™ teachers can use the Communication learning outcome to explore episodes of the program as a text. They could then consider the many ways their interest in Ben10™ might be expressed. This could lead teachers to investigate the types of toys and products associated with Ben10™ and to think about the raw materials that make up the products, where the products are manufactured and what happens to them when they are no longer interested in the toys. This would relate to Learning Outcome 2 Children are connected with and contribute to their world.

From here opportunities might be provided for reflecting on why characters appear on the packaging of children’s food and the health value of the foods promoted by the character. This would connect with Learning Outcome 3 Children have a strong sense of wellbeing.

These experiences would not have to reduce the level of enjoyment children experience in relation to the program, the character or their use of the digital media. Rather, their interest could be used to build their understandings of their social context and their role as participants in that social context, particularly where this relates to their own health and wellbeing, and that of the local environments in which they live (Skouteris, et al., 2010).
Linking contemporary issues to the learning outcomes from the Early Years Learning Framework

As noted, each of these three areas of research aligns with a Learning Outcome from the Early Years Learning Framework (EYLF):

1. **Environmental education**
   Learning Outcome 2 Children are connected with and contribute to their world

   Environmental education in early childhood focuses on the development of young children's knowledge, beliefs, values and dispositions about the environment, including the natural environment.

   It is considered important that young children learn to value and respect the natural world and the relationship between human and other-than-human worlds (Elliot, 2010). This is because understanding and valuing the environment helps children realise the importance of living in a sustainable way in their own lives (Pearson & Degotardi, 2009).

   It is also important that children learn to think about sustainability so that the environment can continue to support people now and into the future.

   Some sub-outcomes associated with these ideas that appear in Learning Outcome 2 Children are connected with and contribute to their world include:

   - Children broaden their understanding of the world in which they live
   - Children express an opinion in matters that affect them
   - Children demonstrate an increasing knowledge of and respect for natural and constructed environments
   - Children explore, infer, predict and hypothesise in order to develop an increased understanding of the interdependence between land, people, plants and animals
   - Children show growing appreciation and care for natural and constructed environments
   - Children explore relationships with other living and non-living things and observe, notice and respond to change

   Environmental education is also referenced in the 'Learning Environments' section of the EYLF as an aspect of practice, emphasizing the uniquely Australian learning environment for young children as a platform for ongoing environmental education (DEEWR, 2009, p. 5).

   In combination with the EYLF, the Australian Curriculum (ACARA, 2011) positions sustainability as a cross-curriculum priority area with the core intent of all young Australians developing 'an appreciation of the need for more sustainable patterns of living, and to build the capacities for thinking and acting that are necessary to create a more sustainable future' (http://www.acara.edu.au/curriculum/cross_curriculum_priorities.html).

2. **Childhood obesity**
   Learning Outcome 3 Children have a strong sense of wellbeing

   Childhood obesity in early childhood education focuses on understanding how children's health and wellbeing can be most effectively supported.

   Research shows that childhood obesity is on the rise in Australia (Wake et al., 2007). There is no single cause of overweight or obesity in young children. Obesity is a complex health issue that results from a combination of genetic, environmental and social influences on children's lives (Robinson, 2010).

   Early childhood education is an important site for children's learning about their physical wellbeing because it can promote opportunities for eating nutrient rich foods and increase children's exposure to physical activity.

   Early childhood education also provides opportunities for children to talk and learn about factors that help them to stay healthy, such as partaking in physical activity, trying to limit their consumption of high calorie foods and reducing sedentary activities, such as watching too much television.
Linking contemporary issues to the learning outcomes from the Early Years Learning Framework

Some sub-outcomes associated with these ideas that appear in Learning Outcome 5 Children are effective communicators, include:

- Children view and listen to printed, visual and multimedia texts and respond with relevant gestures, actions, comments and/or questions;
- Children explore texts from a range of different perspectives and begin to analyse the meanings;
- Children activity use, engage with and share the enjoyment of language and texts in a range of ways; and
- Children recognise and engage with written and oral culturally constructed texts (DEEWR, 2009, p. 41).

The Shaping Paper for the national Technologies curriculum is currently under development by the ACARA. The positioning on childhood obesity in this document is still to be determined. How this will connect with Learning Outcome 3 Children have a strong sense of wellbeing is also still to be determined.

3. Digital technologies and literacy

Learning Outcome 5 Children are effective communicators

Digital technologies and digital literacy in early childhood education focuses on young children’s uses of technologies and their developing understandings about how they use technologies.

Technologies are considered a common experience for young children.

Many people assume that because young children are used to technologies that they know how to use them in a productive way. Research shows that this is not the case and that young children need to be taught how to use technologies in appropriate ways (Selwyn, 2009).

This includes thinking about where digital media comes from and why digital media might promote particular messages (Montgomery & Gottlieb-Robles, 2006). This type of thinking is what contributes to young children being digitally literate (Hobbs, 2011).

Some sub-outcomes associated with these ideas that appear in Learning Outcome 3 Children have a strong sense of wellbeing, include:

- Children engage in increasingly complex sensory motor skills and movement patterns
- Children combine gross and fine motor movement and balance to achieve increasingly complex patterns of activity including dance, creative movement and drama
- Children show an increasing awareness of healthy lifestyles and good nutrition
- Children show enthusiasm for participating in physical play and negotiate play spaces to ensure the safety and wellbeing of others (DEEWR, 2009, p. 32).

The Health and Physical Education national curriculum is currently under development by the ACARA. The positioning on childhood obesity in this document is still to be determined. How this will connect with Learning Outcome 3 Children have a strong sense of wellbeing is also still to be determined.

Recommendations for research and practice

- Raise awareness of childhood obesity, digital technologies /literacies, and environmental sustainability issues among teachers and parents.
- Facilitate teachers’ critical reflection on links between EYLF and pedagogy in relation to these issues.
- Build models of best practice demonstrating interdisciplinary approaches to addressing these issues and their areas of research in early childhood.
- Create improved long term outcomes for children’s health and well being and the environment.
Further reading

If you are interested in learning more about environmental education, obesity prevention and/or digital technologies and literacies and how they integrate in early childhood education you may find the following readings useful:


References


Study 1 Child Interview and Data Recording Sheet

Childcare service:  
Group: Participant:  
Height:  
Weight:  
BMI:  

SEMI-STRUCTURED INTERVIEW QUESTIONS FOR CHILDREN

1. Let’s look at these pictures – what can you tell me about these foods (unhealthy)

2. Let’s look at these pictures – what can you tell me about these foods (healthy)

3. Let’s look at these pictures – what can you tell me about what these children are doing (sedentary)

4. Let’s look at these pictures – what can you tell me about what these children are doing (active play)

5. Let’s look at these pictures – do you think these things will turn into soil if they were buried (compostable items)
6. Let’s look at these pictures – do you think these things will turn into soil if they were buried (non-compostable items, i.e. plastic toys)

7. Let’s look at these pictures – which things do you think you could put into the recycle bin?
Study 1 Interview Images

Question 1:
Question 2
Question 3
Question 4
Question 5
Question 6
Question 7
Study 2 Interview Images
CHILDREN'S INTERVIEW

Exercise 1: Sorting images

We are going to have a look at some pictures now.
Would you put this picture with green (go/do that) or red (stop/don’t do that)?

Record responses:
Green       Red

Exercise 2: Example Connection circle

Example: Which of these three pictures belong together (cup/milk/clock)
Circle response:       Correct       Incorrect

Exercise 3: Connection circle

Let’s use our other pictures again.
Do any of these pictures belong together? Why do they belong together?

Record responses
Eating and Physical Activity Questionnaire with Demographic Questions

PROMOTING HEALTHY EATING, ACTIVE PLAY AND SUSTAINABILITY AWARENESS IN EARLY CHILDHOOD CURRICULA - T1

Please complete the following questions relating to your family.
Thank you.

TODAY’S DATE: __/__/___  PARTICIPANT ID: ________________

Child’s Details (Please respond for your child currently attending Four Year Old Kindergarten)

Gender:  Male ☐  Female ☐

Date of Birth: __/__/___  Country of Birth: _______________________

Number of siblings: ______  Birth order: _____________ (eg. Youngest, Oldest, 2nd, 3rd, etc.)

Mother’s Details

Age: ______ (years)  Country of Birth: _______________________

Please tick highest level of education
☐ High School – Year ___
☐ Vocational/Technical School
☐ University  ☐ Bachelor’s Degree
☐ Master’s Degree
☐ Doctoral Degree
☐ Other __________________
Weight: ______ (kg’s)  Height: ______ (cm’s) If you do not know exactly, please make a “best” estimate.

Father’s Details

Age: ______ (years)  Country of Birth: __________________________

Please tick highest level of education  □ High School – Year ___
□ Vocational/Technical School
□ University  □ Bachelor’s Degree
□ Master’s Degree
□ Doctoral Degree
□ Other __________________________

Weight: ______ (kg’s)  Height: ______ (cm’s) If you do not know exactly, please make a “best” estimate.

Family Income

Please indicate your approximate annual family income: (Please circle one)

(1) Under $25,000  (2) $25,001- $45,000  (3) $45,001- $65,000
(4) $65,001- $85,000  (5) $85,001- $105,000  (6) $105,001- $125,000
(7) $125,001- $145,000  (8) Over $145,001

Any information obtained in connection with this research project that can identify your family or your child will remain confidential and will only be used for the purpose of this research project. It will only be disclosed with your permission, except as required by law. You can be assured that your family and your child will not be identified by name in any way in the reporting of our results in publications and conference presentations.
EATING AND PHYSICAL ACTIVITY QUESTIONNAIRE- T1

The following questions must be answered in relation to your child’s behaviour. Please circle what day it was yesterday. To indicate your response to each question, please tick the appropriate box, or write your responses in the space provided.

Please circle what day it was yesterday:  Mon  Tue  Wed  Thur  Fri  Sat  Sun

1. Yesterday, how long did your child watch TV/videos/DVD or play computer- or video-games at home (or a friend’s or relative’s home)?
   Morning       _______ hrs __ mins  ☐ Don’t know
   Afternoon     ___ hrs ___ mins  ☐ Don’t know
   Evening (after 6pm)     ___ hrs ___ mins  ☐ Don’t know

2. Last week, how many times did you go with your child to a playground, park, swimming pool, or other place for physical activity?
   ____________ times last week

3. What does your child usually do when he/she has a choice about how to spend free time? (Please tick one response)
   ☐ Usually choose inactive pastimes (i.e. TV, computer, drawing or reading)
   ☐ Just as likely to choose inactive as active pastimes
   ☐ Usually choose active pastimes (i.e. outdoor play, dancing, sports)
4a. **Yesterday,** how many servings of the following beverages did your child drink? (Please refer to serving size guide for examples)

<table>
<thead>
<tr>
<th>Fruit juice</th>
<th>Cordial or Soft drink</th>
<th>Water</th>
<th>Plain milk</th>
<th>Flavoured milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ none</td>
<td>□ none</td>
<td>□ none</td>
<td>□ none</td>
<td>□ none</td>
</tr>
<tr>
<td>□ 1</td>
<td>□ 1</td>
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<tr>
<td>□ 6 or more</td>
<td>□ 6 or more</td>
<td>□ 6 or more</td>
<td>□ 6 or more</td>
<td>□ 6 or more</td>
</tr>
<tr>
<td>□ Don’t know □ Don’t know</td>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
<td></td>
</tr>
</tbody>
</table>

4b. Do you usually dilute any of these beverages when your child drinks them?

<table>
<thead>
<tr>
<th>Fruit juice</th>
<th>Cordial or Soft drink</th>
<th>Water</th>
<th>Plain milk</th>
<th>Flavoured milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ no</td>
<td>□ no</td>
<td>□ no</td>
<td>□ no</td>
<td>□ no</td>
</tr>
</tbody>
</table>

5. **Yesterday,** how many servings of the following foods did **your child** have? (Please refer to serving size guide for examples)

<table>
<thead>
<tr>
<th>Vegetables (cooked &amp; raw veg and baked beans)</th>
<th>Packaged snacks (chips, cheezels, muesli bar)</th>
<th>Fruit (fresh, dried and tinned)</th>
<th>Confectionery and/or chocolate</th>
<th>Cake/ doughnuts, sweet biscuits and muffins</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Sample Serve = □ None</td>
<td>□ None</td>
<td>□ None</td>
<td>□ None</td>
<td>□ None</td>
</tr>
<tr>
<td>□ 1/2</td>
<td>□ 1/2</td>
<td>□ 1/2</td>
<td>□ 1/2</td>
<td>□ 1/2</td>
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<tr>
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<tr>
<td>□ 5 or more</td>
<td>□ 5 or more</td>
<td>□ 5 or more</td>
<td>□ 5 or more</td>
<td>□ 5 or more</td>
</tr>
<tr>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
<td>□ Don’t know</td>
</tr>
</tbody>
</table>
6. How many serves of vegetables does your child usually eat each day? (“a serve” = ½ cup cooked vegetables, or 1 cup salad vegetables)

_________________________ serves each day

7. How often do you eat takeaway or fast-food? (e.g. Hot chips, hamburgers, chicken nuggets, sausage rolls, hot dogs, pizza)

☐ Less than once per month
☐ 1 – 3 times per month
☐ Once per week
☐ 2 – 4 times per week
☐ 5 – 6 times per week
☐ Once per day
☐ 2 or more times per day

THANK YOU FOR YOUR PARTICIPATION
Study 1 Educator Intervention Checklist

Promoting healthy eating, active play and sustainability awareness in early childhood curricula: Addressing the Ben 10™ problem

Intervention Implementation Checklist:

Kindergarten:

Educator:

<table>
<thead>
<tr>
<th>Week of intervention implementation (eg. week 1):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Implementation Frequency over that week (eg. 2 times):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time and duration of the intervention (eg. 10:30 am for 15 minutes):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>No of children involved:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Props/resources used:</th>
</tr>
</thead>
</table>
Assessment Records Used:

Early Years Learning Framework Learning Outcomes Aligned with the Intervention:
Study 1 Focus Group Interview Questions for Educators

PROMOTING HEALTHY EATING,
ACTIVE PLAY AND SUSTAINABILITY
AWARENESS IN EARLY CHILDHOOD
CURRICULA

SEMI-STRUCTURED INTERVIEW QUESTIONS FOR TEACHERS

1. What elements of the pedagogical communication strategy did you find useful when designing your curriculum intervention?

2. Do you think the pedagogical communication strategy is a document that other teachers would find helpful for informing practice? Why/why not?

3. What improvements do you think need to be made to the pedagogical communication strategy to make it user friendly for teachers?
Study 2 Interview Questions for Educators

Development of interventions

1. Can you describe what you did for your curriculum intervention?
2. What content knowledge do you think you covered in your curriculum intervention?
3. How did you decide to approach the development of your curriculum intervention?
4. What pedagogical approach did you take to planning the curriculum interventions (e.g. play-types used)?

Teaching and learning associated with interventions

5. What were your aims for the children’s learning when developing your curriculum interventions?
6. On a scale of one to ten how would you rate the children’s levels of engagement with the curriculum interventions you developed?

<table>
<thead>
<tr>
<th>Not at all engaged</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Extremely engaged</th>
</tr>
</thead>
</table>

1. On a scale of one to ten how would you rate the children's understanding of the content embedded in your curriculum?

<table>
<thead>
<tr>
<th>Did not understand</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Understood everything</th>
</tr>
</thead>
</table>

Relationship of interventions to curriculum programming and planning

1. How did the curriculum interventions relate to your normal programming and planning?
2. Do you think the content you covered in your curriculum interventions represents a valuable aspect of what
children should learn at kindergarten?

3. How do you think parents responded to the curriculum interventions? Did you receive any feedback from parents? What did you observe?

Professional learning

4. In your opinion what are the benefits and issues associated with developing a curriculum intervention like the one you designed?

5. How useful was the pedagogical communication strategy and the book about environmental education that you received for helping you develop the curriculum interventions?

6. Did you have any reservations about running the curriculum interventions prior to it starting in your centre? If so, what were these? Now that the intervention is finished what your perspective on the experience?

7. How was your experience of the professional learning sessions and workshops? Please explain what was useful and identify what requires more attention?

8. In your opinion was there sufficient staff resourcing and other funding to support the curriculum intervention? Should more resources be added to make it more effective?

Other

9. An additional feedback or comments? Anything not covered that you would like to add?
APPENDIX E — Supplementary materials for Chapter 6

CONSORT 2010 checklist of information to include when reporting a randomised trial

<table>
<thead>
<tr>
<th>Section/Topic</th>
<th>Item No</th>
<th>Checklist item</th>
<th>Reported on page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title and abstract</td>
<td>1a</td>
<td>Identification as a randomised trial in the title</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)</td>
<td>2</td>
</tr>
<tr>
<td>Introduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2a</td>
<td>Scientific background and explanation of rationale</td>
<td>3-7</td>
</tr>
<tr>
<td></td>
<td>2b</td>
<td>Specific objectives or hypotheses</td>
<td>9</td>
</tr>
<tr>
<td>Methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial design</td>
<td>3a</td>
<td>Description of trial design (such as parallel, factorial) including allocation ratio</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3b</td>
<td>Important changes to methods after trial commencement (such as eligibility criteria), with reasons</td>
<td>N/A</td>
</tr>
<tr>
<td>Participants</td>
<td>4a</td>
<td>Eligibility criteria for participants</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>4b</td>
<td>Settings and locations where the data were collected</td>
<td>10,12</td>
</tr>
<tr>
<td>Interventions</td>
<td>5</td>
<td>The interventions for each group with sufficient details to allow replication, including how and when they were actually administered</td>
<td>9,11</td>
</tr>
<tr>
<td>Outcomes</td>
<td>6a</td>
<td>Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6b</td>
<td>Any changes to trial outcomes after the trial commenced, with reasons</td>
<td>N/A</td>
</tr>
<tr>
<td>Sample size</td>
<td>7a</td>
<td>How sample size was determined</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>7b</td>
<td>When applicable, explanation of any interim analyses and stopping guidelines</td>
<td>N/A</td>
</tr>
<tr>
<td>Randomisation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequence generation</td>
<td>8a</td>
<td>Method used to generate the random allocation sequence</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>8b</td>
<td>Type of randomisation; details of any restriction (such as blocking and block size)</td>
<td>10</td>
</tr>
<tr>
<td>Allocation</td>
<td>9</td>
<td>Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned</td>
<td>10</td>
</tr>
<tr>
<td>Concealment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>10</td>
<td>Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions</td>
<td>10</td>
</tr>
<tr>
<td>Blinding</td>
<td>11a</td>
<td>If done, who was blinded after assignment to interventions (for example, participants, care providers, those</td>
<td>10</td>
</tr>
<tr>
<td>Assessment</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11b</td>
<td>If relevant, description of the similarity of interventions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12a</td>
<td>Statistical methods used to compare groups for primary and secondary outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12b</td>
<td>Methods for additional analyses, such as subgroup analyses and adjusted analyses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Results**

<table>
<thead>
<tr>
<th>Participant flow (a diagram is strongly recommended)</th>
<th>For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>13b</td>
<td>For each group, losses and exclusions after randomisation, together with reasons</td>
</tr>
<tr>
<td>Recruitment</td>
<td>Dates defining the periods of recruitment and follow-up</td>
</tr>
<tr>
<td>14b</td>
<td>Why the trial ended or was stopped</td>
</tr>
<tr>
<td>Baseline data</td>
<td>A table showing baseline demographic and clinical characteristics for each group</td>
</tr>
<tr>
<td>Numbers analysed</td>
<td>For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups</td>
</tr>
<tr>
<td>Outcomes and estimation</td>
<td>For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)</td>
</tr>
<tr>
<td>17b</td>
<td>For binary outcomes, presentation of both absolute and relative effect sizes is recommended</td>
</tr>
<tr>
<td>Ancillary analyses</td>
<td>Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory</td>
</tr>
<tr>
<td>Harms</td>
<td>All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)</td>
</tr>
</tbody>
</table>

**Discussion**

| Limitations | Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses |
| Generalisability | Generalisability (external validity, applicability) of the trial findings |
| Interpretation | Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence |

**Other Information**

| Registration | Registration number and name of trial registry |
| Protocol | Where the full trial protocol can be accessed, if available |
| Funding | Sources of funding and other support (such as supply of drugs), role of funders |

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*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials.

Add additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see [www.consort-statement.org](http://www.consort-statement.org).*
## APPENDIX F — Supplementary Materials for Chapter 8

### Table 5 Articles excluded articles with reasons

<table>
<thead>
<tr>
<th>Reference</th>
<th>Reason for exclusion</th>
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</thead>
<tbody>
<tr>
<td>Study</td>
<td>Abstract/Summary</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Study</td>
<td>Methodology</td>
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<td>---------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Author(s)</td>
<td>Component</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
Full Electronic search strategy for Medline

Limiters: January 2000- August 2014, scholarly (peer reviewed) journals, English language, not clinic based

Key words

1. Preschool or pre school or pre-school
2. Long day care
3. Childcare or child care
4. Kindergarten
5. Parents
6. Caregivers or care givers
7. Overweight or over weight
8. Obese
9. Obesity
10. Adiposity
11. Early childhood education
12. Nursery
13. Intervent*
14. Prevent*

1. 1 and 7 and 8 and 13
2. 1 and 7 and 8 and 14
3. 1 and 9 and 14
4. 1 and 9 and 13
5. 2 and 7 and 8 and 13
6. 2 and 7 and 8 and 14
7. 2 and 9 and 13
8. 2 and 9 and 14
9. 3 and 7 and 8 and 13
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29. 12 and 7 and 8 and 13
30. 12 and 7 and 8 and 14
31. 1 and 10 and 13 and 14
32. 2 and 10 and 13 and 14
33. 3 and 10 and 13 and 14
34. 4 and 10 and 13 and 14
APPENDIX G — Supplementary Materials for Chapter 9