

An exploration of young children's motivational processes within physical education

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**A thesis submitted in partial fulfilment of the requirement of Liverpool John Moores
University for the degree of Doctor of Philosophy**

October 2020

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List of Abbreviations

Abbreviation	Definition
AGT	Achievement Goal Theory
AMS	Academic Motivation Scale
BMI	Body Mass Index
BPN	Basic Psychological Needs
BPNS	Basic Psychological Needs Satisfaction
BPNT	Basic Psychological Needs Theory
CAIMI	The Children's Academic Intrinsic Motivation Inventory
COG	Cognition
COSMIN	Consensus-based Standards for the selection of health status Measurement INstruments
DMA	Divergent Movement Assessment
ERG	Existence, Relatedness and Growth
ESMS	Elementary School Motivation Scale
FMS	Fundamental Movement Skills
HMIEM	Hierarchical Model of Intrinsic and Extrinsic Motivation
HR-PRO	Health-Related Patient-Reported Outcomes
ICC	Intraclass Correlation Coefficients
IOTF	International Obesity Task Force
IQR	Interquartile Range
LP	Linear Pedagogy
MAR	Missing At Random
MAT-PE	The Motivation Assessment Tool for Physical Education
MC	Motor Creativity
MCAR	Missing Completely At Random
MI	Multiple Imputations
MMCOS	Multidimensional Motivational Climate Observation System
MNAR	Missing Not At Random
MVPA	Moderate to Vigorous Physical Activity
NA	Not Applicable
NLP	Nonlinear Pedagogy
OIT	Organismic Integration Theory
PA	Physical Activity

Abbreviation	Definition
PACES	Physical Activity Enjoyment Scale
PE	Physical Education
PMC	Perceived Motor Competence
PROM	Patient-Reported Outcome Measure
RCT	Randomised Controlled Trial
SAMPLE-PE	Skill Acquisition Methods Fostering Physical Literacy in Early-Physical Education
SDT	Self-Determination Theory
SEN	Special Educational Needs
SES	Socio-Economic Status
SPSS	Statistical Package for the Social Sciences
SRQ-A	Self-Regulation Questionnaire-Academic
STEP	Space, Task, Equipment, and People
TARGET	Task, Authority, Recognition, Grouping, Evaluation, Time
TGMD-2	Test of Gross Motor Development – 2 nd Edition
TGMD-3	Test of Gross Motor Development – 3 rd Edition
UK	United Kingdom
USA	United States of America
VAS	Visual Analogue Scale

Glossary of Terms

Term	Definition
Adolescence	Within this thesis, “adolescence” refers to ages defined by the articles that use it. For example, one article includes 10-year-olds as the youngest adolescent age, whereas another includes 13-year-olds as the youngest in the adolescent range. The World Health Organisation defined adolescent age as between 10 and 19 years.
Environmental dimensions	This term refers to the second level of the hierarchy within the Multidimensional Motivation Climate Observation System. They are either empowering (autonomy-supportive, relatedness supportive, task-involving, structure) or disempowering (controlling, relatedness thwarting, ego-involving).
Key stage 1	Key stages are defined as “ <i>The national curriculum is organised into blocks of years called ‘key stages’ (KS). At the end of each key stage, the teacher will formally assess your child’s performance</i> ” (Gov.uk, n.d.) Key stage 1 comes after the Early Years (ages 3 to 5) and includes children aged 5 to 7 separated into Years 1 and 2.
Mastery	Defined as “displaying correct performance on all components of a fundamental motor skill” (Booth et al., 1999).
Motivation	The drive behind any behaviour.
Older children	Within this thesis, the term “older children” refers to children above the age of eight and still within primary school (i.e., maximum age of 11 years).
Parent/guardian	The biological or primary caregiver for a child.
Physical activity	Defined as “ <i>any bodily movement produced by skeletal muscles resulting in energy expenditure</i> ” (Caspersen, Powell & Christenson, 1985, p.126).
Physical Education	Defined as “ <i>A high-quality physical education curriculum inspires all pupils to succeed and excel in competitive sport and other physically-demanding activities. It should provide opportunities for pupils to become physically confident in a way which supports their health and fitness. Opportunities to compete in sport and other activities build character and help to embed values such as fairness and respect.</i> ” (Department of Education, 2013).
Primary school	“In England, primary schools generally cater for 4-11-year olds.” (Gov.uk, n.d.).
Self-determined motivation	Within this thesis, this term refers to the motivational profile of children based on the behavioural regulations they choose. I.e., their motivation is either mostly autonomous (highly self-determined) or controlled (lowly self-determined).
Young children	Within this thesis, the term “young children” is used to refer to children between the ages of five and seven.

Abstract

Self-Determination Theory (SDT) distinguishes between different types of motivation based on the reasons for engaging in a particular behaviour. Engaging in Physical Education (PE) leads to many positive physical, social, cognitive, and affective outcomes. Children's motivation within PE starts to decline from the age of eight years. However, it is unknown whether this decline in motivation occurs earlier due to a lack of motivation tools. Understanding younger children's motivation for PE may give researchers crucial insights into how best to support their motivation. Therefore, an exploration was conducted, through three studies, of younger children's basic psychological needs satisfaction (BPNS), self-determined motivation, and enjoyment for PE, as well as an investigation into motivational climates within PE.

Study 1 developed a novel mixed-method tool, underpinned by SDT for five to six-year-old children. The tool's novelty lies in its mixed-method approach, which contained interactive, age-appropriate activities, where previous motivation tools have either been quantitative or qualitative. To produce motivational profiles, a codebook was developed to mix the quantitative and qualitative strands of the transcript data produced by the tool. The tool demonstrated good content validity, and the codebook was judged to have good content validity, acceptability, and excellent reliability. **Study 2** presented the motivational profiles of 5- to 6-year-old children captured by the tool in Study 1 and investigated whether BPNS and behavioural regulation were important for different forms of movement in this young age group. Movement is a key aspect of young children's development; therefore, it was important to develop a tool which could assess the different aspects of young children's motivation in order to investigate whether motivation is important for movement development. Five to six-year-old children (n=78) reported high enjoyment of PE, high relatedness and competence need satisfaction, and moderate autonomy need satisfaction. The children had moderate to high autonomous motivation, low to moderate controlled motivation, and very low amotivation. Autonomy need satisfaction negatively and significantly predicted motor proficiency and identified regulation positively and significantly predicted MVPA. **Study 3** had three aims, to explore: 1) the extent to which each intervention group were empowering and disempowering (higher-order), 2) the potential differences between intervention groups in empowering and disempowering domains (lower-order), 3) the potential differences between intervention groups in autonomy, relatedness, and competence need satisfaction, as well as enjoyment. Each intervention group demonstrated highly empowering and low disempowering motivational climates (higher-order); however, the control and Linear groups (LP) were significantly more disempowering than the Nonlinear group (NLP). When looking at the motivational climate domains (lower-order), autonomy support was significantly higher in the NLP and structure was significantly higher in the LP. Children in the NLP and LP groups reported significantly higher autonomy need satisfaction and children in the control group reported significantly higher relatedness need satisfaction.

These studies demonstrate that working with young children can offer essential insights into young children's motivational perceptions for PE, which can help inform future intervention studies and teaching practice. These studies also demonstrate

that PE within this age group is mostly empowering; however, practitioners should be mindful of their pedagogical practices for long-term use. In combination, these studies offer important insights regarding policy, research, and practice within PE.

Declaration

I declare that the work contained within this thesis is my own.

Communications resulting from this PhD work:

Publications

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. (under review). Development, content validity and utility of the motivation assessment tool for physical education (MAT-PE) among young children. *Psychology of Sport and Exercise*.

Conference presentations (oral)

Fitton Davies, K., Foweather, L., Roberts, S., Utesch, T., Bardid, F., Watson, P. M., Button, C., Lubans, D., Pesce, C., Crotti, M., O'Callaghan, L., & Rudd, J. R. Exploring the effects of a pedagogical intervention upon psychological factors in 5-7-year-old children. Healthy & Active Kids, 14/09/2019, Verona, Italy.

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development, face and content validity of a novel qualitative tool to measure young children's motivation for physical education. European Congress for Sport Psychology, 17/07/2019, Münster, Germany.

Fitton Davies, K., Foweather, L., Roberts, S., & Rudd, J. R. Physical education pedagogy and self-determination theory. Power of Sport Conference, 11/05/2019, Liverpool John Moores University.

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development of a qualitative methodology to examine self-determination in 5-7-year-old children. Power of Sport Conference, 10/05/2018, Liverpool John Moores University.

Conference presentations (poster)

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development, face and content validity of a novel qualitative tool to measure young children's motivation for physical education. European Congress for Sport Psychology, 17/07/2019, Münster, Germany. [Young Researcher Award, 1st prize]

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development, face and content validity of a novel qualitative method to measure young children's motivation for physical education: draw, write, show

and tell. Centre of Self-Determination Theory Conference, 15/05/2019, Amsterdam, Netherlands.

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development of a qualitative methodology to examine self-determination in 5-7-year-old children. Research and Innovation Conference, 12/04/2018, Liverpool John Moores University. [1st prize poster award]

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development of a qualitative methodology to examine self-determination in 5-7-year-old children. Education, Health and Community Faculty Conference, 09/04/2018, Liverpool John Moores University. [1st prize poster award]

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development of a qualitative methodology to examine self-determination in 5-7-year-old children. Institute for Health Research Conference, 12/03/2018, Liverpool John Moores University.

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. Development of a qualitative methodology to examine self-determination in 5-7-year-old children. Women in Research Conference, 08/03/2018

Other publications

Rudd, J. R., Crotti, M., **Fitton-Davies, K.**, O'Callaghan, L., Bardid, F., Utesch, T., ... & Foulkes, J. (2020). Skill Acquisition Methods Fostering Physical Literacy in Early-Physical Education (SAMPLE-PE): Rationale and Study Protocol for a Cluster Randomized Controlled Trial in 5–6-Year-Old Children from Deprived Areas of North West England. *Frontiers in Psychology*, 11, 1228. <https://doi.org/10.3389/fpsyg.2020.01228>

Whitehead, A. E., Umeh, F. K., Brockett, C., Westerbeek, H., Powling, E., **Fitton Davies, K.**, & Rudd, J. (2020). Motivational differences between 5K, half marathon and full marathon participants in the UK and India. *Managing Sport and Leisure*. <https://doi.org/10.1080/23750472.2020.1791236>

Crotti, M., Rudd, J. R., Roberts, S., Boddy, L. M., **Fitton Davies, K.**, O'Callaghan, L., Utesch, T., & Foweather, L. (2021). Effect of linear and nonlinear pedagogy physical education interventions on children's physical activity: a cluster randomized controlled trial (SAMPLE-PE). *Children*. 8, 49. <https://doi.org/10.3390/children8010049>

Awards

Young Researchers in Sport and Exercise Psychology in Europe

First prize poster award for the poster titled, "Development, face and content validity of a novel qualitative tool to measure young children's motivation for physical education."

Acknowledgements

Firstly, to my supervisory team Dr James Rudd, Dr Lawrence Foweather, and Dr Simon Roberts, and my advisory team Dr Paula Watson, Dr Farid Bardid and Professor Zoe Knowles; Thank you for being unendingly supportive and patient on a personal and professional level. I have really enjoyed learning from you, and I hope that we can work together in future. I would also like to thank Dr James Rudd for putting together such a fantastic SAMPLE-PE team. Without Laura O'Callaghan, Matteo Crotti and Rachael Grace, the project would not have worked as well, and I would not have had as much fun. We have developed and grown together through this journey, and I am unbelievably happy I could share this experience with you. Thanks also to our international undergraduate and postgraduate students who joined us along the way, Aina Cid Centelles, Sebastian Schwarz, Michelle Gorlani, and Frederike Marie Stell whom I have immensely enjoyed working with during the last three years. I was also fortunate to share an office with Dr Tony Cliffe, Victoria Brennan, Laura Quayle, and Rosie Jewitt-Beck who were an amazing source of strength, support, and hijinks during the first couple of years of my PhD. I hope that we stay friends even though our respective journeys have taken us to different places.

To my amazing boyfriend, Daniel Dogan, thank you for being my rock throughout this period. You made me believe I could do it when I did not. You have supported me and been by my side at every step, and I am eternally grateful for your love, support, and patience.

To my sister, Amy Fitton Davies, without you, there would not be resources for the motivational tool within this thesis. Thank you for the time, effort, and hard work you put in towards developing and creating these images.

Finally, I dedicate this thesis to my parents, Nicola and Simon Fitton Davies. Thank you for supporting me, no matter what. You both have inspired me in so many ways and have helped me be the person I am today. I would not have been able to take on this challenge without the eternal encouragement towards learning and the fostering of an intrinsic love for movement through gymnastics and dance. You have instilled resilience and determination in me for which I am immensely grateful.

Chapter 1

Introduction

Context of the thesis

Physical education

Positive early learning experiences in PE are considered critical for sustained participation in physical activity (PA; Hills et al., 2015; Kirk, 2005). Enjoyment of PE positively affects future attitudes and intention towards PA (Ladwig et al., 2018). However, the positive outcomes of PE are not limited to PA, with PE engagement leading to physical, affective, social, and cognitive benefits, as well as the promotion of healthy lifestyles (Bailey, 2006; Casey & Goodyear, 2015; Hills et al., 2015). It stands to reason that children who actively and continuously participate in PE will develop holistically, and consequently, improve their physical literacy and wellbeing (Whitehead, 2019).

One of the main outcomes for PE during the first two years of primary school (ages five to seven) is the development of fundamental movement skills (FMS; Department of Education, 2013). However, considering that FMS development is a primary PE outcome, it is concerning that children, especially low socio-economic status (SES) children, are not achieving FMS mastery (Bardid et al., 2015; Brian et al., 2018; Duncan et al., 2020; Foulkes et al., 2015; Morley et al., 2015). This lack of movement mastery may be due to the physical-education-as-sport-technique, which has been adopted as a means of delivering PE in most primary schools (Kirk, 2009). This approach has 'degenerated into an institutionalised form shaped to meet the requirements of the school rather than the rich potential of the subject and the benefits it could provide to young people' (Kirk, 2010; in Kirk, 2013, p. 2). This technique has been criticised for ignoring the motivational needs of children

(Haerens et al., 2011), which could lead to negative early experiences. It is therefore essential to understand young children's motivational perceptions and enjoyment within PE to best support their physical, social, cognitive, and affective development.

Motivation

According to SDT, there are different types of motivation that drive individual behaviour (Ryan & Deci, 2000). Generally, there are intrinsic and extrinsic reasons for partaking in a behaviour (Deci & Ryan, 1985; Ryan & Deci, 2017). Behaviours that are intrinsically motivating are those that are inherently interesting or enjoyable while behaviours that are extrinsically motivating are those that lead to a contingent outcome. This differentiation is pertinent within PE. As PE is mandatory, it could be argued that due to timetabling and teacher-expectation, children must take part, reducing the likelihood of intrinsic motivation. However, once in the PE environment, children may be intrinsically or extrinsically motivated to participate.

Another way to categorise motivation within an SDT framework is through autonomous and controlled motivation. Autonomous motivation leads to adaptable outcomes in PE, such as enjoyment, intention, and leisure-time PA (Vasconcellos et al., 2019). Controlled motivation leads to maladaptive outcomes in PE, such as boredom and negative affect (Vasconcellos et al., 2019). Motivating children within PE also supports children's PA participation inside and outside of school (Jaakkola et al., 2013; Standage et al., 2003). Therefore, understanding and supporting children's motivation may help to engage them in a lifelong commitment to a healthy lifestyle (Edwards et al., 2017). Despite these aspirations, little is known about young children's motivation (ages five to six). This lack of knowledge may be due to the

perception that young children are challenging to conduct research with (Evans & Fuller, 1996, 1998) and that there is a paucity of age-appropriate motivation tools for this young age group (Sebire et al., 2013). Consequently, to date, there are very few studies that have investigated motivation in primary school children (Vasconcellos et al., 2019). Also, little is known about how teachers support motivation in primary school PE (Teraoka et al., 2020).

Generally, motivation tools have been designed for older children (eight-and-nine-year-old children and upwards; Ryan & Connell, 1989; Vallerand, 1989). Efforts have been made to simplify measures for younger participants (Gottfried, 1990; Guay et al., 2010). However, due to the quantitative nature of these measures, assumptions may be being made around children's ability to understand the questions and the answer formats, despite best efforts to ensure comprehension (i.e., asking teachers to check language level). Qualitative attempts have also been made to understand younger children's motivation (five-and-six-year-old children and upwards; Chandler & Connell, 1987; Erickson, 2019); however, qualitative studies are limited. A mixed-method approach to assessing motivation in PE has the potential to provide a more comprehensive assessment of young children's motivation (Caruth, 2013; Ponce & Pagán-Maldonado, 2015) as it adopts the pragmatic 'what works best' approach (Creswell & Plano Clark, 2011).

Introduction to the thesis

The overall aim of this thesis is to explore young children's (ages five to six) basic psychological need satisfaction, self-determined motivation, and enjoyment for PE. Children aged five to six were included in this thesis as they were identified as the

first year of full-time primary school education, which included mandatory and structured PE lessons. Motivational exploration within this thesis includes the development of a tool that can assess young children's contextual basic psychological needs satisfaction, self-determined motivation, and enjoyment for PE, investigation of the importance of motivation for movement development, the investigation of motivational climates of PE lessons, and young children's resultant need satisfaction and enjoyment.

This thesis comprises three studies, which are described within the thesis study map, located at the start of each chapter. Following this introductory chapter is **Chapter two** (Literature review), which will provide a review and critique of the relevant research relating to PE, motivation, motivation assessment and pedagogy. This review will outline the gaps in the literature base and ends with the rationale and aims for the subsequent study chapters. **Chapter three** introduces *Study 1*, which is the development and content validity of a mixed-method, interactive tool for assessing contextual basic psychological need satisfaction, self-determined motivation, and enjoyment in young children. **Chapter four** is a continuation of *Study 1* with the development, content validity, acceptability, and reliability of a codebook for the tool to combine the quantitative and qualitative strands of data. **Chapter five** introduces *Study 2*, which investigates the utility and predictive validity of the tool. **Chapter six** introduces *Study 3*, which investigates the motivational climates of two pedagogies underpinned by Motor Learning Theory through lesson observation. This chapter also investigates young children's basic psychological needs (BPN) through quantitative data collection. **Chapter seven** provides a synthesis of the results from

the study chapters, highlighting recommendations for future research and potential impact upon research, policy and practice.

Independent contribution to the thesis

This PhD was embedded within a cluster randomised control trial (RCT) called the Skill Acquisition Methods Fostering Physical Literacy in Early Physical Education (SAMPLE-PE; described in the next section) and was funded by Liverpool John Moores University. The wider project included myself and two other PhD students who were exploring different aspects of the RCT (executive functioning and PA, respectively) as well as our research supervisors. The team met regularly, and decisions relating to the RCT were agreed on by consensus. The following section will detail my specific role within this wider project and how it has contributed to the independent PhD work presented in this thesis.

Chapter three (Study 1)

Study design. Co-designing of the tool. Searching the literature. Data collection. Designing the content validity matching task. Data analysis. Preparation of tables and figures.

Chapter four (Study 1)

Study design. Designing the codebook. Searching the literature. Compilation of relevant content validity questions. Data collection. Data analysis. Preparation of tables and figures.

Chapter five (Study 2)

Study design. Data collection. Data analysis. Preparation of tables and figures and writing.

Chapter six (Study 3)

Study design. Collected data. Data analysis. Preparation of tables and figures.

All writing throughout the chapters was completed independently.

Wider project: SAMPLE-PE

Figure 1 illustrates the SAMPLE-PE project, in which the research within this thesis sits. SAMPLE-PE aimed to understand better how two pedagogical approaches (Linear pedagogy (LP) and Nonlinear pedagogy (NLP)) can support the development of five to six-year-old children's physical, cognitive and affective domains of physical literacy (Rudd et al., 2020a). The rationale for conducting this research within the RCT was to work with a convenience sample, due to the difficulty in gaining access to schools, and to lessen the schools' research burden. It was also opportune to investigate the motivational climates of these pedagogies, alongside normal PE provision.

Twelve schools were recruited from highly deprived areas of a large North-West city in England. Three schools were randomly allocated into the LP group, three schools were allocated to the NLP group, and six schools were allocated to the control group. The intervention groups (LP and NLP) received PE from coaches, who were trained to deliver either LP or NLP, over 15 weeks. The 15 weeks were subdivided, for the intervention groups, into five weeks of dance, five weeks of gymnastics, and five

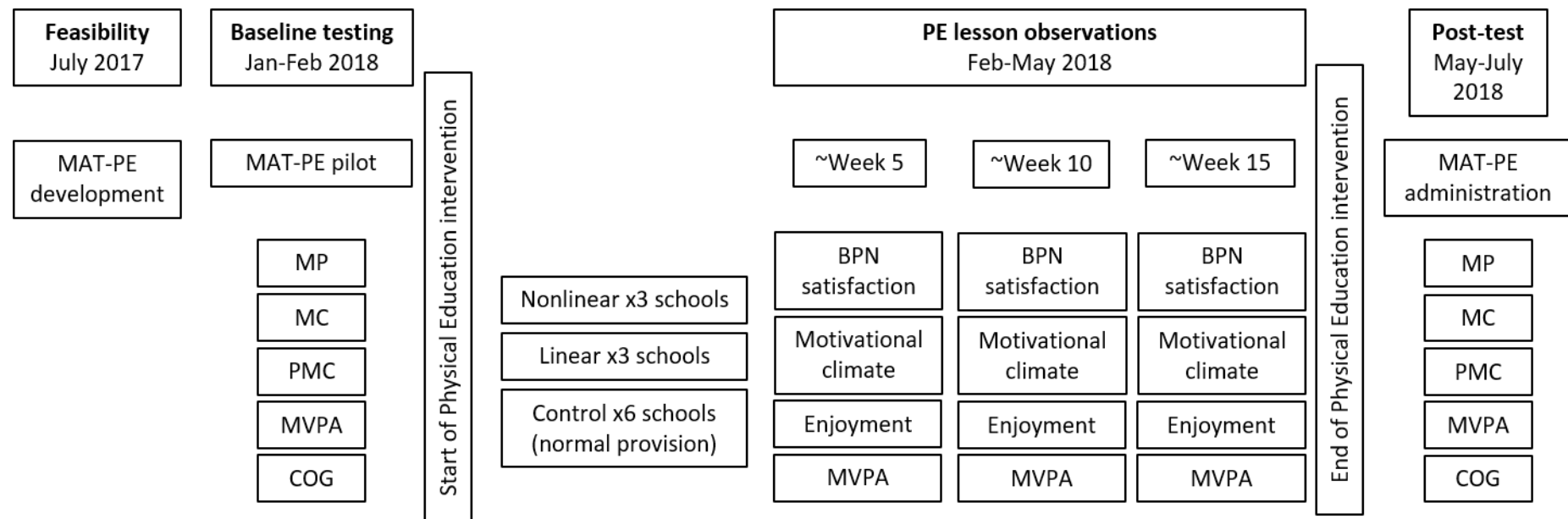
weeks of ball skills. Both intervention groups had the same lesson outcomes; however, they differed by their pedagogy. The control group carried on with their normal PE provision. All schools received 30 PE lessons (twice a week for 15 weeks) with lessons lasting approximately 60 minutes to control for dosage.

Across the 12 schools, 360 children were recruited to take part in the assessments. Assessments took place before the intervention (baseline), and immediately after the intervention had finished (post-test). Data was collected on their movement proficiency and motor creativity skills, perceived motor competence (PMC), executive functioning, and moderate-to-vigorous-physical-activity (MVPA). The Motivation Assessment Tool for Physical Education (MAT-PE) was piloted at baseline and administered at post-test (Study 1 and 2).

Process evaluation was conducted with nine of the 12 schools (3 x LP, 3 x NLP, 3 x control). The research team entered each school every five weeks (end of each PE block) and observed a PE lesson per class. Forty-five PE lessons were video-recorded across the 15 weeks to examine their motivational climates, coach PA behaviour, and pedagogical fidelity. BPNS and enjoyment data were captured at the end of each observed PE lesson (Study 3).

Figure 1

Overview of the RCT this thesis sits within.



Note. MAT-PE = Motivation Assessment Tool for Physical Education, MP = Motor Proficiency, MC = Motor Creativity, PMC = Perceived Motor Competence, MVPA = Moderate to Vigorous Physical Activity, COG = Cognition, BPN = Basic Psychological Needs

Chapter 2

Literature Review

Introduction

The purpose of this chapter is to review the literature associated with SDT, PE and motivation assessment, with particular reference to young children (aged five to seven). This chapter will conclude with a summary leading to the aims and objectives of this thesis and a presentation of theoretical, methodological and ethical considerations used within it.

Context

For children, engagement in PA has demonstrated positive relationships with physical (Janssen & LeBlanc, 2010), cognitive (Donnelly et al., 2016; Marques et al., 2018) and psychological factors (Biddle & Asare, 2011; Biddle et al., 2019) as well as associations with wellbeing (Rafferty et al., 2016). Despite the well-established benefits of participation in PA, an Active Lives Survey conducted by Sport England (2019) stated that between 2017 and 2018, only 18% of children were meeting the recommended guidelines of on average 60 minutes of PA per day, with 33% participating in less than 30 minutes per day. Furthermore, only 15% of children in low SES families took part in 60 minutes of PA per day compared to 22% of children from higher SES families. Moreover, 39% of lower SES children participated in less than 30 minutes of daily PA compared to 26% in higher SES children (NHS digital, 2019).

Low SES families are prone to low levels of PA for several reasons. For example, low SES families have been found to perceive nearby PA facilities as being further away than they are (Giles-Corti & Donovan, 2002). This perception indicates a proximity-perception barrier which is only strengthened by the perception that

their surroundings are unsafe (Giles-Corti & Donovan, 2002). Furthermore, when compared to higher SES families, low SES families have limited access to free PA facilities (e.g., gyms, swimming pools), reduced access to portable play equipment (e.g., bike, skipping rope; Estabrooks et al., 2003). Low SES families also have increased access to sedentary-related items (e.g., tv, game consoles; Tandon et al., 2012). Together, this evidence suggests that most children are not taking part in enough PA, that low SES especially is detrimental for PA, thus creating adverse effects on an individual and national scale (NHS Digital, 2019). It is, therefore, important that all children participate in sufficient PA to experience the aforementioned positive outcomes. Given that PA declines from the start of school entry (Reilly, 2016), it seems crucial to intervene at this earlier stage of development (Rudd et al., 2020a).

Physical education

One opportunity for PA that low SES children can all access is PE. PE is a mandatory subject within the primary National Curriculum in England (Department of Education, 2013). PE promotes many vital aspects of positive development for primary school-aged children (5-11-years-old) including physical, affective, social and cognitive outcomes whilst also supporting healthy lifestyles (Bailey, 2006; Bailey et al., 2009; Casey & Goodyear, 2015; Hills et al., 2015). Although PE is not and cannot be seen as a silver bullet for increasing children's PA, it does have the potential to offer time and resources in supporting children's PA behaviour and more holistic development towards a lifelong commitment to healthy living. For example, evidence shows that PE engagement promotes children's motivation and enjoyment (Carroll & Loumidis, 2001; Chen, 2014), PA (Sallis et al., 2012; Sallis & McKenzie, 1991), FMS (Lemos et al., 2012; Loprinzi et al., 2015), PMC, social interaction (Tsangaridou &

Lefteratos, 2013) and academic achievement (Marques et al., 2017; Rasberry et al., 2011).

Across the globe, the main aim of PE is for every child to have multiple opportunities to become physically confident in a way that supports their ongoing health and wellbeing (UNESCO, 2013). In England, the aim of the curriculum for ages 5-7 years is to “...develop fundamental movement skills, become increasingly competent and confident and access a broad range of opportunities to extend their agility, balance, and coordination, individually and with others” (Department of Education, 2013, p. 199). An emphasis is placed upon the performance of FMS, which is arguably appropriate as FMS do not naturally develop over time. FMS development typically requires context-specific practice, instruction, and structured training (Stodden et al., 2014). High levels of FMS can lead to positive outcomes such as physical fitness (Utesch et al., 2019), cardio-respiratory fitness, PA, and lower obesity (Lubans et al., 2010). However, young children have displayed low FMS across the globe (e.g. Belgium, Australia, the United States and the UK; Bardid et al., 2015; Brian et al., 2018; Foulkes et al., 2015; Morley et al., 2015), and in comparison to a reference group from 40 years ago (Bardid et al., 2015). Furthermore, young disadvantaged children have demonstrated lower FMS in comparison to their more affluent peers (Morley et al., 2015). These studies show that although the primary outcome of PE, especially within the UK, is the development of FMS, children, especially those that are disadvantaged, are not being equipped with the necessary tools to continue their PA journey once they leave Key Stage 1 (age 7+), which is the first stage of formal curriculum.

Early learning experiences in PE are considered critical for sustained participation in PA (Hills et al., 2015; Kirk, 2005), with the enjoyment of PE positively affecting future attitudes and intention towards PA (Ladwig et al., 2018). Kalinowski (1985, in Kirk, 2005) argues that experiences in the early years carry the most significant impact as without positive experiences, there would not be a middle or late period of skill development as children with low FMS will ultimately disengage from participation (Stodden et al., 2008; Robinson et al., 2015). It has been found that low skill and childhood experiences are closely linked within PE as demonstrated by Portman (1995) who interviewed low skilled sixth graders (11-12-year-olds) and found them to have very negative PE recollections. These low skilled children had concrete attitudes towards PE, developed reasons for success (e.g., luck) and failure (e.g., being low skilled, feeling nervous), and experienced performance repercussions for being low skilled (e.g., picked on by higher-skilled children). Ultimately, their experiences led to a lack of enjoyment in PE. Observations of PE lessons confirmed that these children (11-12-year-olds) did not have enough time to learn necessary skills and consequently experienced little to no success over time, with Portman summarising this briefly as “failure breeds failure” (p. 452). Despite this acknowledgement around creating positive experiences and upskilling children, PE has seemingly not changed in its ability to improve children’s experiences almost 20 years later.

Kirk (2013) stated that despite investment in PE since the 1970s, the sport-based PE model that brought optimism in the 1950s has “degenerated into an institutionalised form shaped to meet the requirements of the school rather than

realise the rich potential of the subject and the benefits it could provide to young people” (p. 974). This degeneration has led to PE being delivered through a physical-education-as-sport-technique. Kirk (2013) also stated that PE practitioners have not yet achieved their ‘most cherished aspiration’ where children develop into adults who engage in lifelong PA because of their PE experience. Transfer of learning requires that what children learn in school is used outside of school (concurrent transfer) and once they have left education (delayed transfer; Haerens et al., 2010). However, evidence shows that this delayed transfer does not typically take place, with few adults taking part in the sports they experienced in PE while children (Haerens et al., 2010). Although PE is considered to play a crucial role in promoting an active and healthy lifestyle with a focus placed on preparation for lifelong PA (Fairclough et al., 2002), this lack of transfer indicates that PE has not been sufficient in its aim.

It is, therefore, crucial to provide high-quality PE so that young children have positive and enriching experiences during their early PE experiences. At a young age, PE should focus upon FMS development as ‘actual’ and ‘perceived’ competence are important determinants of PA in youth which contributes towards success and enjoyment (Hills et al., 2015). Children are generally competence driven (Harter, 1988) whereby a circular relationship exists between mastery of FMS and motivation. Understanding how to foster and sustain motivation in children within primary PE is therefore crucial for supporting their PA participation (Jaakkola et al., 2013; Standage et al., 2003) and holistic wellbeing (Whitehead, 2019). High-quality PE fosters social interaction, fun, challenge, competition, motor competence, and personally relevant learning (Beni et al., 2017; Teixeira et al., 2012), and are tightly entwined with

motivation. The motivation for PE (Standage et al., 2012) and motivation, in general, has demonstrated positive effects on PA behaviours (Wang et al., 2016). Motivation drives all behaviour and could be essential for PE and its ability to support children's holistic development and healthy lifestyles. The following section will explore motivational theories in more detail.

Motivation

The underpinning of motivation, i.e., the driver behind behaviours, has been considered from content and process points of view. Sahito and Vaisanen (2017) describe these types of motivation in their work and are described, briefly, here. A *content* motivation theory typically approaches motivation from the “what” perspective. Content motivation theories include Maslow's hierarchy of needs (1943), Alderfer's ERG theory (1979), Herzberg's two-factor theory (1959), and McClelland's theory of needs (1958). Overall, these theories assume all individuals are driven by the same needs and are thus labelled as drive theories. For example, Maslow stated that individuals are driven by five basic needs: physiological, safety and security, belongingness, love, self-esteem, and self-actualisation. Alderfer reduced these five needs to three core needs: existence, relatedness, and growth.

In contrast to content theories of motivation, *process* theories of motivation propose that individuals have diverse needs, and their cognitive process should be attended to, and thus viewed as cognitive theories of motivation. Process theories include theories such as Adam's equity theory (1963), Vroom's expectancy theory (1964), Locke's goal-setting theory (1990), and Skinner's reinforcement theory (1948). For example, Adam's equity theory focuses upon social comparisons: equity

occurs when one person's output to their input ratio is similar to the ratio of another person; inequity occurs when the ratio is different. Vroom's theory centres around three factors that produce motivation: valence (how much you want the reward), expectancy (estimation of the probability that effort will result in the reward), and instrumentality (whether performance will result in receiving the reward). These theories of motivation are more individualistic and mostly reflect differential cognitive processes. It could be argued that Skinner's reinforcement theory does not include as much individualism as the other theories based on its automaticity of behaviours, i.e., behaviour is learned and externally controlled rather than internally strived for (Ryan & Deci, 2020).

It is reasonably clear to see here that content and process types of motivation seek to understand how to motivate people but do so in contrasting ways. Content theories view everyone as the same while process theories do not. Content theories tend to propose inherent needs, while process theories tend to propose individual goals. It is therefore clear that using either of these positions will only allow you to understand one part of the story behind a person's motivation. There are a host of other motivation theories that have emerged over the decades, for example, Competence Motivation Theory (Harter 1978, 1979) and Goal Achievement Theory (Nicholls, 1989); the latter will be discussed more in-depth later on in this chapter. However, one macro-theory, that helps towards an overall understanding of motivation has emerged, developed, and propagated over 35 years: Self-Determination Theory (SDT).

Self-determination theory

SDT is “a broad theory of human development and wellness, with strong implications for education” (Ryan & Deci, 2020). SDT distinguishes between types of motivation based on the reasons that move individuals towards a particular behaviour (Ryan & Deci, 2002). Akin to a vector, motivation within this framework has a level (how much motivation) and an orientation (what type of motivation; Ryan & Deci, 2000). SDT places the concept of intention (the desire to attain a particular future state) as central for understanding the regulation of behaviour (Deci & Ryan, 1994), and is also the difference between motivation and amotivation (the complete lack of motivation; Ryan and Deci, 2017). SDT is an organismic theory and assumes that people are inherently driven toward psychological growth and integration, and therefore, toward learning, mastery and connection with others (Ryan & Deci, 2020).

It is a macro-theory as it addresses aspects such as, but is not limited to, personality development, self-regulation, universal psychological needs, and energy and vitality (Deci & Ryan, 2008). It is made up of six mini-theories. Cognitive Evaluation Theory focuses upon intrinsic motivation; Causality Orientations Theory focuses upon individual differences in motivational styles; Goal Contents Theory focuses upon goals that drive motivation; Relationship Motivation Theory focuses upon the quality of close relationships and their consequences. Organismic Integration Theory (OIT) focuses on the motivating factors that drive behaviours, and Basic Psychological Needs Theory (BPNT) focuses upon the socio-contextual factors that relate to the satisfaction of autonomy, competence and relatedness (Ryan &

Deci, 2017). It is these last two theories, OIT and BPNT, that are arguably the most used in PA (Teixeira et al., 2012) and within PE research (Vasconcellos et al., 2019).

Basic psychological needs theory: Need support and need satisfaction

For healthy development, SDT states that all individuals require support for their BPN (Ryan et al., 2019). BPN are conceptualised as psychological nutrients that individuals need fulfilling so that they can enhance their functioning (e.g., engagement, learning, and performance), and personal growth (e.g., intrinsic motivation, task enjoyment; Cheon et al., 2012). BPN are inherent in all individuals but are unrealised latent potentials that need supportive environmental conditions so that they can be satisfied (Cheon et al., 2012). These BPN include autonomy (a sense of initiative and ownership in one's actions), competence (a sense of mastery and that one can succeed and grow), and relatedness (a sense of belonging and connection; Ryan & Deci, 2020). When supported, these needs lead to wellbeing, whereas when thwarted/frustrated, can lead to ill-being. This consequence of need supporting and need thwarting has been observed cross-culturally (Chen et al., 2015) as well as across age, gender and ethnicity (Ryan & Deci, 2020).

Need supportive and controlling teaching behaviours. A PE teacher can support their children's BPN through their teaching styles. BPN can also be deprived, anticipated, or frustrated (Cheon et al., 2018). Need-supportive teaching behaviours include listening to pupils, giving pupils opportunities to talk, acknowledging signs of improvement and mastery, encouraging effort, being responsive to pupils' comments and questions, and acknowledging pupils' experiences and perspectives (Reeve & Jang, 2006, in Ryan & Deci, 2017). Controlling teaching behaviours include

monopolising the learning materials, providing solutions to problems before pupils have time to work on the solution, and using controlling words such as “should” and “have to” (Reeve & Jang, 2006, in Ryan & Deci, 2017). Haerens et al. (2013) extended these teacher behaviours to include relatedness and structure. Relatedness-based teaching behaviours include being enthusiastic and eager and putting effort and energy into the lesson. Structure related teaching behaviours include giving clear instructions and providing positive feedback. These additions are said to have significant practical utility; however, it is also thought that by supporting autonomy, the other needs are also supported (Ryan & Deci, 2017).

Need support research has shown that when trained middle- and high-school PE teachers provide an autonomy-supportive teaching style, students report improved engagement, skill development and future intentions due to increased need satisfaction (discussed below) (Cheon et al., 2012). Autonomy-supportive teaching has also increased middle- and high-school students’ prosocial behaviour (e.g., encouraged a classmate). It has also decreased antisocial behaviour (e.g., verbally abused a classmate; Cheon et al., 2018), and decreased high-school students’ amotivation (Cheon & Reeve, 2015). In slightly younger children, autonomy need support has increased enjoyment and vitality in 10 to 12-year-old children (Mouratidis et al., 2011), increased effort and enjoyment, and decreased boredom in 11-12-year-olds (Leptokaridou et al., 2016). The positive effects of an autonomy-supportive teaching style have been repeatedly demonstrated in older primary, middle- and high-school populations. This extensive research into autonomy-need support has rarely extended downward to younger children (Vasconcellos et al., 2019).

Research conducted by Escriva-Boulley et al. (2018) investigated the effect of increasing PE teachers' autonomy-supportive motivating style on PA during PE lessons in 293 five to 11-year-old children. The intervention spanned eight months, where four sports were taught with around eight weeks dedicated to each one. Data collection occurred before the intervention and at a further four time points (at the end of each sports period). The control group received a notebook that presented a variety of learning tasks while the intervention group received four x 3-hour teacher professional development sessions and focused on SDT. A positive association between autonomy support and moderate-to-vigorous physical activity (MVPA) during PE was found. This study is the only study to include children under the age of eight, warranting more research. It is still unknown what impact motivationally supportive environments can have on young children's motivation.

A recent systematic review of intervention studies that addressed affective outcomes (e.g., motivation) in PE (Teraoka et al., 2020) highlighted that only six studies were identified as occurring in primary or elementary school populations. However, in some articles, 'primary' aged children included 11-12-year-olds (Escarti et al., 2010; Leptokaridou et al., 2016) which is not consistent with UK primary school age (5-11 years). Of the studies within this systematic review that were within the UK-defined age parameter, only one study investigated autonomy support, through Teaching Games for Understanding (Mandigo et al., 2008). Using a qualitative approach, girls reported higher levels of optimal challenge and enjoyment, and boys reported higher perceived competence. Nevertheless, as highlighted by recent systematic reviews (Teraoka et al., 2020; Vasconcellos et al., 2019), there is a paucity

of need-supportive research in school entry aged children (five to six years), particularly around specific pedagogies.

Need satisfaction. Generally, the satisfaction of BPN leads to pro-activity and wellbeing, while needs frustration leads to passivity and ill-being (Vansteenkiste & Ryan, 2013). It is essential, here, to distinguish between feelings of low basic psychological need satisfaction (BPNS) and frustration. The illustration by Vansteenkiste and Ryan (2013) describes this difference well: if an individual feels low relatedness in their workplace, they might experience less vitality and excitement for work. Whereas, if the individual is actively rejected or excluded, this can lead to feelings of depression or severe symptoms of stress. The difference lies within the environment and causes very different consequences in the individual. Within an education setting, teachers can be need supportive (active), need depriving (indifferent) or need thwarting (antagonistic).

The satisfaction of needs has been found to lead to many positive outcomes in PA. In an exercise referral study, autonomy and competence need satisfaction predicted PA, and autonomy need satisfaction negatively predicted depression (Rahman et al., 2011). Autonomy and relatedness satisfaction positively and significantly correlate with positive affect and significantly and negatively correlate with negative affect (Sheldon & Bettencourt, 2002). Autonomy need satisfaction has predicted subjective vitality and competence need satisfaction has predicted subjective vitality and physical wellbeing in sport (Reinboth et al., 2004). The extent that needs are satisfied fuels internalisation and integration of behaviours (Reeve & Lee, 2019), which is the crux of OIT. Similar to the need support research, there is a

paucity of research concerning need satisfaction in young children. Some research has been conducted in slightly older children within PE, discussed below.

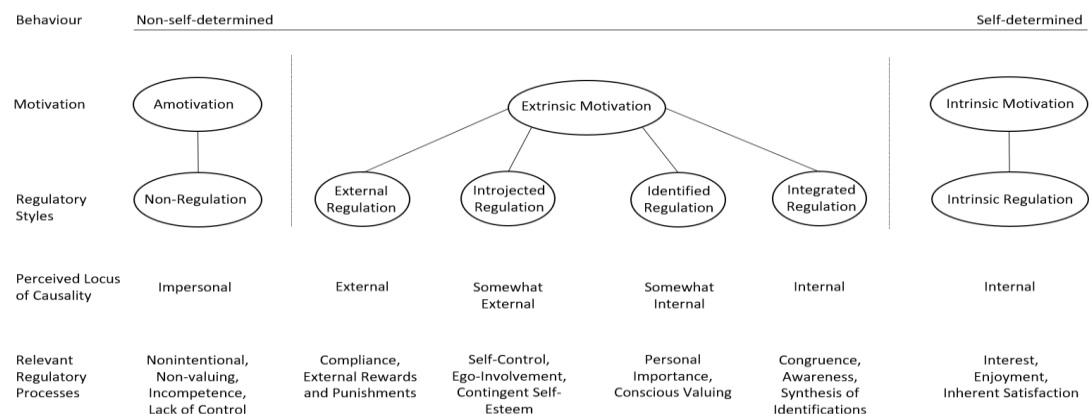
Chen (2014) investigated need satisfaction, motivational regulation, and intention in 291 children aged eight to 12. In this sample, competence was highest with relatedness, and autonomy need satisfaction reported as relatively high. PA intention was high, indicating that students were likely to engage in PA in the near future. This study added to the SDT proposition that need satisfaction significantly and positively associates with autonomous motivation (motivational regulations are discussed below). Similar results were found in 1073 children aged eight to 11 (Chen & Hypnar, 2015) where all BPNS were high. The children also had a high attitude mean score towards PA outside of school.

Organismic integration theory

OIT focuses on what motivates individuals to engage in behaviours that are not necessarily intrinsically interesting (Ryan & Deci, 2017). OIT focuses on internalisation and integration, resulting in different types of motivation that vary by degree of autonomy. These differing motivation types have specific antecedents and effects on behaviour within socio-cultural environments, such as PE. OIT places different types of motivation along a continuum of relative autonomy (see Figure 2). At one end of the continuum lies intrinsic motivation, which refers to participating in an activity for the satisfaction and inherent pleasure from that activity (Deci, 1971). Vallerand et al. (1989) suggest three types of intrinsic motivation: *Intrinsic motivation to know*, which is participation to gain satisfaction and pleasure while learning, exploring, or attempting to understand something new; *Intrinsic motivation to*

accomplish things, which is pleasure and satisfaction while an individual is trying to accomplish or create something, or to surpass the self; *Intrinsic motivation to experience* stimulation which is to experience pleasant sensations associated with an individual's senses. For example, a child in PE may participate because they enjoy learning something new (to know), or to master a skill (to accomplish) or run around because they enjoy the feeling of air moving on their skin and through their hair (to experience stimulation).

At the other end of the continuum lies amotivation, which is a complete lack of intention or motivation to participate in an activity. Ryan and Deci (2017) describe three types of amotivation where a lack of action is due to: feeling unable to attain outcomes or a lack of competence, a lack of interest, relevance or value, or defiance or resistance to influence or rather, a motivated non-action in order to defy demands that thwart autonomy or relatedness. Here a child would experience amotivation in PE if they felt that they could not achieve the outcome, or had no interest in a specific PE topic (e.g., dance, gymnastics, or ball skills), or they do not want to participate in a game involving certain children due to conflict between them. Between these two anchor points lies extrinsic motivation which includes four types of motivation ranging from low relative autonomy to higher relative autonomy which is determined by the level of internalisation. This level of internalisation is split into controlled and autonomous motivation. Controlled motivation has little to no internalisation, and autonomous motivation has relatively higher internalisation (but not to the extent of intrinsic motivation which is fully internalised).

Figure 2*The Organismic Integration Theory Continuum*

Note. Adapted from *Self-determination theory basic psychological needs in motivation, development, and wellness*, R.M. Richard and E.L. Deci, 2017, p. 193, Guilford

Within the controlled portion of extrinsic motivation, which is characterised by an external pressure to engage in an activity, lies external motivation (driven by reward or avoidance of punishment and considered the least internalised form of motivation), and introjected regulation (driven by the ego/pride or guilt/shame). As the drive to participate in an activity is somewhat internally governed within introjected regulation, there is some internalisation. However, as participation is conducted to decrease these negative internal feelings, introjected regulation is still seen as externally driven. An externally regulated child may participate in PE to gain a reward (approach) from the PE teacher or to avoid punishment (avoid). A child may experience introjected regulation by appeasing their ego and endeavour to please the PE teacher and their peers, effectively 'showing-off'. Alternatively, they could feel guilty for not taking part (Ryan & Deci, 2017, 2020).

Following with increasing degrees of internalisation are identified regulation (driven by a desire to pursue an internal goal) and integrated regulation (driven by aligned values and behaviours; Ryan & Deci, 2020). Together with intrinsic regulation (driven by inherent pleasure, interest, or challenge), identified and integrated regulation are forms of autonomous motivation, characterised by levels of volition and self-endorsement (Ryan & Deci, 2017). A child who sees the health benefits of PE would demonstrate identified regulation. An individual who not only recognises the benefit of PE but also aligns it with their other values and beliefs will experience less conflict, in comparison to identified regulation, and thus is more integrated. It is thought that integrated regulation only emerges in adolescence and adulthood (Ryan & Deci, 2017) and therefore, not experienced by primary-school-aged children. Intrinsic motivation is arguably the best type of motivation to experience as it is more permanent than extrinsic types of motivation due to its inherent and internal nature.

Within the same studies mentioned above (Chen, 2014; Chen & Hypnar, 2015), children aged eight to 12 have reported high intrinsic and identified regulations, moderate introjection, and low external regulation and amotivation within PE. These findings indicate that older children are experiencing more autonomous types of motivation in comparison to controlled types within PE settings.

Gender and age as factors within SDT

Ryan and Deci (2017) state that as needs are universal, they will be mostly invariant across gender and age. Subsequent studies in various contexts, including PE, PA, and exercise, have endeavoured to explore the extent of this invariance, some

of which are briefly presented below. The literature indicates mixed results when investigating gender differences within SDT in areas of PE, PA, and exercise.

Gender. Standage et al. (2005) explored a model of SDT within PE of 11-14-year-old children and the invariance of the model across gender. Model fit was mostly invariant across gender; however, a significant path emerged between need satisfaction and introjection for girls only, and the path between amotivation and concentration was dropped for the boys' model. Gillison et al. (2006) also found their model to be largely invariant across gender in 13-15-year-old children within the area of exercise. In a cross-cultural sample of 1,384 participants, Church et al. (2013) found no gender differences in BPNS. However, in a systematic review by Teixeira et al. (2012), gender differences were found within exercise and PA studies. Specifically, external regulation was negatively associated with exercise in males only, and introjected regulation was more positively associated with exercise in females. In children, girls aged eight to nine and 12-13 reported significantly higher relatedness need satisfaction than boys of the same ages (Véronneau et al., 2005). Within an educational context, intrinsic motivation was a more significant positive predictor for females in comparison to males, while external regulation was more substantial for males (Vecchione et al., 2014).

Age. Younger children (age 8-9 years) have reported marginally greater autonomy, significantly greater competence and relatedness need satisfaction in comparison to older children (12-13 years; Véronneau et al., 2005). Eight to nine-year-old children have also reported higher intrinsic motivation in comparison to 13-14-year-old children, while extrinsic motivation demonstrated very little difference

between age groups (Lepper et al., 2005). Chandler and Connell (1987) investigated differences for participating in liked and disliked activities in children aged five to 13-years-old. Liked behaviours were intrinsically motivated across the age range; however, for disliked behaviours, extrinsic motivation was more frequent in younger children, and more internalised motives were more frequent in older children.

Overall, the premise that BPN relates to better wellbeing is invariant across gender and age remains intact (Ryan & Deci, 2017). However, differences can be seen between gender and age groups in BPNS and behavioural regulations, as posited by Ryan and Deci (2017). It is clear to see from the section above that there is a pronounced paucity of research in children under the age of eight. This lack of research means that a whole age group of children are not understood when it comes to their motivation. Future research must examine this younger age group to understand and assess their motivational perceptions so that they may benefit from focused interventions and better teaching in PE.

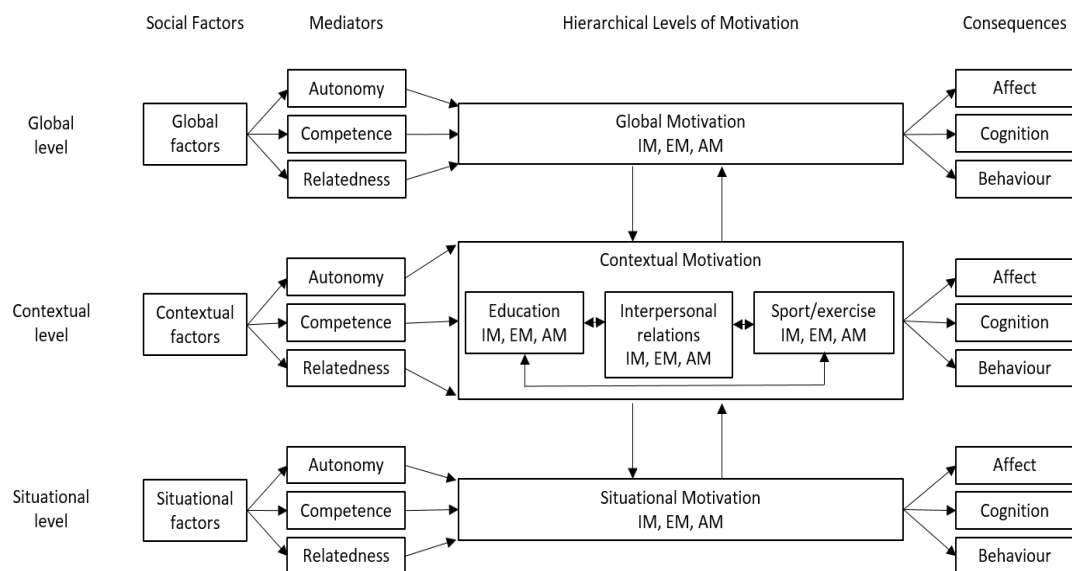
The hierarchical model of intrinsic and extrinsic motivation

Vallerand's (2007) hierarchical model of intrinsic and extrinsic motivation (HMIEM) views intrinsic, extrinsic and amotivation at three levels of generality: global, contextual, and situational (see Figure 3). Vallerand explains that the global level of motivation is akin to a personality trait where an individual is predominately intrinsically or extrinsically motivated, or amotivated. The contextual level is the individual's motivation towards a specific context; Investigating overall motivation for PE would fall within this level of generality. The situational level is the individual's motivation when engaging in a specific activity at a given time; investigating the

motivation of a child within a particular PE lesson would be considered as situational motivation. Global social factors include the role of the parents as their influence is felt across a child's life and thus should affect their global motivation. Contextual social factors are those that are present only within specific contexts, for example, a PE teacher within a PE lesson is only present during PE and thus could affect a child's motivation within PE but not for other subjects in school. Situational social factors are present at specific points in time, for example, when a PE teacher provides praise after a good skill execution. Vallerand highlights that these social factors and their effect upon motivation (intrinsic, extrinsic, or amotivation) is mediated by perceptions of autonomy, competence, and relatedness.

Figure 3

The Hierarchical Model of Intrinsic and Extrinsic Motivation



Note. Adapted from *Intrinsic and extrinsic motivation in sport and physical activity*, R.J. Vallerand, 2007, p. 61, Wiley.

Self-determined motivation

The HMIEM also shows that motivation at any level has affective, cognitive, and behavioural consequences which are most positive when experiencing intrinsic motivation and least positive when experiencing amotivation. Vasconcellos et al. (2019) conducted a systematic review and meta-analysis upon 265 articles investigating SDT within PE, and their findings agreed with the model's proposition that intrinsic motivation leads to more adaptive outcomes compared to amotivation. More specifically, autonomous motivation was positively correlated with adaptive outcomes (e.g., enjoyment, intention, and leisure-time PA) and negatively correlated with maladaptive outcomes (e.g., boredom, and negative affect). External regulation and amotivation demonstrated negative relationships with adaptive outcomes and positive relationships with maladaptive outcomes. Introjection positively correlated with adaptive and maladaptive outcomes. The systematic review findings also supported the SDT premise that autonomy, competence, and relatedness strongly correlate with autonomous motivation. BPN also had a weaker but still positive correlation with introjected regulation. BPN had weak and negative correlations with external regulation, and amotivation had a moderate negative correlation with BPN. Vasconcellos also highlighted the paucity of research within SDT and PE for young children, as most research was conducted in older children and adolescents.

Most of the available SDT research is aimed at secondary school populations (e.g., Bryan & Solmon, 2012; Parish & Treasure, 2003; Sanchez-Oliva et al. 2014; Standage et al., 2005; Taylor & Ntoumanis, 2007). Others have focused on primary school populations but within the older years of primary (e.g., Chen & Hypnar, 2015

(eight to 11 years old); Erwin et al., 2013 (nine to 13 years old); Leptokaridou et al., 2016; Rutten et al., 2012 (12 years old)). Erwin et al. (2013) investigated the effect of lesson type and autonomy upon 292 nine to 13-year-olds' self-determined motivation for PA and their actual PA through PE. While significant differences were found for contextual motivation between school and grade, no differences in situational motivation were reported. Nevertheless, a larger percentage of PE time was spent in MVPA within the team-no-choice and individual-choice in comparison to the two other lesson types, demonstrating that lesson type and autonomy affected MVPA but not motivation. Chanal et al. (2019) explored the motivational trajectories of eight to 12-year-old children up to four times over two years with a newly developed 33-item scale. The scale assessed intrinsic motivation to experience stimulation and towards achievement, identified regulation, introjected approach regulation, introjected avoidance regulation, external approach regulation, external avoidance regulation, and amotivation. Trajectories for autonomous and controlled motivation declined across time for all age groups, which demonstrated that motivation in PE declines at an earlier time than first thought (Digelidis & Papaianou, 1999). This finding suggests that motivation research should focus on younger age groups. The implication is that the time for intervention could and should occur earlier to lessen the risk of this motivational decrease.

In summary, SDT encompasses the *what* and *why* behind behaviours in which individuals participate. It includes the social context and also the internal workings of individuals, which makes it a robust motivation theory that can be applied to a multitude of settings (e.g., educational, work, relationships, parenting; Ryan and Deci, 2017). These settings can benefit from BPN support as it increases prosocial

behaviour, enjoyment, vitality, effort and MVPA and decreases boredom and antisocial behaviour within PE. The HMIEM (Vallerand, 2007) also posits that specific affective, cognitive, and behavioural outcomes emerge from the different types of motivation which have been supported by a recent systematic review and meta-analysis within PE (Vasconcellos et al., 2019). This systematic review also highlighted the paucity of research that has been conducted in children under the age of eight and more is necessary to understand the motivational perceptions of this under-researched age-group. Arguably, more motivation-based research has been conducted in this young age group with a motivational theory that applies to achievement contexts, such as PE. This theory is Achievement Goal Theory (AGT; Nicholls, 1989), and its theory and research are discussed below.

Achievement goal theory

Achievement behaviour is defined as “...that behaviour in which the goal is to develop or demonstrate—to self or to others—high ability or to avoid demonstrating low ability.” (Nicholls, 1984, p. 328). AGT is a socio-cognitive motivation theory that explains the how and the why behind individuals’ participation in achievement contexts (Nicholls, 1989). Ames (1992) describes the effect of the motivational climate created by significant individuals, such as coaches and PE teachers, upon perceived competence and subjective success.

Motivational climates can primarily be either task-involving (mastery-focused) or ego-involving (performance-focused). Individuals who are task-involved perceive more effort as leading to more mastery and higher ability. Those that are ego-involved perceive their chance of demonstrating ability as dependent upon the

abilities of others (Nicholls, 1984). Sports coaches or PE teachers who instil a mastery-focused motivational climate use a self-referenced criterion for defining success such as personal improvement and task-mastery. In contrast, sports coaches or PE teachers who instil a performance-focused motivational climate use an other-referenced criterion for defining success, such as demonstrating a superior ability to others (Seifriz et al., 1992).

It is assumed that individuals within a task-focused motivational climate will experience adaptive outcomes regardless of perceived competence due to the lack of comparison with others. However, individuals within a performance-focused motivational climate with low perceived competence are believed to experience adverse outcomes (Nicholls, 1989) such as low learning investment (Cury et al., 1997, in Ntoumanis, 2001). Whereas, those with high perceived competence within performance-focused motivational climates will exhibit motivational patterns similar to those in mastery-focused motivational climates (Nicholls, 1989).

Research has found that individuals who perceive their motivational climate to be highly mastery-focused reported significantly higher enjoyment and intrinsic motivation in comparison to those who perceived their motivational climate to be low in mastery-focus (Seifriz et al., 1992). Mastery-focused motivational climates have also shown positive relationships with adaptive outcomes such as persistence, adaptive learning strategies, and achievement (Wolters, 2004). A systematic review investigating AGT in children from kindergarten to grade 12 showed that a mastery-focused motivational climate led to a range of positive outcomes such as enjoyment,

intrinsic motivation, effort and persistence, positive emotions, and PA participation (Liu et al., 2017).

The same review found positive and negative outcomes in a performance-focused motivational climate including high levels of anxiety, high levels of self-handicapping strategies, high frequency of self-reported undisciplined behaviour, low enjoyment, lack of motivation and lack of social involvement. More positive outcomes included higher levels of perceived ability, higher levels of perceived competence, demonstration of mastery behaviour and a better 1-mile running performance (Liu et al. 2017). Although there are positive outcomes to a performance-focused motivational climate, these outcomes seem to be constrained to the physical. In contrast, task-focused motivational climates lead to more holistic positive outcomes and demonstrate little adverse outcomes. Although this recent review (Liu et al., 2017) included studies with children aged five to six, the number of articles that researched children under fourth-grade (nine to ten years of age) were minimal and highlights a need for more research in this younger age group.

A different systematic review captured some work underpinned by AGT and conducted in children below the fourth-grade (Braithwaite et al., 2011). Included within this systematic review (Braithwaite et al., 2011), Xiang et al. (2003) investigated the motivational climates of second- and fourth-grade PE classes (seven to eight and nine to 10-year-old children, respectively). Using the TARGET framework (Task, Authority, Recognition, Grouping, Evaluation and Time; Epstein, 1983), PE lessons generally had a mastery-focused climate due to fun, challenging and meaningful activities (task), employment of mastery-based instructional practice

(evaluation/recognition), and groups were heterogeneous and random (grouping). Authority was the only component that was not judged to be mastery-focused as PE teachers did not allow children opportunities to take responsibility for their learning. Similar teaching practices were observed in both age groups; however, second graders perceived their PE environment to be more performance-focused, even though it was judged to be mastery-focused through observations. The authors attributed this to an item within the performance-focused construct which read “My teacher is proud of me when I am the best student” which requires reflection and reference to other children, which younger children are less able to do (Harter, 1999). This study was one of the first to offer insight into the motivational climates within PE for younger and slightly older children.

This systematic review (Braithwaite et al., 2011) also captured research with children as young as five. Valentini and Rudisill (2004) demonstrated that children’s (aged 5.9 to 10.9 years) motor skills improved after a 12-week intervention (mastery-climate) in comparison to the control group. This study demonstrated the physical benefits that a mastery-oriented motivational climate can bring. This finding was further supported when applied to five to six-year-olds who experienced either a mastery-oriented or low-autonomy over 6-weeks where the mastery-oriented children improved significantly in their locomotor and object control skills (Martin et al., 2009). Given the research presented above, it seems that children who experience a more mastery-oriented motivational climate within their PE lessons are more likely to experience positive outcomes. Although efforts have been made to include the younger age group within this exploration, and have found positive physical effects, research is still minimal and requires further investigation.

SDT and AGT

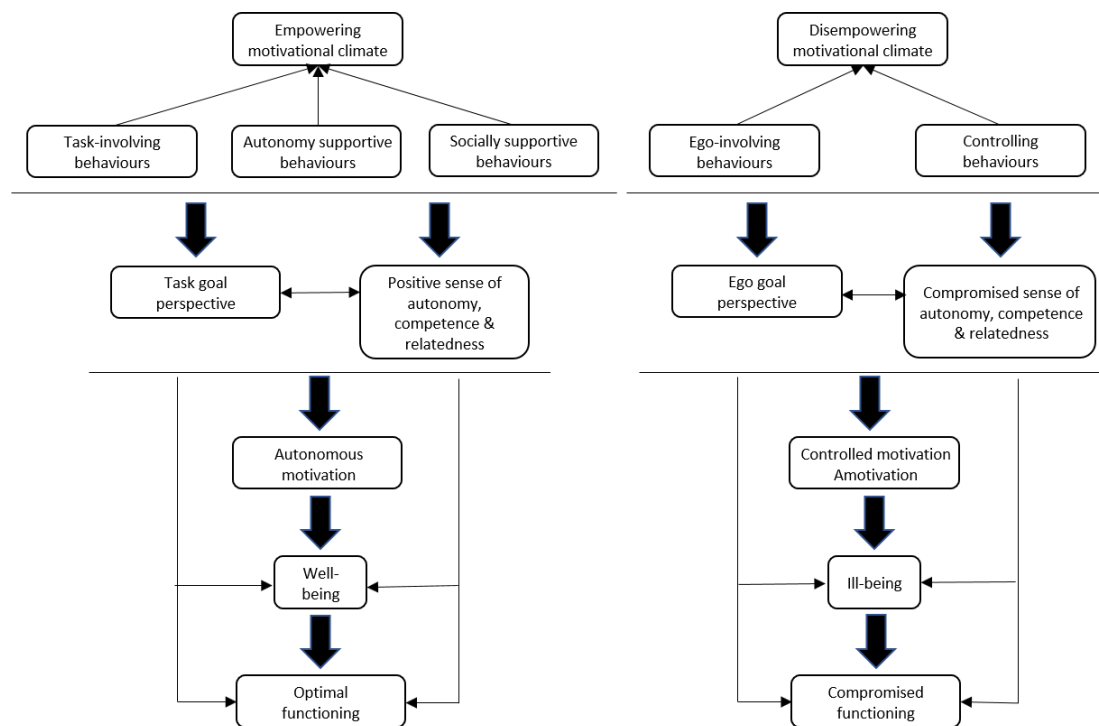
Conceptual links between SDT and AGT have been presented by Duda (1992; in Ntoumanis, 2001) and highlighted by Ntoumanis (2001). These similarities and differences between SDT and AGT should be viewed as complementary and not contradictory (Table 1). Empirical links have also been established between SDT and AGT by Ntoumanis (2001). It was found that task orientation and perceived competence positively predicted all three types of intrinsic motivation and identified regulation. High perceived competence was positively linked to self-determined motivation. Ego orientation positively predicted introjected regulation and external regulation and did not predict amotivation.

Duda et al. (2016, 2018) went further than highlighting conceptual links to form a conceptual model of empowering and disempowering motivational climates along with each climate's consequences upon the participants within those environments (Figure 4). Figure 4 illustrates how a coach/PE teacher within an empowering motivational climate would display task-involving, autonomy supportive, and socially supportive behaviours while a coach/PE teacher within a disempowering motivational climate would display ego-involving and controlling behaviours. The impact of the motivational climate upon learners' motivation and responses relies on how task- or ego-involving the coach/PE teacher is relates to BPNS and motivation. For example, the more task-involving a coach/PE teacher is, the more satisfied the learner will be on their autonomy, competence, and relatedness, culminating in higher autonomous motivation. The more ego-involving a coach is, the learner will experience more autonomy, competence, and relatedness

frustration, which culminates in either more controlled motivation or even amotivation. Following on from this, autonomous motivation leads to well-being and optimal functioning (e.g., enjoyment and embracing challenge) while controlled motivation or amotivation leads to ill-being and compromised functioning (Duda et al., 2018).

Figure 4

The Empowering and Disempowering Model of Motivational Climate.



Note. Adapted from *Towards more empowering and less disempowering environments in youth sport*, J. L. Duda, P. R. Appleton, J. Stebbings, I. Balaguer, 2018.

Recent work has been conducted to combine these two theories within measurements, such as the Multidimensional Motivational Climate Observation System (Smith et al., 2015). This observation tool measures coach-created motivational climates through seven environmental dimensions underpinned by SDT and AGT. Autonomy support, relatedness support, task-involving and structure are

considered empowering (Smith et al., 2017) and controlling, relatedness thwarting and ego-involving are considered disempowering (Duda, 2013). Using this observation system, Smith et al. (2017) investigated the difference in motivational climate between training and competition environments created by UK-based grass-roots soccer coaches. Coaches emphasised autonomy support, task-involving, relatedness-supportive and structure to a significantly greater extent in training than in competition. Coaches were also significantly less controlling and relatedness thwarting during training in comparison to during competition, but were more controlling and thwarted relatedness to a greater extent during competition in comparison to training. This study indicated that context of the environment (training vs competition) affected the behavioural characteristics of the coach.

A study in Chinese adolescents (mean age 18.5 years old) investigated the perceived motivational climate of the Sport Education pedagogy in comparison to regular PE practice (Choi et al., 2020). Students in the Sport Education group perceived their PE lessons to be more empowering and less disempowering than their peers in the control group. This study demonstrates that motivational climates can also be assessed between pedagogical practices and that differences do arise.

In a sample of 112 nine to 16-year-old youth sport participants (football, netball, and hockey teams), perceptions of an empowering motivational climate predicted autonomous motivation (towards sport participation). Autonomous motivation predicted enjoyment, which associated positively with daily MVPA in boys and girls (Fenton et al., 2017). This study indicates providing empowering

motivational climates can not only positively impact participants' affect but also their physical health.

SDT and AGT have also been combined within PE research and enjoyment. Two aspects of intrinsic motivation are interest and enjoyment (Deci & Ryan, 1991). Enjoyment of PE has been found to affect future PA and sedentary habits (Ladwig et al., 2018) and is, therefore, worth investigating.

Table 1

The Similarities and Differences between SDT and AGT.

	Similarities	Differences
1	Both are social cognitive motivation theories.	<p>AGT focuses on the effects of task and ego involvement upon performance and preferences for task difficulty.</p> <p>SDT focuses on goal involvement on intrinsic motivation.</p>
2	Both emphasise the role of social factors as antecedents of achievement-related behaviour.	<p>AGT investigates how perceptions of task and ego involving motivational climates, created by coaches/PE teachers affect cognitive, affective and behavioural factors.</p> <p>SDT investigates how social factors (human and non-human) affect motivation through mediating variables (BPN).</p>
3	Both underline the role of perceived competence in guiding achievement behaviour.	<p>AGT distinguishes between differentiated and less differentiated ability conceptions – leads to an incomplete understanding of motivation.</p> <p>SDT views perceived competence as a unitary need which will lead to self-determined motivation if satisfied – fails to explain how social context influences motivation by promoting one conception of competence over another.</p>

Note. AGT = Achievement Goal Theory, SDT = Self-Determination Theory

Enjoyment

Enjoyment is viewed as a crucial factor within PA and PE. Enjoyment is a significant predictor of vigorous PA in girls but not boys (Trost et al., 1997), and of PA in adults (Lewis et al., 2106). However, a comprehensive review of correlates of PA in children (ages three to 12) and adolescents (ages 13-18) showed that enjoyment was not a significant predictor of PA in either age group (Sallis et al., 2000). A more recent longitudinal study found that enjoyment in 12 to 13-year-olds did not significantly predict PA six years later (Jaakkola et al., 2016). Despite these inconsistent findings, enjoyment positively relates to PA in nine to 13-year-old girls (Best et al., 2017), PA intention in 13-18-year-olds (Bungum et al., 2000) and high levels of motivation in 11-12-year-olds (Yli-Piipari et al., 2009). Enjoyment of PE has been found to decline in nine-year-old girls over two years while remaining consistent in boys (Cairney et al., 2012). This decline has been seen to continue in girls and boys over a three-year period (from age nine to age 12; Prochaska et al., 2003). However, the three BPN, intrinsic motivation and a task-involving motivational climate positively relate to enjoyment in 10-11-year-olds (Jaakkola et al., 2019). Enjoyment has been found to be higher in children aged 14-15 who were categorised as either a 'high autonomy, relatedness, task, and moderate ego climate' or 'high relatedness and task but moderate autonomy and ego climate' group (Jaakkola et al., 2015). It, therefore, seems that enjoyment is a complex concept that can vary between sexes, ages, and outcomes.

It is essential to choose a definition of enjoyment (Kimiecik & Harris, 1996; Scanlan & Simons, 1992; Wankel, 1993) as 1) there are many to choose from and

transparency of thinking is therefore needed, and 2) the definition dictates the tool employed to measure enjoyment. Fun and enjoyment are typically synonymous and interchangeable (Wankel & Sefton, 1989, in Kimiecik & Harris, 1996) in the areas of sport, exercise and PE. Leptokaridou et al. (2016) assessed enjoyment in PE via Scanlan and Simons' (1992) definition of enjoyment through four items using terms such as enjoy, happy, fun and like. They found enjoyment to have small-to-moderate associations with BPN support in 10-12-year-old children. Carroll and Loumidis (2001) used the Pre-Adolescent Attitude toward Physical Education Questionnaire (Shropshire & Loumidis, 1996). Although the authors of this study do not explicitly state which definition of enjoyment they are pursuing, the tool explores liking, interest and value held for PE. They found that boys perceived higher PE enjoyment due to higher perceived competence, in comparison to girls. Cairney et al. (2012), again did not explicitly define enjoyment within their study and used a multi-item enjoyment measure that included enjoyment, fun, and perceived difficulty of games in PE. Again, boys' enjoyment was related to perceived competence. Thus, while previous research indicates that enjoyment is an important factor within PE, there is a paucity of research in children under the age of eight years, and further research is warranted.

Lack of research in younger children may be due to the assumption that young children love PE. Of the limited studies conducted in young children, one study found that 46% of children aged five to 12 rated PE as their favourite subject with 78% rating it within their top three favourite subjects (Coulter & Woods, 2011). However, this study covered a wide age range and did not describe enjoyment per age group, thus making it unclear whether this high PE ranking was representative over the age

group. The lack of research may also be due to lack of appropriate measurement for enjoyment amongst this particular age group. A popular tool for measuring enjoyment is the Physical Activity Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991), validated in children as young as eight (Moore et al., 2009) but not below. Advances in other means for enjoyment self-report in younger children have been made with emoticons and simplified language (Coulter & Woods, 2011; Morano et al., 2019). These measures have demonstrated promising internal consistency and factorial validity, making emoticons a viable solution to the measurement of enjoyment.

Motivation summary

SDT provides a more comprehensive understanding of motivation (in comparison to AGT); however, no study has explored young children's (five to 7-year-olds) motivation for early primary school PE. This age period is essential to understand, motivationally, as MVPA levels begin to decline from the age of school entry (Reilly, 2016). Furthermore, while previous literature in eight to 12-year-olds has reported that motivation for PE declines with age (Chanal et al., 2019), it is vital to understand whether this decrease occurs earlier. Given that children can differentiate between motivational regulations far earlier than first posited (Butler, 2005), examining five- to seven-year-olds motivation for PE warrants further study. However, as discussed in the following section, methods of motivation assessment for this age group are limited and non-existent in PE.

Assessment of motivation

Quantitative assessments

Few tools measuring motivation exist specifically for use with young children. Gottfried (1990) has adapted The Children's Academic Intrinsic Motivation Inventory (CAIMI; Gottfried, 1986) for use in younger children (ages seven to nine; Gottfried, 1990). Guay et al. (2010) modified the Academic Motivation Scale (AMS; Vallerand et al., 1989) to create the Elementary School Motivation Scale (ESMS) designed for six- to nine-year-old children. However, it should be noted that these quantitative tools focused exclusively on intrinsic motivation (Gottfried, 1986, 1990), collapsed motivational constructs (Guay et al., 2010), omitted amotivation and were not PE specific. By isolating single components and grouping constructs into broader categories, these measures are insensitive to motivational intricacies and fail to provide a comprehensive assessment of young children's motivation. Little is known, therefore, about young children's motivation, and a comprehensive tool is needed to gain a broader and more detailed understanding in this under-researched population.

The Self-Regulation Questionnaire-Academic (SRQ-A; Ryan & Connell, 1989) was developed for children aged eight to 12-years-old. It does not collapse regulation types and includes items based on a four-point scale (4=very true, 3=sort of true, 2=not very true, 1=not at all true) for external, introjected, identified and intrinsic motivation. The SRQ-A and the AMS are considered the main scales that assess SDT's motivational constructs within education (Guay et al., 2008). However, these surveys typically capture responses using Likert scales (except for the ESMS which used a double-binary response system), which are unreliable among young children due to

their limited cognitive understanding (Mellor & Moore, 2014). Gelman and Baillargeon (1983) argued that young children think dichotomously; thus, future research should incorporate alternative response formats into assessments (Mellor & Moore, 2014). Research exploring young children's perceived competence has demonstrated success in using structured alternative response formats and utilising pictures within their measurement tools when working with young children (Harter & Pike, 1984; Barnett et al., 2015). Such research instruments could inform the design of assessments of motivation for PE within this age group.

Qualitative approaches to motivation assessment

Children as young as five years of age can describe their internal mental states such as their perceptions, emotions, cognitions and physiological states (Stone & Lemanek, 1990). This capability suggests that qualitative methodologies could elicit young children's voices concerning 'why questions' for motivation in PE. Previous research (Chandler & Connell, 1987) has used a structured interview procedure, and content analysis to explore behavioural regulations towards general 'liked' (e.g., playing a board game) and 'disliked' (e.g., going to bed on time) behaviours amongst children aged five to 13-years-old. Importantly, this research showed that intrinsic, extrinsic and internalised forms of motivation are conceptually and developmentally distinct, and therefore should be explored separately within children's motivational research (not collapsed or omitted). However, while the methodology shows some promise, the study did not examine PE, amotivation was omitted, and the types of behavioural regulation were not delineated. Other research has examined motivation for reading in six- to eight-year-old children through qualitative case

studies (Erickson, 2019), however, again, the study did not examine PE, and the sample size was small due to the methodology (n=8).

Qualitative methods published in other fields of research could offer promising approaches to assessing young children's motivation. For example, the Write and Draw technique (Knowles et al., 2013) alongside semi-structured interviews has effectively captured views on passive smoking in children aged four to eight (Porcellato et al., 2005; Woods et al., 2005). Evolving this methodology, Noonan et al. (2016) developed a humanistic, child-led interactive method called the Write, Draw, Show and Tell. This method has successfully gathered 10 to 11- year-old children's perspectives on PA and may offer a viable means by which to explore BPN and behavioural regulation in younger children.

Evaluation of quantitative and qualitative motivation tools

Despite the positive steps adopted by previous researchers to try and understand young children's motivation through quantitative and qualitative approaches, there have been methodological issues within both types of approaches. For instance, quantitative motivation tools have been evaluated on their language use (e.g., simplification, reader level) by adult experts, such as teachers, in order to ensure that simplified versions of motivation tools are comprehensible to younger children. However, the development processes of such tools were not conducted with the target population. Due to this shortcoming, researchers using these simplified quantitative tools cannot accurately determine that young children understand the questions or the answer format, putting the validity of such tools into question.

Older age groups have had tools developed for them (e.g., the AMS for young adults with average ages of 19.3 and 21.0, the CAIMI for children aged nine years). It perhaps should not be assumed that young children, who vary in development in several systems (cognitive, affective, behavioural, physical), will experience motivation in the same way. The review of the available literature, therefore, suggests researchers must use more creative and child-friendly protocols in order to first determine an accurate perception of young children's motivation before quantifying in a reductionist, quantitative manner. Some qualitative work has explored young children's motivational perceptions; however, a combination of limited studies and those studies involving a small number of participants makes it difficult to understand children's motivational perceptions comprehensively. Reflecting on these methodological concerns, perhaps a mixed-method approach is more appropriate for assessing motivational perceptions in young children.

Mixed-method approaches to assessing motivation in PE

We have seen that tools that assess motivation are limited within young children and non-existent within PE for this age group. A mixed-method approach to assessing motivation in PE in young children has the potential to provide a more comprehensive assessment of young children's motivation (Caruth, 2013; Ponce & Pagán-Maldonado, 2015). For instance, it is well established that from a research perspective, young children are considered quite challenging to conduct research with (Evans & Fuller, 1996, 1998). A mixed-method approach, underpinned by a "what works best" pragmatic philosophy (Creswell & Plano Clark, 2011), may overcome such challenges with this demographic.

Pedagogical models

We have seen, above, that motivational climate can positively impact young children's motor skills (Valentini & Rudisill, 2004), which is a primary outcome for PE (Department of Education, 2013; UNESCO, 2013). However, little is known around the impact of pedagogical models on motivation, within five to six-year-old children, as discussed in the following section.

PE has been identified as an ideal context to help children improve their movement skills (Barnett et al., 2016), which is a crucial element in low SES children's holistic development. As mentioned earlier, as improving motor skills is a primary aim of the National Curriculum (Department of Education, 2013), as well as building a foundation for long-term PA participation (Engel et al., 2018), it makes sense for PE pedagogies in early primary to concentrate on skill development and motivation. PE must develop motor skills while also fostering their motivation in order to create meaningful experiences for children (Beni et al., 2017). Developing FMS through specific pedagogies could support children's skill acquisition and their motivation.

Pedagogy is the method and practice of teaching to deliver the content of the curriculum (Times Education Supplement, 2018). Pedagogical models, typically prioritise learning in a particular domain, culminating in many models from which to choose. Metzler (2005, in Haerens et al., 2011) argues that as PE has diverse content, requiring multiple pedagogical models, and due to work developed by Mosston and Ashworth (1990), states that there is no single best way to teach PE. Kulinna (2008) identifies several curricula and pedagogical models within four categories: games and sports (e.g. sports education model, tactical games model, and the updated multiactivity model), individual and social development (e.g. movement education,

personal-social responsibility model, and the outdoor recreation and adventure education model), fitness and wellness (e.g. health-related PE and conceptual PE programs), and interdisciplinary (e.g. Be Active Kids!), culminating in many models from which to choose.

The current perception of PE is that it has adopted a physical-education-as-sport-technique, falling within the games and sports category, where the teacher is constrained by the rigid and inflexible structure and status in the educational institution (Kirk, 2010). This technique has received similar criticism to the multiactivity model with its lack of depth, inability to engage all students, and failure to offer truly diverse activities (Kulinna, 2008). PE practitioners may have the best intentions when delivering PE to their students; however, continual institutional constraints on timetabling and academic expectations may cause lessons to revert to a physical-education-as-sport-technique. The rigidity within this technique leads to a narrow multi-skills or team sports curriculum where the learning experience is prescriptive, and the learner receives constant corrective feedback in order to reproduce specific movement patterns (Chen et al., 2008; Davids et al., 2012). Also, due to the rigidity and one-size-fits-all approach of the physical-education-as-sport-technique, it is criticised as failing to address the motivational needs of the children (Haerens et al., 2011). This view is fortified by the fact that young children are not achieving the primary outcomes of PE (Bardid et al. 2015; Brian et al. 2017; Foulkes et al. 2015; Morley et al., 2015), meaning they are left unequipped with the necessary tools to be physically active.

Children need the necessary tools to take part in a wide range of activities and reap the positive physical and psychological benefits of PA (Hulteen et al., 2018; Robinson et al., 2015; Stodden et al., 2008). Furthermore, it is integral for any pedagogical model to not only foster this skill development but also foster and sustain motivation for continued participation within PE and outside of school during leisure time, childhood, and into adulthood. Equipped with the right tools and motivation, children can efficiently and functionally explore the multiple environments that they inhabit, not only so they can cope with everyday life but also to find what they enjoy and continue to participate in (Whitehead, 2019). A recent systematic review investigated the effects of pedagogical models within PE upon motivation (Teraoka et al., 2020). This systematic review reported that most studies demonstrated positive effects on motivation when using a student-activated teaching approach, Sports Education, Cooperative Learning, or autonomy-supportive teaching. Differential effects of these models, plus Teaching Games for Understanding and TARGET-based lessons, were reported for BPNS. Taking this all into account, using a pedagogical model underpinned by Motor Learning Theory may result in better skill acquisition within PE. The following sections will discuss Motor Learning Theory and how it underpins two different pedagogies.

Motor learning theory and pedagogy

Motor learning theory

The focus of motor learning research is the learner, the learning process, and factors that influence skill learning (environment, task, and learner). In contrast, pedagogical research typically focuses upon the teacher and the behaviours of teachers that influence learning (Magill, 1990). Both aspects are crucial in

understanding FMS development in children. Therefore, it could be argued that Motor Learning Theory and pedagogy are two sides to the same coin. Although studying these aspects of teaching and learning are typically conducted in isolation, Magill (1990) suggests and evidences that information from motor learning can help direct the decisions that teachers make in their teaching.

Information-processing theory. Initially, motor behaviourists took inspiration from the conception of computers and their information processing capabilities. They created the closed-loop theory, which stated: “provision of the receipt of feedback, the feedback was checked against some reference of correctness, any discrepancy resulted in an error, and the error was subsequently corrected” (Schmidt, 1975, p. 226). Adams (1971) then built on the closed-loop theory by introducing one-to-one mapping of movements. Schmidt (1975) addressed the inherent storage problem of one-to-one movement mapping by introducing the generalised motor programme per class of movements. The crux of Schmidt’s Motor Learning Theory is that of schema production. The process of creating schema consists of an individual storing four elements to satisfy a goal: the initial condition, the response specifications for the motor program, the sensory consequences of the response produced, and the outcome of the movement.

Fitts and Posner (1967, in Ackerman, 1988) describe skill acquisition through three phases within an information-processing theory perspective: cognitive, associative, and autonomous. Children within the cognitive phase experience a high cognitive-attentional demand, which makes the performance of a skill slow and error-full. During the associative stage, the stimulus-response connections strengthen

where the movement pattern necessary for skill acquisition fully formulate. The autonomous stage is characterised by fast and accurate performance, demonstrating competence even when concentration is simultaneously split, making movements automatic and wielding low cognitive demand on the learner. Schmidt (1975) defined learning as an internal change which was relatively permanent as a function of practice. Relative permanency of learning as a function of practice sees learners progressing linearly, through the learning stages outlined by Fitts and Posner. This view on learning is in contrast to the view held by another Motor Learning Theory: ecological dynamics.

Ecological dynamics. “...there would be no point in perceiving if one could not act, and one could hardly act if one could not perceive” (Turvey, 1977, p. 211). The interaction between the environment and the individual acting within it (Gibson, 1979) is the main idea within ecological dynamics. Ecological Dynamics is a combination of two elements, ecological psychology (Gibson, 1979) and dynamical systems theory (Bernstein, 1967). Ecological psychology (Gibson, 1979) describes the constant reciprocal interaction between an individual and the environment through which they are moving. The individual perceives information within the environment, which encourages movement within the individual. Movement from the individual then allows more information from the environment to be perceived, and so and so forth. Dynamical systems theory (Bernstein, 1967) views each individual as a complex system made of many interacting parts, and that the interactions between these parts constrain movement. Ecological Dynamics, therefore, regards learners as complex systems that are afforded opportunities for action from their environment.

Bernstein (1967) describes learners as complex systems due to the degree of freedom within the movement. The meaning of degrees of freedom within learners is illustrated within ecological psychology and Newell's (1986) skill differentiation: coordination, control, and skill. A learner who is in the coordination stage is identified due to their inflexible and rigid movement to affordances (i.e., opportunities for action). In the control stage, children's movements are smoother and less rigid. Children in the control stage seek out and explore different movement solutions. A child is identified within the skill stage once they can exploit environmental factors to enhance and execute goal-directed movements that are energy-efficient and effortless. Adolph (2019) proclaims that a mental library of movement solutions, like in Information Processing Theory, is not viable in the long-term as the solution that worked previously may not work with the maturing body, development of skill and changing environment. This criticism of a mental library is especially true in young children as they are still developing physically, as well as cognitively and affectively. Essentially this means that due to the significant leaps in growth that children experience, they can go to sleep in one body and awake in an effectively different one, i.e., 'learning in development' (Adolph, 2019, p.183). Indeed, learning can appear and disappear, for example, infants are known to learn how to take steps one day, and not on the next but then can step again after its disappearance (Thelen & Fisher, 1982). This emergence and disappearance of this stepping skill is due to a match and then mismatch between mass and strength, coupled with the infants' neuromotor systems.

Here we have two contrasting motor learning theories. Information Processing Theory suggests that learning is linear and permanent, resulting from

repetitive practice that strengthens schemas and focuses upon consistency. Ecological Dynamics suggests that learning is nonlinear, where movement can appear and disappear, with maturation and changing environments and focuses on flexibility. Both theories underpin contrasting pedagogical approaches to PE and are discussed in the following section.

Pedagogy

Linear pedagogy. Information Processing Theory underpins the Direct Instruction Model (Metzler, 2017), which is a popular pedagogy within PE. The Direct Instruction Model is a teacher-centred pedagogy grounded in behaviourism, with the responsibility of content development, class management, student accountability, and student engagement lying with the teacher (Metzler, 2017). Typical teaching techniques within the Direct Instruction Model are: monitoring student performance, providing corrective feedback, increasing engagement through the use of small-group instruction, and unison responding (Stein et al., 1998). The Direct Instruction Model creates 'closed' environments that are highly controlled and structured that first concentrate on the technical proficiency of the skill before applying the learned skill within an 'open' environment of a performance context such as a game (e.g., football, mat-ball, dodgeball). Emphasis is on the repetitive practice of a prescriptive action where learners try to replicate the optimal template that the teacher demonstrates. As there is an optimal template to aim towards, variability in skill execution is squashed until the learner can execute the movement efficiently and reliably, and feedback from the teacher is typically didactic.

The Direct Instruction Model and Information Processing Theory are conceptually and practically aligned: The Direct Instruction Model has a one-size-fits-all approach to teaching. Progression through Information Processing Theory's skill acquisition phases (cognitive, associative, autonomous) is assumed to be similar between children. The Direct Instruction Model has a top-down approach (teacher-centred, behaviouristic) as does Information Processing Theory (a central system that rules behaviour). Feedback from the teacher is corrective within the Direct Instruction Model, and deviations from the motor program are corrected within Information Processing Theory. Both prefer a 'closed' environment during the initial stages of skill acquisition, squashing variability where quick feedback informs corrections. Due to the linear progression through the learning stages, this combination of the Direct Instruction Model and Information Processing Theory is labelled Linear Pedagogy (LP; Rudd et al., 2020a) and will be referred to as such during the rest of the thesis. LP characteristics can be seen in Table 2.

Developing proper technique or proficiency is a central component of LP. It has helped improve FMS in five- to seven-year-olds (Matvienko & Ahrabi-Fard, 2010), six to eight-year-olds (Ayers et al., 2005), 7-8-year-olds (Gusthart & Sprigings, 1989) and 12-13-year-old children (Kalaja et al., 2012). Housner (1990) describes the merits of the Direct Instruction Model as well defined, easily taught, appealing, and empowering to teachers and effective in promoting student achievement. Critics of this approach state that the Direct Instruction Model is mechanistic and potentially harmful to student attitudes and motivation (Housner, 1990). Of the 14 studies included in Teraoka's (2020) systematic review that used pedagogical models, none

used a Direct Instruction Model approach. Therefore, there is little evidence to show how LP influences motivation.

Table 2

Linear Pedagogical Characteristics and their Descriptions.

Pedagogical characteristic	Description
1 A singular optimal movement pattern	Each FMS has an optimal template to replicate. PE teachers demonstrate the skill and children practice the movement repetitively through drills to replicate the movement.
2 Skills are broken down into components	Each FMS is broken down into stages of movement which are practised in isolation before recombining as a whole skill.
3 Movement variability is squashed	Variance in movement is seen as 'noise' and indicates an inconsistency in performance. Repetitive practice creates an efficient, reliable and accurate movement skill performance.
4 Internal focus of attention	The PE teacher instructs children to focus on the movement itself, or parts of the body, rather than the outcome of the movement (i.e., external focus).

Nonlinear pedagogy. Ecological dynamics support NLP through five principles: manipulation of constraints, representative learning design, developing relevant information-movement couplings, ensuring functional variability, an external focus of attention (Chow et al., 2015; outline in Table 3). The premise of *constraint manipulation* assumes that movement solutions emerge within a perceptual-motor landscape (Davids et al., 2008a). Perceptual-motor means that learners can adapt their movements to a dynamic environment based on different information that is being offered by that dynamic environment (Chow et al., 2009). The movements that are produced by an individual are constrained by internal mechanisms such as the anatomical organisation of the learner (weight, height,

fitness) and intention (motivation to act), and also external mechanisms such as visual, auditory, or haptic information.

A representative learning design allows for situated and authentic learning through a ‘bottom-up’ manner (Davis et al., 2006), developing the learners’ ability to problem-solve and make appropriate decisions in the moment (Fajen et al., 2009). Regarding skill acquisition, a representative learning design supports the transference of learning from PE to physical activities outside of school, and vice versa, due to these similarities in available information from the environment.

Table 3

Nonlinear Pedagogical Characteristics and their Descriptions.

Pedagogical characteristic	Description
1 Manipulation of constraints	Three types: <i>individual</i> (e.g., height, weight, cognition, and motivation) <i>environment</i> (physical, e.g., ambient light, temperature; socio-cultural, e.g., peer groups, family support, values and cultural norms) <i>task</i> (e.g., equipment, task rules, and the number of players).
2 A representative learning design	A learning environment that consists of a similar informational flow found in a performance environment.
3 Development of information-movement coupling	Macro-level: Learners attune to picking up relevant sources of information from the environment so that they can make sound tactical and physical decisions around their movements. Micro-level: simplification of skill rather than a break down into its constituent parts.
4 Functional variability	‘Noise’ in movements is considered as a necessary bi-product of exploratory activities, which guide the learner to discover individualised functional solutions.
5 An external focus of attention	The learner focuses on the outcome of a movement rather than on the action itself.

The development of *information-movement coupling* links heavily to ecological psychology (Gibson, 1979) and that of affordances. Affordances are opportunities for action and are dependent upon the skill capabilities and state of the individual matching with the state of the environment (e.g., intrinsic dynamics of the individual and the environmental dynamics). Affordances are always present within the environment. Perceiving affordances is dependent upon the learner's skill level and motivation to act upon that affordance.

Perturbation is a crucial element within exploratory learning environments to ensure *functional variability*. Here, the PE teacher recognises that a child has reached a movement plateau and is performing a skill in the same way over the practice period. The PE teacher can perturb the learning experience by manipulating task constraints to make the task harder or easier so that the child is encouraged to stop performing that skill and to think of another way to solve the movement problem. Functional variability benefits the learner as it supports them to think creatively and produce movements that are not directly taught but satisfy the outcome goal of the activity.

An *external focus of attention* evokes a subconscious control of movement and encourages self-organisation processes in movement control. From an NLP perspective, self-organising processes should be used by which an external focus of attention facilitates these processes (Chow et al., 2009). Due to this subconscious control of movement evoked by an external focus, it frees-up cognitive capacity for learners in the coordination stage (low-skilled).

NLP has shown promising results in improving skill development (Barris et al., 2014; Clark et al., 2019; Greenwood et al., 2016), decision making and performance behaviours (Práxedes et al., 2019; Roberts et al., 2020), and divergent thinking (Richard et al., 2018). The previously mentioned systematic review (Teraoka et al., 2020) that looked at intervention programmes' influence on affective outcomes (e.g., motivation) found that pedagogical models had a differential effect upon motivation outcomes (need satisfaction). Although this demonstrates a link between pedagogy and motivation, none of the included studies used an NLP approach. Also, of note, which also highlights the consistent gap in the literature, was that no study included children under the age of nine. This lack of research with younger children also applied in the NLP skill development literature; a limited number of studies have been conducted with primary school-age children (ages five to 11). Except for Richard et al. (2018) who explored divergent thinking in children with a mean age of 9.56 years, most skill acquisition studies have been conducted in older children, adolescents and athletes.

Although NLP's effect upon motivation as a whole has not been investigated in younger children, a systematic review (Buszard et al., 2016) demonstrated the effects of scaled equipment (e.g., size appropriate tennis rackets, smaller courts, lower nets) on psychological, skill performance, biomechanical, and cognitive processing factors in four to 14-year-old children. The systematic review examined 25 studies that investigated the effects of scaled equipment in tennis, basketball, FMS, and, to a lesser extent, volleyball. Psychologically, scaled equipment led to more engagement in eight-year-old children due to achieving more success during tennis practice. Six to 11-year-old children experienced higher 'shot-efficacy' where they felt

they could achieve the desired effect from shooting in basketball. As highlighted by Buszard et al. (2016), a heightened sense of mastery is an indicator of motivation (Duda & Nicholls, 1992). Motivation leads to higher PA, which increases the likelihood of skill acquisition, or mastery, which then heightens motivation, creating a cyclical process.

Pedagogy and self-determined motivation

Few empirical studies have investigated NLP and LP's effect upon need satisfaction and enjoyment during movement skill learning in PE, nor the motivational climates these pedagogies provide. Moy et al. (2016) found that NLP demonstrated more significant improvements in enjoyment, effort and intrinsic motivation over LP; however, it should be noted that this was in young adults (mean age of 20.5 years). Qualitatively, NLP facilitates perceived competence, autonomy, and relatedness (Lee et al., 2017) in nine to 10-year-old children; however, no differences in intrinsic motivation were found between NLP and LP. Thus, there is a paucity of research that has investigated the motivational climates that pedagogies provide and the effects of pedagogy upon motivation and enjoyment, especially in younger children.

Summary

Motivation is integral within the holistic development of children, as without motivation, children become apathetic (Whitehead, 2019). As sedentary lifestyles are highly prominent in today's world, it is crucial now more than ever to keep children motivated in PE as motivation in PE transfers to PA outside of school (Jaakkola et al., 2013; Standage et al., 2003). A decline in motivation in PE has been captured in

children from as young as eight years of age (Chanal et al., 2019). It is not known if this decline occurs sooner as there are no appropriate measures currently in existence that can assess motivation in young children (Sebire et al., 2013).

Motivation is complex and as such, requires an assessment tool and methods that appreciates that complexity. SDT seeks to understand motivation from a content (what) and process (why) perspective and therefore allows a comprehensive understanding of motivation. AGT has been used a lot in young children's motivation research (Liu et al., 2017); however, it only provides part of the motivation picture due to its focus upon competence-related goals (Ntoumanis, 2001). Despite this, AGT does provide information around motivational climates, aligns well with SDT (Ntoumanis, 2001), and is specific to achievement-related contexts, such as PE, and should therefore be used in motivation research with young children. There is a paucity of motivation research in PE with children under the age of eight (Vasconcellos et al., 2019), which needs addressing if researchers are to help support ongoing participation in PE.

Enjoyment is an integral component of intrinsic motivation (Ryan & Deci, 2000) and is considered synonymous with fun within sport and exercise research (Wankel & Sefton, 1989, in Kimiecik & Harris, 1996). Enjoyment of PE has been linked with adult PA participation and sedentary behaviour (Ladwig et al., 2018) and has seen to decline from the age of nine (Cairney et al., 2012; Prochaska et al., 2003). Therefore, it is crucial to investigate this component within younger children to understand how to best support their enjoyment of PE as they mature.

Self-determined motivation in PE has been found to positively influence enjoyment, intention, and leisure-time PA in school-aged children (Vasconcellos et al., 2019). Within SDT, BPNS has been found to positively influence positive affect, subjective vitality, and physical well-being in sport and exercise within adult populations (Rahman et al., 2011; Reinboth et al., 2004). However, little is known about the consequences of motivation in PE for younger children. It is important to understand the predictive capability of young children's motivation upon other PE related outcomes (e.g., motor competence, motor creativity, MVPA). If motivation is important for these outcomes, this indicates that supporting young children's motivation should have a more central focus in primary PE aims. Researchers must glean this motivational information as motivation drives all behaviour, including skill development.

Motor skill levels in young children within the UK, and globally, are low, especially in disadvantaged children. This low skill level means that disadvantaged children are more likely to suffer adverse consequences, physically, cognitively and affectively (Lubans et al., 2010; Utesch et al., 2019). PE is a mandatory element of the National Curriculum; therefore, all children participate. Skill acquisition has been found to improve with the application of Motor Learning Theory (Ayers et al., 2005; Barris et al., 2014; Clark et al., 2019; Greenwood et al., 2016; Gusthart & Sprigings, 1989; Matvienko & Ahrabi-Fard, 2010). It would be reasonable to assume that PE underpinned by Motor Learning Theory would help children gain the necessary tools for PA participation. However, the extent to which pedagogies underpinned by Motor Learning Theory (LP and NLP) motivationally impact disadvantaged children has not

yet been investigated. Exploration of the motivational climates of such pedagogies should be conducted in order to inform future best practice in PE.

Research aims and objectives

This PhD thesis, therefore, seeks to explore five to six-year-old children's motivation for PE. The first main aim is to develop a novel mixed-method measurement tool to assess contextual basic psychological needs satisfaction, self-determined motivation and enjoyment in young children. The second main aim will seek to explore the motivational climates of pedagogies underpinned by Motor Learning Theory, providing a more comprehensive exploration of motivational processes, and their impact upon young children's situational motivation. These aims will be achieved through the following objectives in each study and their respective chapters. The theoretical underpinning of the thesis and the related studies are depicted in Figure 5.

Study 1: Development, content validity and utility of the Motivation Assessment Tool for Physical Education (MAT-PE) among young children

Chapter 3

- To develop a mixed-method tool for assessing young children's basic psychological need satisfaction, self-determined motivation, and enjoyment.
- To ascertain the content validity of the tool.

Chapter 4

- To develop a codebook in order to integrate the quantitative and qualitative strands of the tool.
- To ascertain the content validity, acceptability, inter- and intra-rater reliability of the codebook.

Study 2: Utility and predictive validity of the MAT-PE

Chapter 5

- To investigate the utility of the tool and codebook.
- To describe the motivational profiles of 79 children aged 5-6 years.
- To ascertain the predictive validity of the MAT-PE and other PE outcomes such as motor proficiency, motor creativity and MVPA.

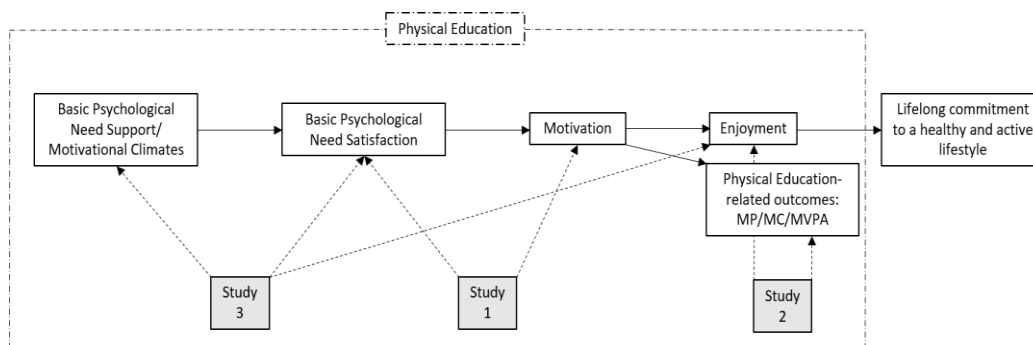
Study 3: Influence of linear and nonlinear pedagogy on motivational climate, need satisfaction and enjoyment in Physical Education among 5-6-year-old children.

Chapter 6

- To explore the potential for two pedagogies underpinned by Motor Learning Theory (NLP and LP) in providing empowering and disempowering motivational climates in comparison to usual PE provision.
- To explore to what extent both pedagogies support empowering and disempowering environmental dimensions.
- To explore young children's BPNS and enjoyment within PE.

Figure 5

The Main Motivational Theoretical Underpinning of the Thesis and Related Studies.



Note. Black arrows indicate the theoretical order and direction; dotted arrows indicate the links between studies and motivational variables. MC = Motor Creativity, MP = Motor Proficiency, MVPA = Moderate-to-Vigorous-Physical-Activity.

Theoretical, methodological, and ethical considerations

Theoretical considerations

This thesis is underpinned by two main theories: SDT and Motor Learning Theory. SDT differs from previous motivation theories (drive and cognitive), as it differentiates between types and sources of motivation that influence the quality of behaviours (Ryan & Deci, 2017). The Motor Learning Theories underpinning this work are Ecological Dynamics and Information Processing Theory. Ecological dynamics views learning as a bottom-up process, while Information Processing Theory views learning as a top-down process. More specifically, Ecological Dynamics views learning as a reciprocal relationship between learner and environment while Information Processing Theory views learning through the use of schemas.

As such, there is an almost automatic synergy between SDT and Ecological Dynamics. At the simplest form, both rely on interactions with the environment. Within SDT, *internalisation* is considered a ‘natural growth process – a process of

active learning and self-extension' (Ryan & Deci, 2017, p. 180), which develops through interacting with the environment. Thus, the more the environment supports interaction with it, the more self-determined learners become within movement tasks. It could, therefore, be argued that children within a learning environment supported by Information Processing Theory are theoretically at a motivational disadvantage. However, Information Processing Theory theoretically provides many opportunities for supporting structure, which is important for perceptions of competence in children and might enhance motivation.

In essence, Ecological Dynamics is theoretically primed for supporting children's autonomy, while Information Processing is theoretically primed for supporting children's competence. One of the aims of this thesis is to empirically explore this and investigate the embedded motivational support within both Motor Learning Theories.

Methodological considerations: Mixed-methods

A mixed-method approach to assessing motivation in PE in young children has the potential to provide more comprehensive information than using one design (quantitative or qualitative), enabling richer insights to be captured surrounding children's interpretations of their experiences (Caruth, 2013; Ponce & Pagán-Maldonado, 2015). Numerous mixed-method designs can answer a research question (Creswell & Plano Clark, 2011) and are shown in Table 4.

Although using an already established mixed-method design is popular, a dynamic approach to mixed-methods can also be used (Maxwell & Loomis, 2003). The dynamic approach requires the consideration of five interconnected

components: the study's purpose, conceptual framework, research questions, methods, and validity considerations. Regardless of the adoption of an established mixed-method design or a more dynamic approach, four elements help determine the design (Creswell & Plano Clark, 2011): the level of interaction between the quantitative and qualitative strands, the relative priority of the strands, the timing of the strands, and the procedures for mixing the strands.

Combining methods is challenging, and therefore a reason for mixing is necessary and should be explained. Reasons for mixing include several choices according to Bryman (2006), including but not limited to: triangulation, completeness, different research questions, explanation, unexpected results, instrument design, sampling, credibility, and illustration.

Table 4

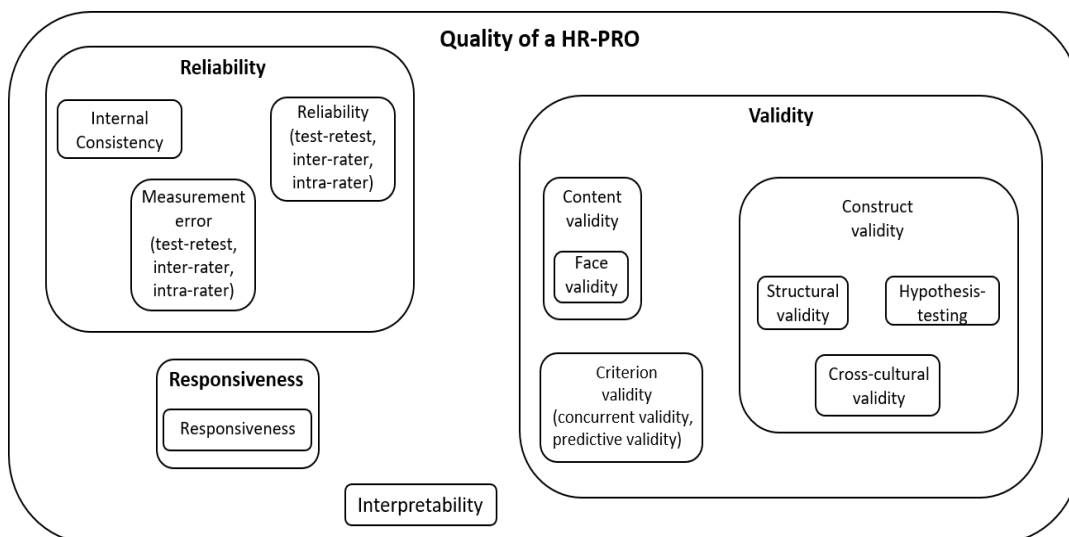
Descriptions of the Six Main Mixed-Method Designs.

Mixed-method design	Description
The convergent parallel design	The quantitative and qualitative data are captured during the same phase and analysed separately before being merged during interpretation.
The explanatory sequential design	The quantitative data collection and analysis is followed by qualitative data collection and analysis where both are merged at interpretation.
The exploratory sequential design	A broader qualitative data collection leads to a narrower quantitative data collection before interpretation.
The embedded design	The quantitative data is embedded within a qualitative study design or vice versa.
The transformative design	The quantitative data collection and analysis is followed up with qualitative data collection and analysis and then is interpreted, all within a transformative framework.
The multiphase design	The qualitative data is captured in study one, which informs quantitative data collection in study two, which informs mixed methods in study three, all within an overall program projective.

When designing a new tool, be it quantitative or mixed-method, there are essential aspects to consider, such as validity and reliability. The qualitative approach has its own set of validity- and reliability-like considerations, although they are termed and thought about differently due to philosophical differences (Noble & Smith, 2015; Smith & McGannon, 2018). The COnsensus-based Standards for the selection of health status Measurement INstruments (COSMIN; Mokkink et al., 2010) is a checklist developed via a four-round Delphi study to evaluate the methodological quality of studies on measurement properties. The agreed checklist is illustrated in Figure 6. Twenty experts took part in all four rounds and had an average number of 20 years of experience in measuring health or comparable outcomes (e.g., educational or psychological measures). Health-related patient-reported outcomes (HR-PRO) were the central focus as measurement instruments in this area are complex, multidimensional and not directly observable (Mokkink et al., 2010). This checklist can apply to motivation tools as motivation is complex, multidimensional, and not directly observable.

Figure 6

Agreed Upon Measurement Properties within the COSMIN Checklist



Note. Adapted from *The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study*, L.B. Mokkink, C.B. Terwee, D.L. Patrick, J. Alonso, P.W. Stratford, D.L. Knol, L.M. Bouter & H.C.W. de Vet, 2010, p. 542, Quality of Life Research.

Measurement validity and reliability

Validity. Validity is the extent to which a concept is accurately measured (Heale & Twycross, 2015), where, in this case, does the new tool measure enjoyment, BPNS and behavioural regulation? If so, then it is valid, if not, then it is not valid. COSMIN (Mokkink et al., 2010) guidelines state that validity should be measured through content validity, construct validity and criterion validity. Descriptions for each type of validity are in Table 5. Content validity is arguably the most important psychometric property to determine the suitability of a measurement tool as, without content validity, other types of validity cannot be conducted (Prinsen et al., 2018).

Table 5*Types of Validity and their Descriptions.*

Type of validity	Description
Content	The extent that items and instructions are relevant (are the questions relevant to the construct?), comprehensive (is each aspect supported conceptually in accordance to the theoretical framework?) and comprehensible (does the target population understand the questions and answer format?) (Terwee et al., 2018)
Construct	The extent to which an instrument measures the intended construct (Heale & Twycross, 2015)
Structural validity	The degree to which the scores of an instrument are an adequate reflection of the dimensionality of the construct (van Bruggen et al., 2020)
Hypotheses-testing	The extent to which results reflect theoretically derived predictions about the relations between constructs (Wampold et al., 1990)
Cross-cultural validity	Whether measures generated initially in a single culture are applicable, meaningful and thus equivalent in another culture (Matsumoto, 2003)
Criterion	How a measure effectively estimates an individual's performance on some outcome measure(s) (Lin & Yao, 2014)
Concurrent	Test scores and criterion scores are taken simultaneously to demonstrate the extent test scores correctly estimate an individual's present condition on a relevant measure (Lin & Yao, 2014)
Predictive	The extent scores on a scale applied earlier predict scores on some later measure (Cronbach & Meehl, 1955).

According to COSMIN (Terwee et al., 2018), a tool has good content validity when its items and instructions are relevant, comprehensive and comprehensible. In order to do this, the target population should be involved so that the items are relevant to them as irrelevant items lead to failure to measure the target population's perceptions (Wiering et al., 2017). Some methods of validity are not possible for every instrument, for example, to determine structural validity, a measure needs multiple items per construct (van Bruggen et al., 2020), therefore if a measure has only global items, this type of validity cannot be ascertained.

Reliability. Reliability refers to the consistency of an instrument (Heale & Twycross, 2015) and includes three aspects, according to COSMIN: internal consistency, reliability and measurement error. Descriptions for each type of reliability are in Table 6. Cronbach's alpha is a standard test used for determining the internal consistency of an instrument. This test averages all correlations in every combination of split-halves where scores can be between 0 (absolutely no internal consistency) and 1 (perfect internal consistency). A score of .75 and above is considered as good reliability (Portney & Watkins, 2009). This type of reliability is only possible for instruments that have at least two items for each construct within the instrument (rather than the use of global items).

Stability is assessed through a test-retest where participants are given the same instrument more than once at least five days apart. A high correlation in scores between the two administrations demonstrates stability, where a correlation of .50 or over is considered strong (Statistics, 2013). In regards to motivation and this form of reliability, a test-retest on situational motivations would not be appropriate due to the situational, and therefore specific, nature of the motivation felt at the time of administration. Instruments aimed at the global or contextual levels of motivation would benefit from conducting this type of reliability as they are considered more stable forms of motivation (Vallerand, 2007). Intraclass Correlation Coefficient (ICC) values of 0.75 and above are considered excellent (Cicchetti, 1994) for determining inter- and intra-rater reliability.

Table 6*Types of Reliability and Their Descriptions.*

Type of reliability	Description
Internal consistency	The extent to which items within an instrument measures various aspect of the same construct (Revicki, 2014)
Reliability	
Test-retest	The degree to which scores remain unchanged when measuring a stable individual characteristic on different occasions (Vilagut, 2014)
Inter-rater	The extent to which two more raters agree; consistency of the implementation of a rating system (Lange, 2011)
Intra-rater	The extent of self-consistency in scoring (Lange, 2011)
Measurement error	The precision of the instrument; measurement error indicates the magnitude of the uncertainty around an observed score (De Vet et al., 2011) – of test-retest, inter-rater, and intra-rater reliability

Ethical considerations when conducting research with young children

Conducting research with young children has an added layer of ethical consideration due to their young age, as highlighted by the Declaration of Helsinki (World Medical Association, 2001). Children younger than 16 years are argued by some to be unable to provide legal consent, and therefore assent is obtained. Therefore, within this project, tiers of ethical consent/assent were obtained: Gatekeeper, parental, and child (Shaw et al., 2011). Gatekeeper consent allowed all children in the intervention groups to participate in the PE lessons. Parents were given project information packs containing consent/assent forms. An actioned consideration was the provision of child-friendly information packs. If consent/assent forms were returned with parental consent but no child assent, researchers took the time to sit with those children, explained the project to them, allowing for questions, and children were then asked if they assented to take part in the project.

Confidentiality and anonymity were an important consideration during this project (Shaw et al., 2011). All children's data were anonymised and saved under password-protected computers. Children 'in care' were avoided being captured when video recordings were being conducted. Only children whose parents opted-in for information dissemination (e.g., at conferences) were photographed and only children whose parents consented to video/audio recording were recorded.

Child protection was also a consideration within this project, as highlighted by the National Children's Bureau (Shaw et al., 2011). I attended a child protection workshop before the commencement of the project. Since we were working with young children, low SES children, and due to the one-to-one nature of some of the activities, I needed to be vigilant and aware of child protection aspects such as abuse, neglect and the potential of disclosure from children. A related point, regarding disclosure, saw that I should be mindful if children discussed topics that were not directly related to the project. In this case, I should either turn off any recording equipment (e.g., Dictaphone during one-to-one activities) or not transcribe those verbal disclosures during transcription. Other ethical considerations include respect, justice in fairly sharing the burdens and benefits of research, avoidance of harm, prevention of risk and beneficence (Alderson, 2015).

Chapter Three

Study One:

The development and content validity of the Motivation Assessment Tool for Physical Education (MAT-PE)

Based on a paper under review at Psychology of Sport and Exercise:

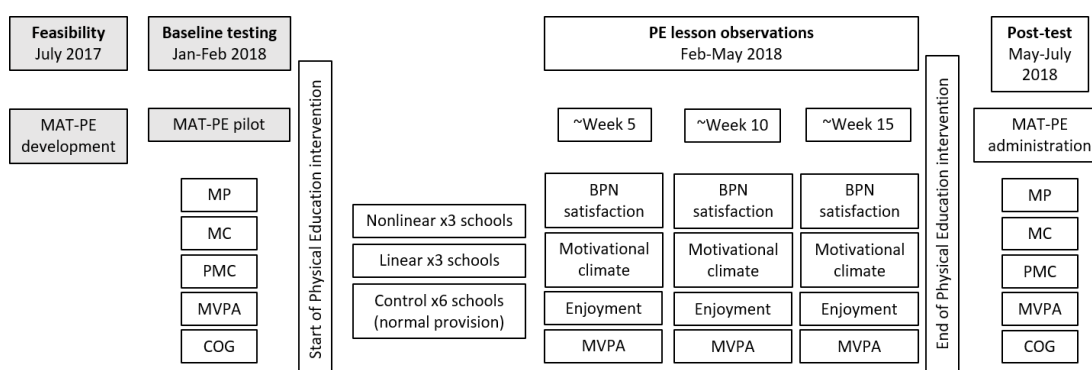
Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. (under review). Development, content validity and utility of the motivation assessment tool for physical education (MAT-PE) among young children. *Psychology of Sport and Exercise*.

Thesis study map

Chapter Three (Study One):	Objectives:
The development and content validity of the Motivation Assessment Tool for Physical Education (MAT-PE)	<ul style="list-style-type: none"> To develop a mixed-method tool for assessing young children's enjoyment, BPNS and behavioural regulation within PE. To ascertain the content validity of the tool through the research team and independent researchers.

Figure 7

The Placement of Study 1 within the RCT (greyed).



Note. MAT-PE = Motivation Assessment Tool for Physical Education, MP = Motor Proficiency, MC = Motor Creativity, PMC = Perceived Motor Competence, MVPA = Moderate to Vigorous Physical Activity, COG = Cognition, BPN = Basic Psychological Needs

Abstract

Introduction: It is important to understand young children's motivation within PE so that researchers and teachers can effectively support children's physical, affective, social, and cognitive development as well as PA behaviours. However, there is a dearth of motivation research in PE with children under the age of seven due to a lack of developmentally appropriate assessment tools. **Aims:** This chapter outlines the development and content validity of a novel, mixed-method tool to assess young children's enjoyment, basic psychological needs and behavioural regulation within PE (MAT-PE). **Methods:** Stage 1 consisted of the iterative development of the MAT-PE

through working with 43 young children (ages 5-6) from three primary schools located within a large city in North West England. This work culminated in MAT-PE version 1. Stage 2 consisted of the content validity assessment in a sample of 85 children (ages 5-6) from 12 primary schools located within a large city in North West England. Content validity was determined via the research team and also via an independent sample of SDT researchers. **Findings:** Development of the MAT-PE resulted in a seven-stage, activity-based tool which was determined to have content validity by the research team and the independent sample of SDT researchers.

Introduction

PE promotes many vital aspects of positive development for primary school-aged children (5-11-years-old) including physical, affective, social and cognitive outcomes whilst also supporting healthy lifestyles (Bailey, 2006; Bailey et al., 2009; Casey & Goodyear, 2015; Hills et al., 2015). For example, PE engagement promotes children's PA (Sallis & McKenzie, 1991; Sallis et al., 2012), FMS (Lemos et al., 2012; Loprinzi et al., 2015), PMC, motivation and enjoyment (Carroll & Loumidis, 2001; Chen, 2014), social interaction (Tsangaridou & Lefteratos, 2013) and academic achievement (Marques et al., 2017; Rasberry et al., 2011). Young children (aged 4-7 years) recognise the subject of PE as a forum for learning how to move their bodies, to exercise and get fit, and can recall activities completed during PE lessons (Solmon & Carter, 1995). Accordingly, early learning experiences in PE are considered critical for sustained participation in PA (Hills et al., 2015; Kirk, 2005), with the enjoyment of PE positively affecting future attitudes and intention towards PA (Ladwig et al., 2018). Actual and perceived competence are important determinants of PA in youth which contributes towards success and enjoyment (Hills et al., 2015). Motivation is a mechanism that helps sustain behaviour within PE, thereby supporting actual and perceived competence. Understanding how to foster and sustain motivation in children within primary PE is therefore crucial for supporting their PA participation (Jaakkola et al., 2013; Standage et al., 2003), physical literacy and holistic well-being (Whitehead, 2019).

The present chapter is concerned with young children's contextual motivation toward PE (Vallerand, 1997). Specifically, young children's ability to conceptualise a)

the motivating factors driving their PE behaviours, and b) the social-contextual factors within the PE environment that relate to the satisfaction of autonomy, competence, and relatedness. These are the central tenets of OIT and BPNT, which of the six mini-theories within SDT (Ryan & Deci, 2017), are arguably the most widely used in PA (Teixeira et al., 2012) and PE research (Vasconcellos et al., 2019). For children to flourish in wellbeing and performance, three BPN must be supported and satisfied within the social environment, leading to autonomous motivation (Milyavskaya & Koestner, 2011; Standage et al., 2012). The extent of internalisation (and the quality of motivation) and need satisfaction experienced by a child in PE is dependent upon the extent to which the three BPN are supported by their PE teacher's delivery style and the PE environment. Autonomy can be supported by providing meaningful choices, competence by providing guidance, and relatedness by providing a friendly demeanour (Ryan & Deci, 2017). Thus, autonomy, competence and relatedness act as mediators between the contextual factors (PE teacher and children's peers) and contextual motivation (intrinsic, extrinsic and amotivation) (Vallerand, 1997).

Across the globe, research supports the use of SDT as a framework for supporting positive experiences and participation in PE. In the USA, Erwin et al. (2013) found that autonomy support (choice vs no choice) and lesson structure (individual vs group activities) affected PA levels during PE among 8-11-year-olds. Leptokaridou et al. (2016) found positive relationships between autonomy-supportive teaching and effort and enjoyment in PE among 11-12-year-olds from Greece, while Escrivá-Boulley et al. (2018) reported a positive association between autonomy support and moderate-to-vigorous physical activity (MVPA) during PE in 5-11-year-olds from

France. Within the UK, numerous studies have explored SDT in PE among youth (aged 11 to 16 years: Ntoumanis, 2005; Standage et al., 2003, 2005; Taylor & Ntoumanis, 2007). These studies also demonstrate that a need-supportive motivating teaching style in PE leads to greater need satisfaction among students, which in turn predicts intrinsic motivation and future participation in PA inside (optional PE) and outside of school (leisure PA). However, to our knowledge, no UK-based study has explored young children's (5-7-year-olds) motivation for early primary school PE. This age period is essential to understand, motivationally, as previous literature has reported that motivation for PE can decrease from as early as eight years of age (Chanal et al., 2019), while MVPA levels begin to decline from the age of school entry (Reilly, 2016). Given that children can differentiate between motivational regulations far earlier than first posited (Butler, 2005), examining 5-7-year-olds motivation for PE warrants further study.

One of the reasons for the lack of research into young children's motivation is the paucity of measurement tools available for this age group (Sebire et al., 2013). As discussed in Chapter Two, it seems that current motivation tools have been created for older populations and adapted for younger children (Gottfried, 1986, 1990; Guay et al., 2010). These tools are quantitative, and either focused exclusively upon intrinsic motivation, collapse constructs or omit amotivation, which is not ideal when attempting to gain a comprehensive understanding of the motivations of a largely under-researched demographic (younger children). Other limitations of these tools include that they are not PE specific and have a propensity to use Likert scales which can lead to unreliable responses from young children (Mellor & Moore, 2014). Children tend to think dichotomously (Gelman & Baillargeon, 1983), advocating the

use of alternative response formats which have demonstrated success in younger children, alongside the use of pictures (Harter & Pike, 1984; Barnett et al., 2015). Such research instruments could inform the design of assessments of motivation for PE within this age group.

There has been little qualitative work conducted in younger children (Chandler & Connell, 1987; Erickson, 2019), as discussed in Chapter Two, with similar limitations to quantitative measurements (i.e., omission of amotivation, not PE-specific). The Write and Draw (Knowles et al., 2013; Porcellato et al., 2005; Woods et al., 2005) and the Write, Draw, Show and Tell (Noonan et al., 2016) have successfully gathered children's perceptions around a myriad of topics (e.g., PA, smoking). These methods offer viable means by which to explore BPN and behavioural regulation in younger children. Developing a tool that can assess young children's motivation within PE would benefit researchers as it would improve understanding of the psychological mediators that affect young children's motivation and related contextual cognitive, affective and behavioural outcomes (Ferrera-Caja & Weiss, 2000) and as such inform intervention design. Educational curricula aim to be more child-centred (Department of Education, 2013) but no appropriate tools for affective outcomes exist to understand young children's motivation within PE better. An affective tool could help inform teaching styles, bridging the gap between research and practice; therefore, a novel tool is necessary for this to occur.

In summary, supporting children's motivation within PE is crucial for their holistic development (Bailey, 2006; Bailey et al., 2009; Casey & Goodyear, 2015). Little is known about young children's motivation towards PE due to a lack of

empirical studies (Vasconcellos et al., 2019), which is likely due to a lack of developmentally-appropriate tools to measure motivation in PE (Sebire et al., 2013). To date, quantitative and qualitative methods have been used separately in order to measure motivation, primarily within OIT, in academic subjects, and with older children. A mixed-method approach to assessing motivation in PE in young children has the potential to provide more comprehensive information than using one design, enabling richer insights to be captured surrounding children's interpretations of their experiences (Caruth, 2013; Ponce & Pagán-Maldonado, 2015). Therefore, this study aimed to develop a novel, mixed-method tool to explore perceptions of enjoyment, BPNS, and behavioural regulation, as well as ascertain its content validity.

Study design

The overall development of the novel tool is described through two stages. Stage 1 includes the development of a tool to measure young children's enjoyment, BPNS, and behavioural regulation in PE, aligned with SDT. Stage 2 includes the process of tool content validity via the target population, research team and independent researchers. Both stages followed COSMIN guidelines (Terwee et al., 2018). Stage 1 details the steps taken to take an initial researcher-designed set of activities, which were then worked through with the target population (young children), resulting in many changes to the tool. Stage 2 details the steps taken to administer the developed tool with a larger sample and ascertain its content validity within the research team and sample of independent researchers within the area of SDT. The institutional research ethics committee approved the study (Ref. 17/SPS/031). For this study's placement within the RCT, please see Figure 7.

Stage 1: Development of the Motivation Assessment Tool for Physical Education

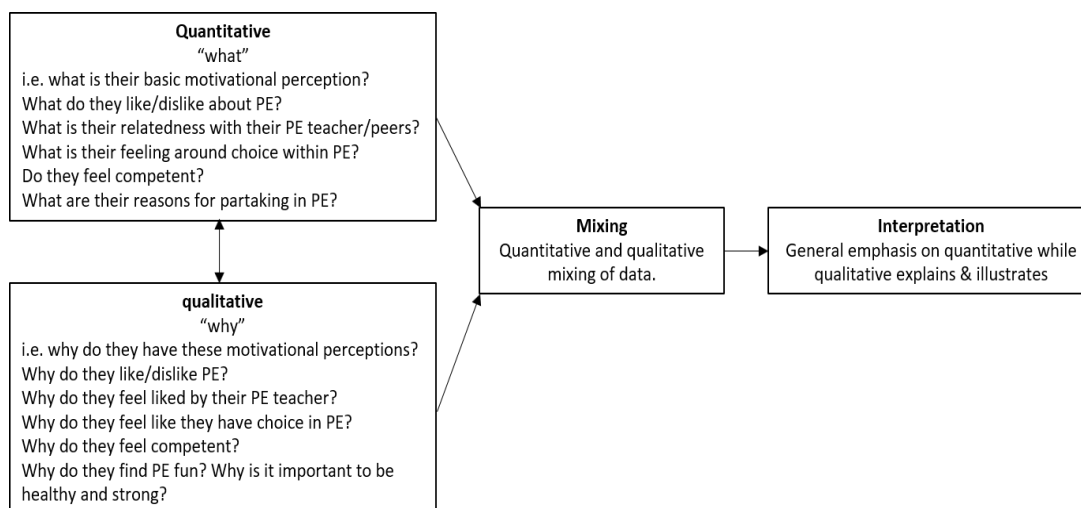
This first stage aimed to develop a tool to measure the contextual enjoyment, BPNS, and behavioural regulation of young children in PE, using the theoretical framework of SDT. Following guidance from COSMIN (Terwee et al., 2018) and that of Dunn et al. (1999), a team of cross-disciplinary researchers constituting Professors, Readers and Senior Lecturers took part in a series of interactive meetings to co-produce the tool. Primary areas of expertise within the research team focused around qualitative methods, tool development, intervention towards psychological well-being in children, health behaviour change in children, PE, and motor learning development. All had at least 15 years of experience working with children (maximum of 30 years), and all but one had published within the SDT area, with half having published at least four SDT-related journal articles. As the target population was young children and this population is considered quite challenging to conduct research with (Evans & Fuller, 1996, 1998), it was decided that a mixed-method approach to the tool would be most appropriate as it encompasses a pragmatic philosophy of using what “works best” to address the study’s research problem (Creswell & Plano Clark, 2011).

A mixed-method approach was deemed most suitable as the tool needed to capture *what* (quantitative) children’s motivational perceptions were and *why* (qualitative) they had those particular perceptions. Thus, the reasons for mixing the quantitative and qualitative strands within the tool were to *answer different research questions* (what and why), to *explain* (qualitative to explain quantitative findings) and *illustrate* (qualitative putting ‘meat on the bones’ of quantitative findings) children’s

motivations within PE (Bryman, 2006). Creswell and Plano Clark (2011) state that any mixed-method approach needs to answer four questions around the level of interaction, priority, timing and where and how to mix the quantitative and qualitative strands. Consequently, the tool would include an *interactive level of interaction*, as a direct interaction would exist between the quantitative and qualitative strands; a *quantitative priority*, as it is the *what* that determines whether they have given a positive or negative response to the questions within each construct of the tool which is then clarified and confirmed by the qualitative why-based questions; *concurrent timing* as both strands would be collected during the same phase of the research study, and *mixing would occur during data analysis* (see Chapter Four). These aspects are depicted in Figure 8.

Figure 8

Overview of the mixed-methods approach within MAT-PE.



Participants

Guidelines from COSMIN state that the target population should be involved with the development of tools that measure an outcome within its population.

Following written informed headteacher and parental consent and child verbal assent to take part in the study, a convenience sample of 43 participants (aged 5-6, male=53.66%) from two reception and three year 1 classes within three primary schools situated in Liverpool, UK, took part in the development of the tool. Class teachers purposively selected children based on having sufficient communication skills to hold a conversation and who felt comfortable to talk with a visiting researcher. Reception classes include children below the age of five and consequently were not selected for this study. These inclusion criteria were deemed necessary due to the high propensity of migrant children within the schools who may not have any English language skills.

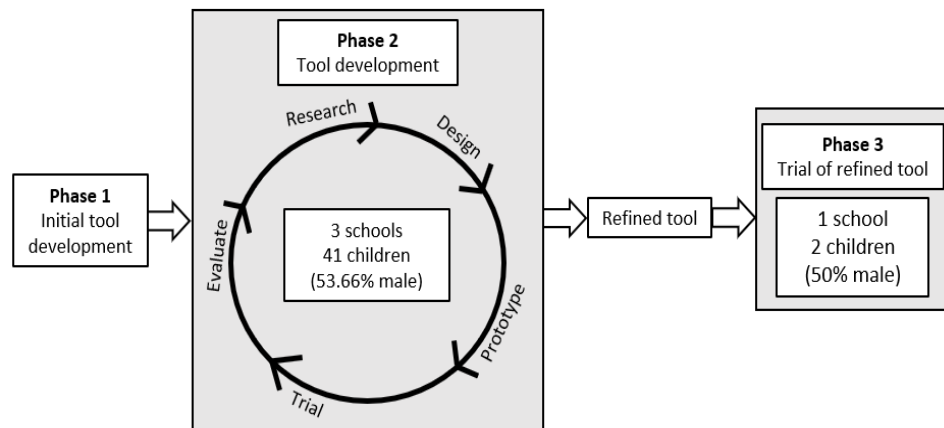
Development process

The tool was developed through three development phases (see Figure 9) for each motivation construct: enjoyment, BPNS (relatedness, autonomy and competence) and behavioural regulation. The first development phase was completed within the research group to develop a starting activity to trial its feasibility with children (to see this first iteration, please see Table 7). The second phase saw the activities piloted with the children where changes were made during the three-week period. This phase was especially important as developing a tool with the target population strongly aids content validity (Wiering et al., 2017). The third and final phase of tool development consisted of the last iteration of the tool, developed further after working with children in phase 2 and consultation with the research group, and piloted with a couple of children. It was piloted with two children

due to time constraints within the larger SAMPLE-PE project and due to the end of the school term. Each phase is described in the following section.

Figure 9

Development phases of the MAT-PE



Enjoyment

Enjoyment is an aspect of intrinsic motivation (Deci & Ryan, 1991) and an important influence on future PA behaviour (Ladwig et al., 2018), therefore, an essential aspect of children's PE perceptions to understand. As highlighted in Chapter Two, it is essential to make clear what definition of enjoyment a researcher is using within their work in order to aid transparency and the extent of inference that can be made. This thesis aligns with Scanlan and Simons (1992).

Table 7*Description of the MAT-PE version 0.1.*

Construct	Activity	Description	Rationale
<i>Whole class activity</i>			
PE participation part 1	Draw and Write	Children were given 30 minutes to draw a picture of why they take part in PE.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al., 2005; Noonan et al., 2016).
<i>One-to-one activities completed with a researcher</i>			
Icebreaker	Pair-matching card game	A memory game to match pairs of PE-themed cards.	To build rapport between researcher and child (Irwin & Johnson, 2005). PE theme to integrate with rest of the tool.
PE participation part 2	Discussion	Child describes to the researcher what they have drawn. The researcher asks probing questions (e.g. who is this? Why were you doing that?) to ascertain the depth of responses.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al., 2005; Noonan et al., 2016).
Relatedness	Choose and discuss	The child was presented with two sets of two pictures depicting a child (them) and their relationship with either (i) peers (quantity) or (ii) PE teacher. The child was asked to pick the picture that was most relevant to them for each set and explain why they had chosen each picture.	PE teachers and peers have differential effects on children's relatedness (Vasconcellos et al., 2019); therefore, both were included. Activity format based on the structured alternative format used by Harter and Pike (1984) and Barnett et al. (2015).
Autonomy	Sorting	The child was shown a silhouette and told that it represented them in PE. They were shown two thought clouds (one with PE equipment and one with children) and were asked to place these over the head of the silhouette if they thought that they got to choose those things in PE.	Autonomy is classified into three categories: procedural, organisational and cognitive (Stefanou et al., 2004). Procedural (e.g., choice of equipment) and organisational (e.g., peer selection) were included in this development phase.

Table 7*Description of the MAT-PE version 0.1*

Construct	Activity	Description	Rationale
Competence	Visual analogue scale (VAS)	The child was shown a 10cm VAS with “zero” and “superhero” stems and pictures anchoring each end. The child was asked to mark the line at a point which depicts how good they think they were at things in PE.	While there is conflicting evidence for the suitability of VAS in young children (Shields et al., 2003), it was trialled as it allows for the strength of perception without numbers.
Self-regulation	Choose and sort	The child was shown each type of regulation depicted by a picture from Google and a simplified stem derived from the literature. They were asked to pick their favourite reasons for taking part in PE and then to order them in the matter of importance.	A picture and stem were produced for each type of regulation based on previous research (identified, Guay et al., 2010; Sebire et al., 2013).

They state that enjoyment is “a positive affective response to the sport experience that reflects feelings and/or perceptions such as pleasure, liking, and experienced fun” (p. 259 in Kimiecik & Harris, 1996). By using this definition, the following phases were progressed through to develop a method of exploring young children’s enjoyment of PE.

Phase 1. The first activity of the tool was informed by work by Porcellato et al. (2005) and Woods et al. (2005): The Write and Draw technique. This creative technique is said to allow children time to think and build ideas in stages rather than providing an immediate response to questions (Gauntlett, 2006). It also allows for differences in verbal comprehension and communication skills which vary according to age, gender, experiences and individual learning needs (Hill, 2006). The Write and Draw has been used as an investigative tool over the last 40 years and has explored children’s perceptions around sun safety, perception of cancer, healthy lifestyles, diet and exercise within primary school ages (four to 11-year-olds; Angell et al., 2015). This approach allows the researcher to go beyond a definitive line of questioning found in quantitative methods and place children as experts in revealing detail around their individual experiences (Knowles et al., 2013). In the initial version of the tool, children were asked to draw a picture of why they take part in PE. The question was put in this way so that their drawings could be analysed deductively around enjoyment of PE.

Phase 2 and 3. Responses from the children were mixed in regards to relevancy to the stem “why do you take part in PE?” A classroom teacher highlighted that the question was perhaps too abstract for young children. The stem was changed

to “Draw a picture of what you like about PE” on one side of A4 paper and “Draw a picture of what you don’t like about PE” on the other side. This approach aligned more with the work conducted by Knowles et al. (2013), who investigated the ‘likes’ and ‘dislikes’ of school recess time in seven to 11-year-old children. Here the question was more direct and thus would lead to a deductive analysis of enjoyment. Drawings from the children were more consistently relevant in phases 2 and 3. The research group agreed that this was the best question and best method to collect PE-related enjoyment data with young children.

Icebreaker

An icebreaker was created to build rapport with the children (Irwin & Johnson, 2005). Building rapport helps the participant to feel comfortable in answering questions. Although no sensitive questions were being asked, it is considered good practice to incorporate an icebreaker to help participants to talk. It was decided to place it before the one-to-one activities as this would be the first opportunity the researcher had with the child outside of the classroom. The activity consisted of a pair-matching game with a PE-theme, to align with the rest of the activities. The child set the pace in regards to the level of difficulty (i.e., they could choose to make the task more difficult by adding cards). Cards were designed especially for the tool.

Relatedness

Phase 1. In PE, children’s relatedness is influenced by the PE teacher and their peers (Vasconcellos et al., 2019); therefore, both social agents were included for assessment. A mixture of contextual cues (Steward et al., 1993) and an alternative response format was chosen for this particular activity due to the dichotomous

nature of young children's thinking (Gelman and Baillargeon, 1983; in Mellor & Moore, 2014). The relatedness activity was modelled on work by Barnett et al. (2015) and Harter and Pike (1984) whose work, in part, has focused upon PMC in young children. This format is effective with young children (Barnett et al., 2015) and was therefore adopted for this activity. The relatedness activity underwent several iterations before being trialled with children in phase 2 (see Appendix A).

Phase 2. During trialling this activity with children, further explanation was needed for children using the resources as they were. The resources went through more development, including the use of colour and facial expression placement (see Appendix A). The stem for peer relatedness was also re-thought and changed from quantity (this child has lots of friends to play with in PE) to inclusion/exclusion "*Other children let me play with them in PE/ Other children don't let me play with them in PE.*" Children seemed to understand the meaning of the pictures better. The last change made before phase 3 was to create consistency in the stem formation between peer and PE teacher by saying *Other children let this boy play with them in PE, other children don't let this boy play with them in PE.*

Phase 3. Children were able to describe the meaning behind each picture without prompting and were able to describe why they had chosen their particular choice. It was decided by the research group that the relatedness items and pictures were sufficient in gaining in-depth relatedness need satisfaction data from the children.

Autonomy

Phase 1. In the first iteration, it was sought to determine the level of choice children perceived they had in PE (i.e., did they choose PE equipment and the children they played/worked with). The research group suggested that this stage needed an activity. The use of activity was to try and keep the children engaged in participating.

Phase 2. The activity had children place options they felt they could choose in PE above the head of a figure that represented them (see Appendix A). It was found that although the children seemed to understand the activity, not enough depth was captured. The options were split where peer choosing was divided into choosing a friend and choosing a group in which to work. The PE equipment was separated into individual pieces so that the children could provide more detail over what if any, PE equipment they could choose. The idea was to then sort these pictures ($n = 9$) onto either a “You” plate which was explained as theirs or onto the “PE teacher” plate which was explained to belong to their PE teacher (i.e., procedural autonomy). Children were also asked to provide examples if they thought they could choose certain things. Additional questions were added at the end of the activity to try to explore children’s autonomy need satisfaction fully. These questions included asking children whether they ever got to choose the activities they did in PE or if the PE teacher chose (i.e., organisational autonomy) and whether they got to choose how they completed movements or if the PE teacher showed them how to do it (i.e., cognitive autonomy). By including all these elements, the activity had the potential to capture different types of autonomy (Stefanou et al., 2004).

Phase 3. These changes were implemented, and it was found that children could differentiate between the different types of PE equipment around what they could choose and what their PE teachers chose. They were able to give examples of the things that they did choose, and they were able to answer the additional questions.

Competence

Phase 1. The competence activity sought to understand how good children felt they were at things in PE. In this initial phase, the competence activity consisted of a 10 cm Visual Analogue Scale (VAS) with “zero” at one end and “superhero” at the other. Initially, VAS was used as research had shown some success in its use with young children (Shields et al., 2003). The main question in the activity was “How good are you at PE?” where “zero” meant not very good and “superhero” meant very good. Children were asked to make a mark along the line as to where they believed they were along the continuum. The research group suggested replacing the follow-up question “How do you know that you’re there on the line?” to “Tell me why you have put your mark there.” This set-up was trialled with children in phase 2.

Phase 2. Children seemed to be biased towards the superhero end of the continuum. To test whether they felt highly competent (as young children are prone to feel (Noordstar et al., 2016; Spessato et al., 2013a) or if positive bias was occurring, different forms of stimuli were placed at the negative and positive end of the scale (see Appendix A). The children were asked the same question for each alternative, and it was found that their responses varied between the different alternatives and highlighted disparities between where they had made their mark and the answers,

they provided around why they had placed it there. It was suggested that a rating scale might work better for this age group. A horizontal 1-5-star rating scale was created with an unsure-looking figure above the 1-star and children demonstrating different types of skills above the 5-star rating. In line with findings from Mellor and Moore (2014), young children could understand a verbally described word-based Likert scale format using stars from one to five as visual anchors. An alternative response format has given valid and reliable results for quantitative perceived competence measures (Barnett et al., 2015; Harter & Pike, 1984). However, due to the mixed-method approach of MAT-PE, it was felt that a rating scale plus reasons why children felt the competence they did might offer more perceptual information. Children's answers to why questions matched their rating choice and all the star ratings were chosen across the sample indicating sensitivity. Due to ambiguity around the middle range stars, further iterations were trialled (see Appendix A). It was decided to accompany the star chart with different pictures of FMS (everyday movements they would recognise from experience in PE and also a primary outcome for Key Stage 1 PE). This iteration was trialled in phase 3.

Phase 3. The children could identify different FMS. The children were able to rate themselves and were able to provide relevant and coherent answers as to why.

Behavioural regulation

Phase 1 and 2. It was decided to represent each type of behavioural regulation except for integrated as that type of regulation does not typically emerge until middle to late adolescence (Ryan & Deci, 2017). Stems and pictures were created for the autonomous motivation types: intrinsic and identified, and the

controlled motivation types: introjected and external, and also amotivation. The aim was to represent each motivation type with simplified language but maintain conceptual integrity. Initially, pictures were taken from Google to represent each type of behavioural regulation (see Appendix A). Each stem was considered carefully and aimed to align with previous stems used within the SDT literature (identified, introjected and external, Guay et al., 2010; intrinsic, Sebire et al., 2013). External regulation was split into two: reward and punishment, as although both stem from the same psychological underpinning, children may feel more affinity with one over the other, and it felt necessary to capture that potential. Children seemed to differentiate between the two external regulation options and therefore, were kept as separate. Three amotivation pictures and stems were created at first; however, it was decided only to include one broad type, and the reason for their amotivation could be captured through follow-up questioning.

Pictures were developed for each stem and followed the same design as the rest of the resources of the tool (neutral ethnicity and sex). The stems and follow-up question (if chosen) were: I do PE because it's fun (intrinsic; follow-up question: what makes PE fun?), I do PE because I want to be healthy and strong (identified; follow-up question: Is being healthy and strong important/to you? Why is it important to you?), I do PE because I want my teacher and classmates to like me (introjected; follow-up question: Is it important that your PE teacher and classmates like you? Why? Do you feel like you need to show other children and your PE teacher how good you are at PE?), I do PE because I don't want to get into trouble (external punishment; follow-up: If your PE teacher never shouted, would you still want to do PE?), I do PE because I might get a reward (external reward; follow-up question: What rewards do

you get for doing PE? Do you get rewards for being behaved or for doing well at PE?) and I don't want to do PE (amotivation; follow-up question: Why don't you want to do PE?). Follow-up questions were developed for each type to explore children's reasons behind their choices fully and children placed into matter of importance.

Phase 3. The children understood the activity and were able to give relevant and coherent answers to the follow-up questions.

Results – Stage 1 tool development

The MAT-PE was developed over three weeks, with a total of 43 children. The initial MAT-PE (version 0.1) took around 15 minutes to administer (excluding the classroom-based drawing) and went through multiple iterations during the development phase. Changes were made to the wording; for example, most children did not understand what 'guilty' meant. Picture resources were changed, for example, pictures for PE equipment and group work separated. Some activities were changed; for example, the competence activity changed from a VAS to a five-star star-chart. The meaning behind some activities was changed; for example, the relatedness activity changed from a quantity [how many friends] to a quality [feeling of inclusion/exclusion] activity.

A final iteration of the tool (MAT-PE version 1: see Table 8) was piloted with two children (m=50%) as data collection finished at the end of the school year. The tool took approximately 20 minutes to administer (excluding the classroom drawing activity), depending on the amount the children talked. These two children responded well to all activities. For example, both children understood the 1-5-star chart within the competence activity and were able to articulate reasons for their

score. The separation of the autonomy choices into individual pieces of PE equipment and peer selection led to more sensitivity in the choices the children felt they had within PE. Both children were able to provide coherent and relevant answers to the follow-up questions given for each chosen type of behavioural regulation, including introjected (where the stem had changed to, *I do PE because I want my PE teacher and classmates to like me*). It was determined that this iteration of the tool elicited enough depth and understanding from the children around their motivational perceptions to show promise of content validity. However, it was deemed necessary to further trial MAT-PE version 1 with a larger sample of young children to confirm these assertions.

Stage 2: Content validity of the MAT-PE Version 1

Study Design

The purpose of Stage 2 was to assess the content validity of the developed tool (MAT-PE version 1, Table 8) in a larger sample of young children. This stage was conducted during baseline assessments of the SAMPLE-PE RCT (see Figure 7: Rudd et al., 2020a). In line with recommendations by Dunn et al. (1999), content validity was sought through researchers with expertise in SDT who were independent of the tool development. The study received ethical approval from the institutional research ethics committee (Reference 17/SPS/031).

Methods

Participants

Children

Parent/guardian consent and child assent were obtained for 360 children from 18 year 1 classes (5-6 years) within 12 primary schools located in a large city in North West England to participate in the cluster- RCT. A purposeful sub-sample of eighty-five children (aged 5-6, 47% male) - approximately five children per class - were selected to undertake MAT-PE version 1. These children were deemed by the class teacher to be comfortable to talk to an adult visitor to the school (i.e., visiting researcher) and have sufficient English language skills.

Independent researchers

Fifteen researchers who worked within the area of SDT were contacted via email through snowball sampling; nine of those researchers agreed to participate in the study. This sample constituted of Professors, Assistant Professors and Lecturers in Health Psychology, Sport and Exercise Psychology, and Sport and Movement Education. Primary areas of expertise included health psychology, motor development, motivation and behaviour, exercise motivation, PE, SDT, and behaviour change. This sample included a range of experience working with children (0-17 years), and within SDT (4-21 years). All but one had published within the SDT area with a range from one to 32 SDT-related publications.

Procedure

The content of the MAT-PE tool (version 1) is outlined in Table 8. Following training, a postgraduate student helped to administer the MAT-PE. The training

lasted one hour and covered all aspects of tool administration, including the administration script, the assessment process, activities, and resources. The postgraduate student completed administration with two children under observation before administering the MAT-PE independently. Throughout trialling the MAT-PE version 1 with the 85 children, the research team came together every week over the 6-week data collection period to discuss the tool's content validity. Discussions were noted and guided by COSMIN considerations around content validity (Terwee et al., 2018). Each aspect was reviewed for relevancy (were the questions relevant to the construct?), comprehensiveness (was each aspect supported conceptually in accordance to the theoretical framework?) and comprehensibility (did the children understand the activities and what they were supposed to do?)

Table 8*Description of the MAT-PE (version 1)*



Construct	Activity description	MAT-PE resources
Whole-class activity		
Enjoyment part 1: Draw and Write	Children were given 30 minutes to draw pictures of what they liked and/or disliked about PE.	
Activities completed one-to-one with researcher		
Icebreaker: Pair-matching card game	A set of PE-themed cards were laid face-up before the child. The child is asked to remember where all the matching pictures are so when turned over, they turn over only the matching pictures.	
Enjoyment part 2: Discussion around like/dislike of PE drawings	<p>Children presented with their drawings about what they liked and/or disliked about PE.</p> <p>Quantitative: <i>I asked you to draw a picture of what you like about PE, what have you drawn here?</i></p> <p>Qualitative: Why do you like...? Why don't you like...? You haven't drawn anything, why is that?</p> <p><i>I asked you to draw a picture of what you don't like about PE, what you have drawn here?</i></p>	Draw and write pictures from Part 1
Relatedness:	Children presented with two sets of two cards: one set focused on the PE teacher relationship and one set on peer relationships.	

Table 8*Description of the MAT-PE (version 1)*

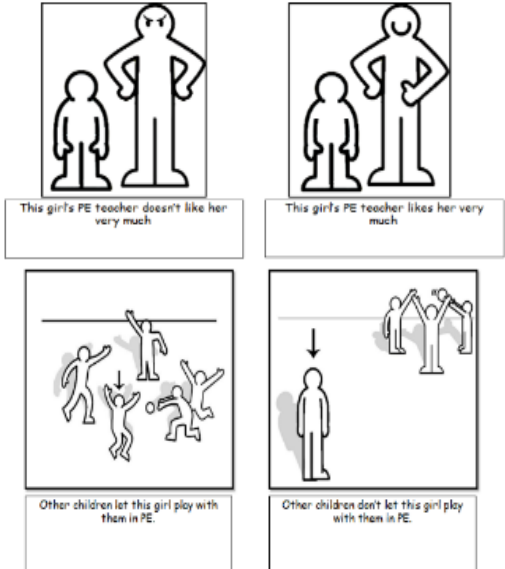
Construct	Activity description	MAT-PE resources
Choose and discuss	<p>Quantitative: <i>This girl/boy's PE teacher likes them very much, this girl/boy's PE teacher doesn't like them very much, which girl/boy are you most like?</i></p> <p><i>Do you like your PE teacher?</i></p> <p><i>Other children let this girl/boy play with them in PE; Other children don't let this girl/boy play with them in PE, which girl/boy are you most like?</i></p> <p><i>Do you let other children play with you in PE?</i></p>	<p>Qualitative: <i>How do you know your PE teacher likes/doesn't like you? What do they say or do that makes you think that they like/don't like you?</i></p> <p><i>Why do you/don't you like your PE teacher?</i></p> <p><i>Can you tell me about a time when other children let you/didn't let you play with them in PE?</i></p> <p><i>Is it important to let them play? Why? Why not?</i></p>  <p>The resources include four pictorial cards. The top-left card shows a girl and a PE teacher with a sad face, captioned 'This girl's PE teacher doesn't like her very much'. The top-right card shows a girl and a PE teacher with a happy face, captioned 'This girl's PE teacher likes her very much'. The bottom-left card shows a group of children playing, captioned 'Other children let this girl play with them in PE'. The bottom-right card shows a girl standing alone with a downward arrow pointing to her, captioned 'Other children don't let this girl play with them in PE'.</p>

Table 8*Description of the MAT-PE (version 1)*


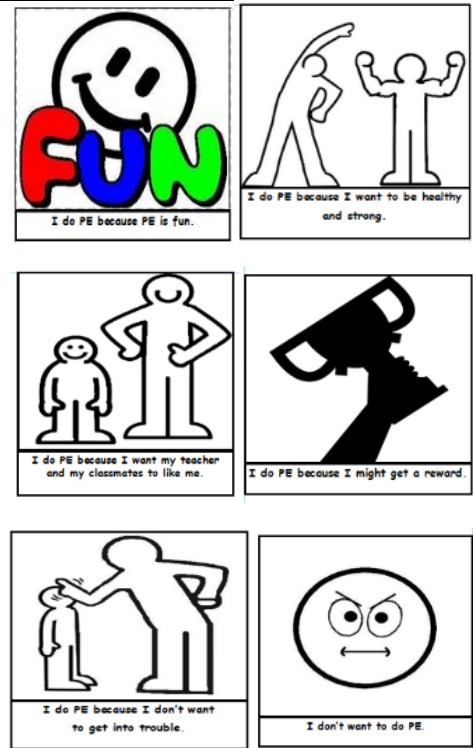
Construct	Activity description	MAT-PE resources
Competence: Choose and discuss	<p>The child was presented with a series of FMS and a 1 to 5-star star-chart and told: A child who can do all of these things all of the time would get five stars. A child who can do most of these things most of the time would get four stars. A child who can do some of these things, some of the time would get three stars. A child who can do a couple of things would get two stars. A child who can maybe do one thing would get one star.</p> <p>Quantitative: <i>How many stars would you give yourself for doing things in PE?</i></p>	<p>Qualitative: <i>Why would you give yourself X star(s)?</i></p> 



Table 8*Description of the MAT-PE (version 1)*

Construct	Activity description	MAT-PE resources
Self-regulation: Choose, sort and discuss	<p>The child was presented with all the reasons why they might take part in PE: I do PE because PE is fun (intrinsic), I do PE because I want to be healthy and strong (identified), I do PE because I want my teacher and classmates to like me (introjected), I do PE because I might get a reward (external approach), I do PE because I don't want to get into trouble (external avoid), I don't want to do PE (amotivation). They were asked to choose their favourite reasons for taking part. They were then asked follow-up questions for each chosen reason. They were then asked to place the chosen reasons in order of importance for them.</p> <p>Quantitative: <i>Out of all these reasons, which are your favourite reasons for doing PE?</i></p> <p>Can you place your reasons into the order of importance where the first means the most important?</p>	 <p>The MAT-PE resources consist of six cards, each with a cartoon illustration and a caption:</p> <ul style="list-style-type: none"> Card 1: A smiley face with the word "FUN" in large, colorful letters. Caption: "I do PE because PE is fun." Card 2: A stick figure performing a yoga-like stretch. Caption: "I do PE because I want to be healthy and strong." Card 3: A stick figure standing next to a larger stick figure (teacher). Caption: "I do PE because I want my teacher and my classmates to like me." Card 4: A stick figure holding a megaphone. Caption: "I do PE because I might get a reward." Card 5: A stick figure being pulled back by a larger stick figure. Caption: "I do PE because I don't want to get into trouble." Card 6: A sad face with a straight line for a mouth. Caption: "I don't want to do PE."

Qualitative: **Intrinsic:** Why is PE fun?
Identified: Why is being healthy and strong important to you? **Introjected:** Why is it important that your teacher and classmates like you? Do you ever feel like you need to do PE to show other children and teacher how good you are at PE? **External (reward):** Do you get rewards in PE? What rewards do you get in PE? **External (punishment):** If you knew you wouldn't get into trouble, would you still want to do PE? Why? **Amotivation:** Why don't you want to do PE?

Tool procedure

The MAT-PE comprises a classroom Draw and Write activity followed by a semi-structured interview that is administered in a one-to-one format by a trained researcher. The semi-structured interview uses a pictorial instrument and consists of interactive activities (e.g., choosing, sorting) designed to capture motivational perceptions within SDT-related constructs: enjoyment, relatedness, autonomy, competence, and self-determined motivation. The use of visual resources was designed to overcome issues with children's attention span, verbal ability, and abstract thinking. For each activity, the child is presented with picture cards and receives a scripted set of explanations and questions from the interviewer. Children are directed to choose the card(s) that best represents their thinking (fixed choice: quantitative strand, the what) and then the interviewer asks a series of open-ended questions with probing to understand their fixed choice selection (qualitative strand, the why).

Enjoyment: Part 1 (Draw and Write). The draw and write classroom-based activity was conducted first. Children were asked to draw a picture of 'what they like about PE' on one side of an A4 blank paper and 'what they don't like about PE' on the other side. This activity was informed by the Write, Draw, Show, and Tell procedure by Porcellato et al. (2005) and Noonan et al. (2016). Following the completion of the draw and write activity, members of the research team escorted the children to an adjacent location from the classroom for the completion of the (one-to-one) activities.

Ice breaker. The interview commenced with a PE-themed pair-matching card game to build rapport between the child and researcher (Irwin & Johnson, 2005).

Enjoyment: Part 2 (discussion). Each child was then presented with their drawing from the classroom-based activity and discussion between the researcher and child was had about their pictures (Noonan et al., 2016; Porcellato et al., 2005).

Relatedness need satisfaction. A structured alternative response format (Barnett et al. 2015; Harter & Pike, 1984) was used. Children were first shown two sets of two pictures. One set concerned their PE teacher (“This girl/boy’s PE teacher likes her/him very much, this girl/boy’s PE teacher doesn’t like her/him very much, which girl/boy are you most like?”). The other set concerned their peers (“Other children let this girl/boy play with them in PE, other children don’t let this girl/boy play with them in PE, which girl/boy are you most like?”). Questions addressed both PE teachers and peers as it has been found that both social agents affect children’s relatedness (Vasconellos et al., 2019). Once they had chosen which child they were most like, they were then asked why they felt that way.

Autonomy need satisfaction. The autonomy activity focused upon the choicefulness element of autonomy, more specifically procedural (e.g., choice of equipment), organisational (e.g., peer selection) and cognitive (e.g., choice of activities; Stefanou et al., 2004). Children were shown a selection of PE equipment and two plates labelled “you” for the child and “PE teacher” for their PE teacher. The children were asked to sort the PE equipment onto their plate if they ever got to choose it in PE or sort onto their PE teacher’s plate if the PE teacher chose it. Children were then asked to expand on their responses.

Competence need satisfaction. Within the competence activity, children were asked to rate themselves on a 1-5-star star-chart (“How good are you at things in PE?”) based on pictures of FMS which the development of is a primary outcome for PE (Department of Education, 2013; UNESCO, 2013). Children were then asked why they felt that way.

Behavioural regulation. Each type of regulation was presented to the children, one at a time, and read aloud. Children were asked to choose their most favourite reasons for taking part in PE. For any choice made, they were asked a related follow-up question for that type of regulation. They were then asked to put the chosen regulations into an order of importance (i.e., most important to least important). More than one type of regulation could be positioned the same, for example, intrinsic and external reward as first, external punishment as second and identified as third.

Once completed, the researcher thanked the participant, gave them a sticker, and escorted them back to the classroom. Interviews were recorded using a Dictaphone; children wore microphone clips to aid recording quality. Conversations were typed up verbatim in the form of an interview transcript (qualitative), and fixed choice item selections were recorded (quantitative) for subsequent analysis (see Chapter Four). The total time for administration was approximately one hour, inclusive 30 minutes for the Draw and Write enjoyment activity and approximately 25 minutes for the SDT-related MAT-PE activities.

Independent researcher content validity procedure

Independent researchers within SDT were sent a matching task (Hambleton, 1980 in Dunn et al., 1999) via email to ascertain content validity. In order to complete

the task, researchers had to match each item of the tool with the construct (enjoyment, relatedness, autonomy, competence, intrinsic, identified, introjection, external approach, external avoid and amotivation) they felt each item aligned with most. They were also asked, on a scale from one to five, to rate each item on how relevant (1=poor match, 2=fair match, 3=good match, 4=very good match, 5=excellent match) and comprehensive (1=poor comprehensiveness, 2=fair comprehensives, 3=good comprehensives, 4=very good comprehensiveness, 5=excellent comprehensiveness) each item was within that construct. Matching scores for each item was determined through the number of researchers out of the sample who correctly aligned it with the designated construct within the MAT-PE, culminating in a percentage score. Mean scores were calculated for relevance and comprehensiveness.

Results

MAT-PE version 1 required approximately 15-25 minutes to administer (not including the 30-minute classroom drawing task), depending on how talkative the children were. It was determined that MAT-PE elicited sufficient depth from the children according to their enjoyment of PE, their BPNS and behavioural regulation. Within the research team discussion, aspects of content validity were judged. The tool was deemed *relevant* as all activities were judged to include aspects pertinent to each theoretical construct and were representative of an early primary school PE context. The tool was deemed *comprehensive* as all activities encompassed sufficient components to ensure key considerations of BPNS and behavioural regulation were assessed to the fullest extent possible in this age group (e.g., inclusion of PE teacher

and peer groups within the relatedness activity; addition of follow-up questions related to cognitive autonomy, i.e., choice over activities and movement). The tool was judged to be *comprehensible* as activities were familiar and understood by the children (e.g., drawing, sorting, choosing). Therefore, the consensus among the research team was that content validity was reached. As recommended by Dunn et al. (1999), content validity was sought from a sample of researchers with expertise in SDT that was independent of the tool development.

Nine researchers with SDT experience completed the matching task by matching each of the 19 MAT-PE items with the construct they believed in which the items most aligned. Table 9 shows each of the items under constructs that they were designed to align with within the MAT-PE. The matching column demonstrates the percentage of researchers that matched each item within the designated constructs of the MAT-PE. Eleven of the items were matched by at least 75% of the researchers (items 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, and 19). Five of these items were matched by 100% of the researchers (items 7, 8, 17, 18, and 19). Four items were matched by around half of the researchers (55.55-66.66%; items 2, 6, 9, and 16). Another four items were matched by a third of the researchers or less (11.11-33.33%; items 1, 10, 11, and 15). The researchers also judged how relevant and comprehensive each item was within the construct they aligned it with on scales from one to five.

The majority of items were judged to be “good” (score of 3) or above for relevance and comprehensiveness. Items of particular note, due to their low matching or relevance/comprehensiveness score, are items 1, 10, 11 and 15. A third of the researchers matched item 1; however, those researchers judged the item to

be “very good” on relevance and comprehensiveness. A third of the researchers also matched item 10; however, it was judged to be “good” on relevance and “fair” on comprehensiveness. One researcher matched item 11; however, they judged the item to be “very good” on relevance and comprehensiveness. Item 15 was matched by two researchers and judged it to have “excellent” relevance and “good” comprehensiveness. Due to this triangulation of data, it was decided that the items of the MAT-PE were independently judged to have sufficient content validity and were in agreement with the research team.

Table 9. Matching percentage between the MAT-PE items and their constructs and their means and standard deviations for relevance and comprehensiveness.

Construct	Item	Matching (%)	Relevance Mean (SD)	Comprehensiveness Mean (SD)
Enjoyment	1. Like PE	33.33	4.67 (.58)	4.50 (1.00)
	2. Dislike PE	55.55	4.25 (.50)	4.25 (.96)
Relatedness	3. Liked/Disliked by PE teacher	88.88	4.00 (1.07)	3.43 (1.13)
	4. Like/Dislike of PE teacher	88.88	3.62 (1.06)	4.17 (.98)
	5. Included/Excluded by peers	77.77	3.29 (1.11)	3.00 (1.09)
	6. Includes/Excludes peers	66.66	2.29 (.95)	2.71 (1.38)
Autonomy	7. PE equipment choice	100	4.56 (.73)	3.88 (1.55)
	8. Choice of movements	100	4.22 (1.09)	3.88 (1.55)
	9. Choice of activities	66.66	4.50 (.84)	4.00 (1.73)
	10. Listened to by PE teacher	33.33	3.67 (.58)	2.67 (1.53)
	11. PE teacher answers questions	11.11	4.00*	4.00*
Competence	12. Self-rating of FMS	88.88	4.11 (1.27)	3.86 (1.07)
Intrinsic	13. I do PE because it's fun	88.88	4.63 (1.06)	4.83 (.41)
Identified	14. I do PE because I want to be healthy and strong	77.77	4.29 (1.25)	4.00 (1.55)
Introjected	15. I do PE because I want my PE teacher and classmates to like me	22.22	5.00 (.00)	3.50 (2.12)

Table 9. *Matching percentage between the MAT-PE items and their constructs and their means and standard deviations for relevance and comprehensiveness.*

Construct	Item	Matching (%)	Relevance Mean (SD)	Comprehensiveness Mean (SD)
Introjected	16. Do you ever feel like you need to do PE to show other children and your teacher how good you are PE?	55.55	4.40 (.89)	4.25 (1.50)
External approach	17. I do PE because I might get a reward	100	4.44 (.73)	4.63 (.74)
External avoid	18. I do PE because I don't want to get into trouble	100	4.88 (.35)	3.86 (1.68)
Amotivation	19. I don't want to do PE	100	4.67 (.71)	4.25 (1.16)

SD = Standard Deviation, * = data from one person therefore Standard Deviation could not be computed for that item

Discussion

Despite the ability of young children to report on their own experiences (Stone & Lemanek, 1990), and their suspected ability to differentiate between motivational constructs (Butler, 2005; Guay et al., 2010), there is a distinct lack of appropriate tools to measure young children's motivation (Sebire et al., 2013), particularly within PE. This research study aimed to develop a tool aligned with SDT in order to measure young children's enjoyment, BPNS, and behavioural regulations in PE. Stage 1 developed the MAT-PE, a mixed-method, age-appropriate tool for assessing 5-6-year-old children's enjoyment, BPNS, and behavioural regulations for PE. Stage 2 found the tool to have content validity by the research team and an independent group of SDT researchers.

Tool development process

Tool underpinning

Contextual vs situational motivation. The MAT-PE was designed to assess young children's contextual motivation (motivation towards a specific context or set of specific and related activities; Vallerand, 2007), rather than situational motivation (motivation when engaging in a specific activity at a specific time). This choice was made in order to help researchers evaluate children's general feelings of motivation towards PE rather than during particular PE lessons. The tool allows researchers to understand *what* children are feeling towards PE, motivationally. The tool enables the pinpointing of children who have higher motivation, or rather, more self-determined motivation towards PE, in comparison to peers who may have lower motivation or more controlled motivation. The tool also enables researchers to understand *why* children feel the way they do. This insight can inform future PE-

based interventions that seek to increase motivation or influence other outcomes such as PA, BMI, or motor proficiency.

BPNS and OIT. The tool was underpinned by the BPNS and OIT mini-theories of SDT in order to assess children's ability to conceptualise the motivating factors that drive their PE behaviours and the socio-contextual factors within the PE environment that relate to autonomy, competence and relatedness needs satisfaction. These two theories are arguably most widely used in PA (Teixeira et al., 2012) and PE research (Vasconcellos et al., 2019). These theories were also deemed most appropriate out of the six mini theories.

Cognitive Evaluation Theory focuses purely upon intrinsic motivation. As PE is a mandatory school subject, participation is automatically externally driven (school schedule) and therefore does not allow children to initiate PE participation due to inherent interest. Children may also participate for other reasons other than intrinsic; therefore, this theory was deemed too narrow. Also, tools already exist to measure intrinsic motivation in young children, albeit simplified versions of measures initially aimed at older populations and not within PE (Gottfried, 1986, 1990). Causality Orientations Theory focuses upon individual differences in motivational styles. As we have not yet assessed motivation broadly within young children, it was felt that this particular theory was more appropriate to underpin future work within this population, once it has been investigated a little more. Goal Contents Theory was also deemed too specific, this time around the goals that drive children's motivation. The goal (taking part in PE) is predetermined; therefore, this theory was not appropriate to underpin this venture. Relationships Motivation Theory focuses upon

the qualities of close relationships and their consequences and was also determined not to be an appropriate theory to underpin this particular work (Ryan & Deci, 2017).

Mixed-method approach

From a practical point of view, a mixed-method approach allows for researchers to gather reliable data from children as they hear in real-time how children have interpreted the question by the answers they provide, allowing re-phrasing and additional questions, if necessary. Younger children do not have a fully developed neural structure that fully supports attention (Best & Miller, 2010) and the attention they do possess varies between children (Rothbart & Posner, 2006). Therefore, it was decided to explore answers to questions in depth via follow-up questions rather than a wide range of questions that children may not comprehend. Fewer items would help keep younger children's attention and help us gather their data.

Within pragmatism, researchers do not have to "be the prisoner of a particular [research] method or technique" (Robson, 1993, p.291, in Feilzer, 2010) and argues that research should not aim to represent reality accurately but "aim at utility for us" (Rorty, 1999, p. xxvi, in Felzer, 2010). This type of utility ushers in a level of reflexive practice, asking research-based questions such as "'what is it for' and 'who is it for' and 'how do the researchers'" values influence the research" (Feilzer, 2010, p. 8), where these questions are more important than mirroring reality. In essence, this tool was created to comprehensively assess motivation in a highly under-researched demographic: young children ("what is it for").

In regards to “who is it for”, it was designed and developed for and with young children. However, it is also for researchers who have SDT knowledge and who are interested in understanding this younger demographic within PE. The tool is appropriate for researchers with SDT knowledge as it consists of a semi-structured interview anchored by interactive activities. Many mixed-method approaches, although capture quantitative and qualitative data, do so in isolation, within their analysis and presentation (Bryman, 2007). This study sought to create a tool that captured quantitative and qualitative strands of data that could then be mixed so that both could be analysed and interpreted together (see Chapter Four).

Content validity

Content validity is arguably the most important psychometric property to determine the suitability of a measurement tool as, without content validity, other types of validity cannot be conducted (Prinsen et al., 2018). According to COSMIN (Terwee et al., 2018), a tool has good content validity when its items and instructions are relevant, comprehensive and comprehensible. In order to do this, the target population should be involved to ensure that the items are relevant to them as irrelevant items lead to failure to measure the target population’s perceptions (Wiering et al., 2017).

The MAT-PE was co-produced by researchers with knowledge of SDT and related fields and included an extensive, iterative development phase (~9 months in duration) with young children to ensure relevancy and comprehensiveness in this age group. The involvement of the target population led to a tool which comprehensively captured BPNS and behavioural regulations in PE - including distinct assessments of introjected and external regulations which were collapsed in previous measures as it

was believed that these regulations were too difficult for young children to understand (Guay et al., 2010). The research team agreed that the tool had content validity and independent researchers with expertise in SDT further supported this. Each item was judged no lower than “fair match/comprehensiveness” on its relevance and comprehensiveness. The item that focused on children who included others was matched quite highly (66.66%); however, it only received “fair relevance/comprehensiveness” from independent SDT researchers. Despite this lower score, Ryan and Deci (2017) state that “Relatedness refers to both experiencing others as responsive and sensitive and being able to be responsive and sensitive to them...” (p.86). This statement implies a two-way, meaningful interaction between social agents and consequently. Therefore, the item was retained.

One researcher only matched the PE teacher answering children’s questions item. However, that researcher judged it be “very good” on relevance and comprehensiveness. In their comments, they mentioned that this item was around a choice of being listened to which has been identified as an inclusive element of autonomy items in other measures (Smith et al., 2015). Overall, the independent researchers agreed with the assertions made by the research team.

Practical implications

The MAT-PE is feasible for a researcher to administer one-to-one with a young child in a quiet location, and the resources are relatively low cost. Thirty minutes was allocated to the Draw and Write classroom-based activity, and ~20 minutes for the remainder of the MAT-PE administration. Purely quantitative motivation measures have taken from 20-30 minutes to administer (Gottfried, 1990; Guay et al., 2010) on a whole-class basis. One-to-one measures, such as The Pictorial Scale of Perceived

Movement Skill Competence for Young Children (Barnett et al., 2015) and the Self-Perception Profile for Children (Harter & Pike, 1984) designed for younger children take less than 10 minutes to administer. Any researcher with a background in SDT would be capable of using the tool, though it would be advised that future researchers who wish to use the MAT-PE receive training; development of an appropriate training package is currently ongoing.

Also, although the tool itself is considered mixed-method, the data it produces can be analysed through qualitative or quantitative approaches, making it accessible to different types of researchers and research questions. Future research should also examine further aspects of validity, such as concurrent and predictive validity, as well as test-retest reliability and responsiveness.

At this point, the MAT-PE is primarily for researcher use, towards understanding young children's motivation, how and if it changes over time, the effect their motivation has on other outcomes such as PA, BMI and MP, and to inform interventions. However, bridging the gap between research and practice is possible whereby data from the MAT-PE could help inform PE teacher practice. This aspect is important as PE teachers can identify children with poor quality or no motivation and their source of motivation and subsequently understand how to support their motivation through their teaching styles.

Strengths and limitations

This study had several strengths, including the comprehensive iterative development of the MAT-PE with the relevant target populations over nine months. Strength was also found in the variety of expertise within the research team, where content validity was judged based on multi-disciplinary rather than narrow

perspectives (Terwee et al., 2018). A sample of independent researchers within SDT also deemed the tool to have content validity. A limitation may be attributed to the condensed number of questions due to the young age of the target population, which may have impacted their responses. However, as explained above, this was implemented to not over-burden the children and to allow reliable responses.

Conclusion

This study developed a novel, mixed-method tool to measure young children's enjoyment, BPNS and behavioural regulations in PE through an age-appropriate set of activities aligned with SDT and informed by young children. This tool allows researchers to explore how the PE environment affects young children's BPNS and subsequent behavioural regulation. Knowing this information can inform interventions on a class level (changing the environment to support BPN) and to identify individual children who may be experiencing controlled motivation or amotivation. Through this, research can help inform teachers about motivating styles and their practice within early primary PE. Due to the mixed-method approach to the MAT-PE, it is necessary to create a means to mix the quantitative and qualitative strands in order to 1) analyse children's responses and 2) to facilitate the statistical investigation of motivational profiles. The former is explored in Chapter Four.

Chapter Four

Study 1 (Continued)

The development of the Motivation Assessment Tool for Physical Education codebook

Based on a paper under review at Psychology of Sport and Exercise:

Fitton Davies, K., Watson, P. M., Rudd, J. R., Roberts, S., Bardid, F., Knowles, Z., & Foweather, L. (under review). Development, content validity and utility of the motivation assessment tool for physical education (MAT-PE) among young children. *Psychology of Sport and Exercise*.

Thesis study map

<p>Chapter Three (Study One):</p> <p>The development and content validity of the Motivation Assessment Tool for Physical Education (MAT-PE)</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop a mixed-method tool for assessing young children's enjoyment, BPNS and behavioural regulation within PE. • To ascertain the content validity of the tool through the research team and independent researchers. <p>Key findings:</p> <ul style="list-style-type: none"> • A seven-stage, mixed-method, activity-based tool was developed with the target population. • The tool's content validity was ascertained via a sample of independent SDT researchers.
<p>Chapter Four (Study One):</p> <p>The development, content validity, acceptability and reliability of the Motivation Assessment Tool for Physical Education codebook</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop codebook in order to integrate the quantitative and qualitative strands of the tool. • To ascertain content validity, acceptability, inter- and intra-rater reliability of the codebook.

Abstract

Introduction: In the previous chapter, a mixed-method tool was created to assess young children's enjoyment, BPNS, and behavioural regulations within PE. In order to mix the quantitative and qualitative strands of the MAT-PE data, a codebook was developed. **Aims:** To describe the development of the codebook, the acceptability and content validity of the codebook via independent researchers, and inter- and intra-rater reliability of the codebook. **Results:** A codebook table was developed for each question of the MAT-PE. The codebook was judged to have content validity as well as acceptability via an independent sample of researchers. The codebook demonstrated excellent inter- and intra-rater reliability (ICC=.90). **Conclusion:** It was

possible to create a codebook so that the quantitative and qualitative strands within the MAT-PE could be mixed so that interpretation could occur. The codebook allows the production of numerical motivational profiles for children based on the quantitative and qualitative aspects of their MAT-PE responses.

Introduction

The reasons for creating a mixed-method tool (the MAT-PE) in Chapter Three was to answer different research questions (what young children feel and why they feel it), to provide an explanation, and to illustrate findings (Bryman, 2006). It was decided that the mixing of the quantitative (the what) and qualitative strands (the why) should occur during data analysis (Creswell & Plano Clark, 2011). Therefore, this chapter is concerned with developing an approach to enable the mixing of quantitative (fixed choice selection) and qualitative (open-ended question responses) MAT-PE data for analysis (Creswell & Plano Clark, 2011).

It was decided that the quantitative strand would take priority as the qualitative strand helped to explain and illustrate the quantitative data (Bryman, 2006). Furthermore, a quantitative priority for analysis was sought in order to facilitate the statistical investigation of motivational profiles, the antecedents and consequences of motivation, and to provide numerical data that could be analysed in longitudinal and experimental research. Thus, quantitative content analysis (Rourke and Anderson, 2004) was selected as this is an acceptable form of deductive analysis for semi-structured interviews and can be used to count the frequency and intensity of responses. An essential stage of quantitative content analysis is to establish a coding scheme that allows testing of hypotheses (Rourke & Anderson, 2004; White & Marsh, 2006).

Therefore, this chapter aimed to develop a codebook for researchers so that the transcript data from the MAT-PE could be analysed by coding young children's motivational perceptions towards PE through mixing the quantitative and qualitative

strands. As there is not a currently existing codebook to analyse the MAT-PE data, this study also aimed to examine the content validity and acceptability of the developed codebook, as emphasised by Rourke and Anderson (2004), and determine inter-rater and intra-rater reliability. The following sections outline the development process of the codebook, the process taken in establishing the codebook's content validity and acceptability and the exploration of the codebook's inter- and intra-reliability.

Development of the MAT-PE codebook

The University ethics committee approved this study (Reference 17/SPS/031). Six members of the research team (KFD, PW, JR, SR, FB, LF) from the MAT-PE development were involved in creating the codebook. They provided the necessary skill, labour, thinking and energy (Fernald & Duclos, 2005) within this development process. Following previous research (Fonteyn et al., 2008; MacQueen et al., 1998), the codebook was developed through an iterative process and structured similarly. The research team met on six occasions over three months to review and refine the codebook content. These meetings included confirming codes, determining a coding scheme, and checking for ambiguous wording in code descriptions.

The MAT-PE codebook (see Table 10) was scaffolded and underpinned by SDT and included codes (numerical), code descriptions and code examples. A coding table was included with predetermined categories for each construct within the MAT-PE: enjoyment, relatedness, autonomy, competence needs satisfaction and behavioural regulation. Codes for each motivational construct were initially created by reading through randomly selected transcript data from Study 1 (Chapter Three, Stage 2).

Codes were numerical, whereby higher values indicated higher levels of motivational perceptions. This quantitative content analysis (White & Marsh, 2006) approach was used in order to understand and describe motivational perceptions in a way that can be counted, quantified and therefore measured. The numerical scoring process was designed to take into account the child's initial quantitative response/choice (the 'what': yes or no, this or that) alongside the qualitative nature of the child's answer (the 'why'). Whether the child provided a surface level (gave no more detail to their initial answer) or deep level response (gave more detail to their initial answer) to the researcher's questions was also taken into account. Deep-level responses were taken to indicate stronger motivational perceptions, whereas surface-level responses were taken to indicate weaker motivational perceptions. Positive and negative aspects of each construct were therefore merged within the same coding matrix. For example, in the relatedness activity, children chose between being included or excluded by peers in PE. Responses were put on the same coding scale from the most negative (scored 1: excluded, deep level response) to most positive (scored 4: included, deep level response).

Code descriptions outlined the choice and depth of response for each code, while code examples included direct quotes from children's actual transcript data, providing authenticity. Overall construct scoring differed by construct: enjoyment score was calculated by taking the coding given in "Like of PE" and subtracting the coding given in "Dislike of PE" which provided a range from -3 to +3. Codes from all four relatedness responses were added together to create the overall relatedness score, giving a range from 4 to 16. The same was done for autonomy where all four responses were added to create the overall autonomy score, giving a range from 4 to

15. Competence included one item only and therefore constituted the overall score (1-9). For autonomous motivation, the coding given for intrinsic and identified regulations were added and then divided by two to obtain the mean. For controlled motivation, first, the coding for external regulations (approach and avoidance) were added and then divided by two to obtain a mean. This mean was then added to introjection and then divided by two to obtain a mean for overall controlled motivation. Amotivation included one item only and therefore constituted the overall score.

In the final step, four of the research team (KFD, JR, SR, LF) coded the same transcript data and found few discrepancies in coding. Thus, a consensus was reached among the research team that the codebook development process was complete.

Table 10*The Complete MAT-PE Codebook*

Likes/Dislikes PE Strength of Liking PE Activity 1a (Drawing)		
Question(s): <i>I asked you to draw a picture of what you like about PE, what have you drawn here?</i> Follow-up question(s): <i>Why do you like...? You haven't drawn anything, why is that?</i>		
Code	Description	Example
4	<p>The child has drawn a picture or written words/phrases/sentences on the <i>liked</i> side of the drawing activity. The child articulates a deeper level response as to why they like PE.</p> <p><i>Note.</i> A child obtains a score of 4 if they provide a deep level response to at least one of the pictures they have drawn.</p> <p>The child has not drawn a picture, but when asked by the researcher, the child provides a deep level response.</p>	<p>R: "Why is it that you like racing?"</p> <p>→ C: "Cos I like to go fast."</p> <p>R: "Why do you like playing football?"</p> <p>→ C: "Because we get to learn new stuff that is a little bit hard."</p> <p>R: "Why do you like PE?"</p> <p>→ C: "Because I love learning new things."</p>
3	<p>The child has drawn a picture or written words/phrases/sentences on the liked side of the drawing activity. The child articulates a surface level response as to why they like PE.</p> <p><i>Note.</i> A child obtains a score of 3 if they only provide surface-level responses to all pictures drawn.</p>	<p>R: "Why do you like running around cones?"</p> <p>→ C: "Because I like running." / → C: "Because I just do." / → C: "Because I like it."</p>

Table 10*The Complete MAT-PE Codebook*

Likes/Dislikes PE Strength of Liking PE Activity 1a (Drawing)		
Code	Description	Example
2	<p>The child has drawn a picture or written words/phrases/sentences on the liked side of the drawing activity. The child does not articulate why they like PE but indicates that the picture is what they like about PE.</p> <p>The child articulates a surface level or irrelevant response as to what they like about PE but has not drawn a picture.</p>	<p>R: Why do you like playing football?"</p> <p>→ C: Silence</p> <p>R: But you like doing this?</p> <p>→ C: "Yes."</p> <p>R: "Why do you like PE?"</p> <p>→ C: "Because I do." / → C: "Because I like playing with my grandad in the garden."</p>
1	<p>The child has not drawn a picture or written any words/phrases/sentences on the liked side of the drawing activity. The child also does not articulate a response when the researcher asks if they like anything about PE.</p> <p>The child's drawing or statement indicates that they do not like PE.</p> <p>The child has drawn nothing but articulates that they don't like PE and provides a reason with either surface or deep level as to why they don't like PE.</p>	<p>R: "Is there anything you like about PE?"</p> <p>→ C: "I don't know."</p> <p>R: "Does this picture mean you don't like PE?"</p> <p>→ C: Nods head/ "Yes."</p> <p>R: "You haven't drawn anything; why is that?"</p> <p>→ C: "Because I don't like PE."</p> <p>R: "Why don't you like PE?"</p> <p>→ C: "Because I just don't like it" (surface) / → C: "Because I think it's really boring" (deep)</p>
Comments (e.g. if the child provided an irrelevant response, any notable or unique comments)		

Table 10

The Complete MAT-PE Codebook

Likes/Dislikes PE Strength of Liking PE Activity 1b (Drawing)		
Code	Description	Example
4	<p>The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity.</p> <p>The child articulates a deeper level response as to why they dislike PE.</p> <p><i>Note.</i> A child obtains a score of 4 if they provide a deep level response to at least one of the pictures they have drawn.</p> <p>The child has not drawn a picture, but when asked by the researcher, the child provides a deep level response.</p>	<p>R: "Why don't you like running?"</p> <p>→ C: "Because I always bump into people and hurt myself." / → C: "Because I'm not very good at it." / → C: "Because it's boring."</p> <p>R: "Why do you not like PE?"</p> <p>→ C: "Because it's too hard."</p>
3	<p>The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity. The child articulates a surface-level response to why they don't like PE.</p> <p><i>Note.</i> A child obtains a score of 3 if they only provide surface-level responses to all pictures drawn.</p>	<p>R: "Why don't you like running?"</p> <p>→ C: "Because I don't."</p> <p>→ C: "I don't know."</p>

Table 10*The Complete MAT-PE Codebook*

Likes/Dislikes PE Strength of Liking PE Activity 1b (Drawing)		
Code	Description	Example
2	<p>The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity. The child does not articulate why dislike PE but indicates that the picture is what they don't like about PE.</p> <p>The child articulates a surface level or irrelevant response to the researcher's questions but has not drawn a picture.</p>	<p>R: Why don't you like playing football? → C: Silence</p> <p>R: But you don't like doing this? → C: "Yes."</p> <p>R: "Why don't you like PE?" → C: "Because I don't." / → C: "Because my dog always takes the ball away."</p>
1	<p>The child has not drawn a picture or written any words/phrases/sentences on the disliked side of the drawing activity. The child also does not articulate a response when the researcher asks if there is anything they don't like about PE.</p> <p>The child's drawing or statement indicates that they like PE.</p> <p>The child has drawn nothing but articulates that they like PE and provides a reason with either surface or deep level as to why they like PE.</p>	<p>R: "Is there anything you don't like about PE?" → C: "I don't know."</p> <p>R: "Does this picture mean you like PE?" → C: Nods head/ "Yes."</p> <p>R: "R: "You haven't drawn anything; why is that?" → C: "Because I like PE."</p> <p>R: "Why do you like PE?" → C: "Because I just like it" (surface) / → C: "Because I think it's really fun" (deep)</p>
Comments (e.g. if the child provided an irrelevant response, any notable or unique comments):		

Table 10*The Complete MAT-PE Codebook*

Relatedness Satisfaction Liked/Disliked by PE Teacher Activity 2a		
Question(s): This girl's/boy's PE teacher likes her very much, this girl's/boy's PE teacher doesn't like her very much, which girl/boy are you most like? Follow-up question(s): How do you know your teacher likes/doesn't like you?		
Code	Description	Example
4	The child has chosen "liked by teacher" and articulates a deep level response as to how they know that.	R: "How do you know your PE teacher likes you?" → C: "Because sometimes he says good work." / → C: "Because she never gets angry at me, and she lets me help her." / → C: "Because I do good work."
3	The child has chosen "liked by teacher" and articulates a surface level or irrelevant response as to how they know that.	R: "How do you know your PE teacher likes you?" → C: "They just do." / → C: "Because I like ice cream." / → C: "I don't know."
2	The child has chosen "disliked by teacher" and articulates a surface level or irrelevant response as to how they know that.	R: "How do you know your PE teacher doesn't like you?" → C: "I don't know." / → C: "Because I like ice cream."
1	The child has chosen "disliked by teacher" and articulates a deep level response as to how they know that.	R: "How do you know your PE teacher doesn't like you?" → C: "Because he is mean to me." / → C: "Because sometimes he says I'm naughty."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	The child may choose both or neither to obtain an N/A.
<u>Coder's comments</u> (e.g. if they provided an irrelevant response, any notable comments):		

Table 10*The Complete MAT-PE Codebook*

Relatedness Satisfaction Like/Dislike of PE Teacher Activity 2b		
Question(s): <i>Do you like your PE teacher? Why?</i> Follow-up question(s): <i>Why don't you like your PE teacher?</i>		
Code	Description	Example
4	The child has articulated that they like their PE teacher and articulates a deep level response as to why.	R: "Why do you like your PE teacher?" → C: "Because they always plan fun games."
3	The child has articulated that they like their PE teacher and articulates a surface level or irrelevant response as to why.	R: "Why do you like your PE teacher?" → C: "Because I do." / → C: "Because we all have to like everyone." / → C: "Because I like ice cream."
2	The child has articulated that they do not like their PE teacher and articulates a surface level or irrelevant response as to why.	R: "Why don't you like your PE teacher?" → C: "Because I just don't." / → C: "Because I like ice cream."
1	The child has articulated that they do not like their PE teacher and articulates a deep level response as to why.	R: "Why don't you like your PE teacher?" → C: "Because they're boring." / → C: "Because they make us do hard work, and I don't like that."
N/A	The child has failed to answer and has not articulated toward which way they feel more affinity with when prompted by the researcher.	The child may choose both or neither to obtain an N/A

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10

The Complete MAT-PE Codebook

Relatedness Satisfaction Inclusion/Exclusion by Peers Activity 2c		
<p>Question(s): Other children let this girl/boy play with them in PE, other children don't let this girl/boy play with them in PE, which girl/boy are you most like?</p> <p>Follow-up question(s): Can you tell me about a time when other children let you play with them in PE? Can you tell me about a time when other children didn't let you play with them in PE?</p>		
Code	Description	Example
4	The child has chosen the "included by peers" option and has articulated a deeper level response when prompted for an example.	R: "Can you tell me about a time when other children let you play in PE?" → C: "Last week, Sally and Jimmy let me in their group when Miss told us to get into groups."
3	The child has chosen the "included by peers" option and has articulated a surface level response when prompted for an example.	R: "Can you tell me about a time when other children let you play in PE?" → C: "I can't remember anything." / → C: "Because I like jelly."
2	The child has chosen the "not included by peers" option and has articulated a surface level response when prompted, for example.	R: "Can you tell me about a time when other children didn't let you play in PE?" → C: "I don't remember." / → C: "Because I like jelly."
1	The child has chosen "not included by peers" and has articulated a deeper level response when prompted, for example.	R: "Can you tell me about a time when other children didn't let you play in PE?" → C: "Miss told us to get into groups, but Bobby and Jimmy wouldn't let me play."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher	
<p><u>Coder's comments</u> (e.g. if they provided an irrelevant response, any notable comments):</p>		

Table 10*The Complete MAT-PE Codebook*

Relatedness Satisfaction Inclusion/Exclusion of Peers Activity 2d		
Question(s): <i>Do you let other children play with you in PE? Why? Why not?</i>		
Code	Description	Example
4	The child articulates that they include other children either all the time or most/some of the time. They also articulate a deeper level response as to why it's important to do this.	R: "Why is it important to let other children play in PE?" → C: "Because if a person is by themselves, they won't be able to play by their self like throw the ball by their self."
3	The child articulates that they include other children either all the time or most/some of the time. They also articulate a surface level or irrelevant response as to why it's important to do this. The child articulates that they include other children either all the time or most/some of the time and articulates that it's not important to let them play.	R: "Why is it important to let other children play in PE?" → C: "Because the teacher makes us." / → C: "Because I just do." / "Because we all do." / → C: "Because I like pancakes."
2	The child articulates that they do not let other children play all the time or most/some of the time. They also articulate a surface level or irrelevant response as to why they don't.	R: "Why don't you let other children play in PE?" → C: "Because I just don't" / "Because I don't want to." / → C: "Because I like pancakes."
1	The child articulates that they do not let other children play all the time or most/some of the time. They also articulate a deeper level response as to why they don't.	R: "Why don't you let other children play in PE?" → C: "Because I like to play alone." / → C: "Because other children don't let me play, so I don't let other children play."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	
<u>Coder's comments</u> (e.g. if they provided an irrelevant response, any notable comments):		

Table 10*The Complete MAT-PE Codebook***Autonomy Satisfaction | Pictorial Choices in PE | Activity 3a**

Choices	Partner	Group	Balls	Beanbags	Cones	Hoops	Mats	Benches	Horses
Tick (if chosen)									

Question(s): *I've got some pictures, and I want to know which things you get to choose in PE and which things your teacher gets to choose. Can you tell me about a time you chose...?*

Code	Description	Example
6	<p>The child chooses most (≥ 5 out of 9) of the pictorial choices on their plate and articulates deep level responses as examples for them.</p> <p><i>Note.</i> A child obtains a score of 6 if they provide a deep-level response to at least one of the choices they have picked.</p>	<p>R: "Can you tell me a time you got to choose a ball?"</p> <p>→ C: "Miss put all the balls in the middle of the hall, and I got to choose mine."</p>
5	<p>The child chooses most (≥ 5 out of 9) of the pictorial choices on their plate and articulates surface level or irrelevant responses as examples for them.</p> <p><i>Note.</i> A child obtains a score of 5 if they provide surface-level or irrelevant responses to all choices they have picked.</p>	<p>R: "Can you tell me a time you got to choose a ball?"</p> <p>→ C: "I chose the red one." / → C: "Last Tuesday." / → C: "Because I like trifle."</p>
4	<p>The child chooses some (1-4 out of 9) of the pictorial choices on their plate and articulates deep level responses as examples for them.</p> <p><i>Note.</i> A child obtains a score of 4 if they provide a deep level response to at least one of the choices they have picked.</p>	<p>R: "Can you tell me a time you got to choose a ball?"</p> <p>→ C: "Miss put all the balls in the middle of the hall, and I got to choose mine."</p>

Table 10*The Complete MAT-PE Codebook*

Autonomy Satisfaction Pictorial Choices in PE Activity 3a		
Code	Description	Example
3	<p>The child chooses some (1-4 out of 9) of the pictorial choices on their plate and articulates surface level or irrelevant responses as examples for them.</p> <p><i>Note.</i> A child obtains a score of 3 if they provide surface-level or irrelevant responses to all choices they have picked.</p>	<p>R: "Can you tell me a time you got to choose a ball?"</p> <p>→ C: "I chose the red one." / → C: "Last Tuesday." / → C: "Because I like trifle."</p>
2	<p>The child chooses none of the pictorial choices and does not articulate examples of the PE teacher choosing them.</p>	<p>R: "Does your PE teacher choose these things all the time or sometimes?" → C: "I don't know."</p> <p>R: "Can you tell me about a time when your teacher chose the beanbags?" → C: "I don't know."</p>
1	<p>The child chooses none of the pictorial choices and articulates some examples of the PE teacher choosing them.</p> <p><i>Note.</i> The child can articulate a deep, surface or irrelevant response.</p>	<p>R: "Does your PE teacher choose these things all the time or sometimes?" → C: "All the time."</p> <p>R: "Can you tell me about a time when your teacher chose the beanbags?" → C: "Miss handed us each a beanbag and told us to throw as far as we could." / → C: "She chooses all the time." / → C: "I like candy floss."</p>
N/A	<p>The child fails to choose any of the pictorial options for themselves or the teacher.</p>	

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10*The Complete MAT-PE Codebook*

Autonomy Satisfaction Follow-up Question 1 Activity 3b		
Question(s): <i>Do you ever get to choose the activities you do in PE or does the teacher?</i>		
<i>Do you get to choose the movements you do in PE, or does the PE teacher show you and tell you what to do?</i>		
Code	Description	Example
3	The child must perceive that they choose both movements and activities either all the time or sometimes .	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "I get to choose." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose?" → C: "I get to choose."
2	The child perceives that they choose either how to perform movements in PE or if they get to choose the activities they do in PE, either all the time or sometimes .	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "The PE teacher chooses." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose?" → C: "I sometimes get to choose."
1	The child perceives that they never get to choose how to perform movements in PE and have no choice over the activities they do in PE.	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "The PE teacher chooses." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose?" → C: "The PE teacher chooses."

Table 10*The Complete MAT-PE Codebook*

Autonomy Satisfaction Follow-up Question 1 Activity 3b	
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.
<u>Coder's comments</u> (e.g. if they provided an irrelevant response, any notable comments)	

Table 10*The Complete MAT-PE Codebook*

Autonomy Satisfaction Follow-up Question Part 2 Activity 3c		
Question(s): <i>Does your teacher listen to you if you have something to say to them?</i>		
Code	Description	Example
3	The child clearly answers yes.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "Yes."
2	The child answers sometimes and may offer an explanation as to why that is.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "Sometimes."
1	The child clearly answers no.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "No."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10*The Complete MAT-PE Codebook***Autonomy Satisfaction | Follow-up Question Part 2 | Activity 3c**Question(s): Does your teacher answer any questions you might have?

Code	Description	Example
3	The child clearly answers yes.	R: <i>Does your PE teacher answer any questions you might have?</i> → C: "Yes."
2	The child answers sometimes and may offer an explanation as to why that is.	R: <i>"Does your PE teacher answer any questions you might have?"</i> → C: "Sometimes."
1	The child clearly answers no.	R: <i>"Does your PE teacher answer any questions you might have?"</i> → C: "No."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10*The Complete MAT-PE Codebook*

Competence Satisfaction Overall Competence Activity 4		
Question(s): <i>How many stars would you give yourself for doing things in PE? / Why would you give yourself...stars?</i>		
Code	Description	Example
9	The child perceives themselves to be 5 stars and articulates a deep level response as to why they think this.	R: "Why do you give yourself five stars?" → C: "Because it feels like it's easy peasy, and it's not even hard, and I can do everything."
8	The child perceives themselves to be 5 stars but articulates a surface level response as to why they think this.	R: "Why do you give yourself five stars?" → C: "Because I just am." / → C: "Because I like popcorn."
7	The child perceives themselves to be 4 stars and articulates a deep level response as to why they think this.	R: "Why do you give yourself four stars?" C: "I'm really good at everything except hula hooping".
6	The child perceives themselves to be 4 stars and articulates a surface level response as to why they think this.	R: "Why do you give yourself four stars?" → C: "Because I just am." / → C: "Because I like popcorn."
5	The child perceives themselves to be 3 stars and articulates a deep or surface -level response as to why they think this.	R: "Why would you give yourself 3 stars?" → C: "Because I am good at some of these things." / → C: "I'm not too sure."
4	The child perceives themselves to be 2 stars and articulates a surface level response as to why they think this.	R: "Why would you give yourself 2 stars?" → C: "Because I just am."

Table 10*The Complete MAT-PE Codebook*

Competence Satisfaction Overall Competence Activity 4		
Code	Description	Example
3	The child perceives themselves to be 2 stars and articulates a deep level response as to why they think this.	R: "Why would you give yourself 2 stars?" → C: "Because I'm good at running and kicking and maybe balancing but nothing else."
2	The child perceives themselves to be 1 star and articulate a surface level response as to why they think this.	R: "Why would you give yourself 1 star?" → C: "Because I just am."
1	The child perceives themselves to be 1 star and articulates a deep level response as to why they think this.	R: "Why would you give yourself 1 star?" → C: "Because I'm not good at anything." → C: "Because I'm kind of good at running but nothing else."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10*The Complete MAT-PE Codebook*

Self-Determined Motivation Summary Table Activity 5		
	List of choices	Deep or surface/irrelevant responses (D/S)
First choice		
Other choices		
Not picked		

Table 10

The Complete MAT-PE Codebook

Self-Determined Motivation Favourite Reasons for PE Participation Activity 5		
Intrinsic: I do PE because it's fun.		
Question(s): <i>Out of all these reasons, which are your favourite reasons for doing PE?</i> / Follow-up question: <i>Why is PE fun?</i>		
Code	Description	Example
5	First choice/Deep level response. The child has chosen intrinsic regulation as their first choice for PE participation and articulates a deep level response for the intrinsic follow-up question.	R: "Why is PE fun?" → C: "It's fun because we get to play games with my friends." / → C: "It's fun because we get to learn new things."
4	First choice/surface level response. The child has chosen intrinsic regulation as their first choice for PE participation and articulates a surface level or irrelevant responses for the intrinsic follow-question.	R: "Why is PE fun?" → C: "Because it is." / → C: "I don't know." / → C: "Because I like popsicles."
3	Other choice /Deep level response. The child has chosen intrinsic regulation as their other choice for PE participation and articulates deep level responses for the intrinsic follow-up question.	R: "Why is PE fun?" → C: "It's fun because we get to play games with my friends." / → C: "It's fun because we get to learn new things."
2	Other choice /Surface level or irrelevant response. The child has chosen intrinsic regulation as their other choice for PE participation and articulates surface level or irrelevant responses for the intrinsic follow-question.	R: "Why is PE fun?" → C: "Because it is." / → C: "I don't know." / → C: "Because I like popsicles."
1	Not picked	The child does not pick intrinsic regulation
<u>Coder's comments</u> (e.g. if they provided an irrelevant response, any notable comments)		

Table 10

The Complete MAT-PE Codebook

Identified: I do PE because I want to be healthy and strong.

Question(s): *Out of all these reasons, which are your favourite reasons for doing PE?* / **Follow-up questions:** *Is being healthy and strong important? Why is it important to you?*

Code	Description	Example
5	First choice/Deep level response. The child has chosen identified regulation as their first choice for PE participation and articulates deep level responses for identified regulation.	R: "Why is it important to be healthy and strong?" → C: "It's important to be healthy and strong because you live longer."
4	First choice/Surface or irrelevant level response. The child has chosen identified regulation as their first choice for PE participation and articulates surface level or irrelevant responses for the identified follow-questions. <i>Note.</i> The child also obtains a score of 4 if they state that being healthy and strong is not important.	R: "Why is it important to be healthy and strong?" → C: "I don't know why." → C: "So you can get healthier and stronger." → C: "Because I like candy canes."
3	Other choice/Deep level response. The child has chosen identified regulation as their other choice for PE participation and articulates deep level responses for identified regulation.	R: "Why is it important to be healthy and strong?" → C: "It's important to be healthy and strong because you live longer."
2	Other choice/Surface level or irrelevant response. The child has chosen identified regulation as their other choice for PE participation and articulates surface level or irrelevant responses for the identified follow-questions. <i>Note.</i> The child also obtains a score of 2 if they state that being healthy and strong is not important.	R: "Why is it important to be healthy and strong?" → C: "I don't know why." → C: "So you can get healthier and stronger." → C: "Because I like candy canes."
1	Not picked	The child does not pick identified regulation

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10

The Complete MAT-PE Codebook

Introjected: I do PE because I want my teacher and classmates to like me.		
Question(s): <i>Out of all these reasons, which are your favourite reasons for doing PE?</i> / Follow-up questions: <i>Is it important for your teacher and classmates to like you? Why? Do you ever feel like you need to do PE to show other people how good you are at PE?</i>		
Code	Description	Example
5	First choice/Deep level response. The child has chosen introjected regulation as their first choice for PE participation and articulates deep level responses for the introjected regulation follow-up questions.	R: "Why is it important that they like you?" → C: "It's important that they like me because otherwise, I won't have any friends."
4	First choice/Surface or irrelevant level response. The child has chosen introjected regulation as their first choice for PE participation and articulates surface level or irrelevant responses for the introjected follow-questions. <i>Note.</i> The child also obtains a score of 2 if they state that it is not important for their teacher and classmates to like them.	R: "Why is it important that they like you?" → C: "I don't know why." → C: "Because I like cookies."
3	Other choice/Deep level response. The child has chosen introjected regulation as their other choice for PE participation and articulates deep level responses for the introjected regulation follow-up questions.	R: "Why is it important that they like you?" → C: "It's important that they like me because otherwise, I won't have any friends." /
2	Other choice/Surface level or irrelevant response. The child has chosen introjected regulation as their other choice for PE participation and articulates surface level or irrelevant responses for the introjected follow-questions. <i>Note.</i> The child also obtains a score of 2 if they state that it is not important for their teacher and classmates to like them.	R: "Why is it important that they like you?" → C: "I don't know why." → C: "Because I like cookies."

Table 10*The Complete MAT-PE Codebook*

Introjected: I do PE because I want my teacher and classmates to like me.		
Code	Description	Example
1	Not picked	The child does not pick identified regulation

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10

The Complete MAT-PE Codebook

External (Reward): I do PE because I might get a reward.		
Question(s): <i>Out of all these reasons, which are your favourite reasons for doing PE?</i> / Follow-up questions: <i>Do you get rewards in PE? What are they?</i>		
Code	Description	Example
5	First choice/Deep level response. The child must state what rewards are offered in PE and articulates a deep level response for what rewards they receive in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "We get stickers and star of the week."
4	First choice/Surface level or irrelevant level response. Child states what rewards they are offered and articulates a surface level or irrelevant response for what rewards they receive. <i>Note.</i> The child also obtains a score of 4 if they state that they do not receive rewards in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "I don't know." / → C: "I like doughnuts."
3	Other choice/Deep level response. The child must state what rewards are offered in PE and articulates a deep level response for what rewards they receive in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "We get stickers and star of the week."
2	Other choice/Surface level or irrelevant response. The child states what rewards they are offered and articulates a surface level or irrelevant response for what rewards they receive. <i>Note.</i> The child also obtains a score of 2 if they state that they do not receive rewards in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "I don't know." / → C: "I like doughnuts."
1	Not picked	The child does not pick external (reward) regulation.
Coder's comments (e.g. if they provided an irrelevant response, any notable comments):		

Table 10*The Complete MAT-PE Codebook***External (Punishment): I do PE because I don't want to get into trouble.****Question(s):** *Out of all these reasons, which are your favourite reasons for doing PE?* / **Follow-up question:** *If you knew you wouldn't get into trouble, would you still want to do PE?*

Code	Description	Example
5	First choice. The child has chosen external (punishment) regulation as their first choice for PE participation. <i>Note.</i> The child must state no to the follow-up question.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "No" R: "Why?" → C: "Because I wouldn't get into trouble if I didn't do PE." / → C: "I don't know why."
4	First choice. The child has chosen external (punishment) regulation as their first choice for PE participation. <i>Note.</i> The child has said yes to the follow-up question and offers a deep or surface-level/irrelevant response.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "Yes" R: "Why?" → C: "Because I like PE" / → C "I don't know."
3	Other choice. The child has chosen external (punishment) regulation as their other choice for PE. <i>Note.</i> The child must state no to the follow-up question.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "No" R: "Why?" → C: "Because I wouldn't get into trouble if I didn't do PE." / → C: "I don't know why."
2	Other choice. The child has chosen external (punishment) regulation as their other choice for PE participation and articulates. <i>Note.</i> The child has said yes to the follow-up question and offers a deep or surface-level/irrelevant response.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "Yes" R: "Why?" → C: "Because I like PE" / → C "I don't know."
1	Not picked	The child does not pick identified regulation

Coder's comments (e.g. if they provided an irrelevant response, any notable comments):

Table 10*The Complete MAT-PE Codebook***Amotivation: I don't want to do PE.****Question(s):** *Out of all these reasons, which are your favourite reasons for doing PE?* / **Follow-up question:** *Why don't you want to do PE?*

Code	Description	Example
5	First choice/Deep level response. The child has chosen amotivation as their first choice and articulates deep level responses for the amotivation regulation follow-up questions.	R: "Why don't you want to do PE?" →C: "I don't want to do PE because I'm not good at it." / →C: "I don't see the point."
4	First choice/Surface or irrelevant level response. The child has chosen amotivation as their first choice and articulates surface -level responses as to why they don't want to do PE.	R: "Why don't you want to do PE?" → C: "I don't know why." / → C: "Because I like bonbons."
3	Other choice/Deep level response. The child has chosen amotivation as their other choice and articulates deep level responses for the amotivation regulation follow-up questions.	R: "Why don't you want to do PE?" →C: "I don't want to do PE because I'm not good at it." / →C: "I don't see the point."
2	Other choice/Surface level or irrelevant response. The child has chosen amotivation as their other reason and articulates surface -level responses as to why they don't want to do PE.	R: "Why don't you want to do PE?" → C: "I don't know why." / → C: "Because I like bonbons."
1	Not picked	The child does not pick identified regulation

Coder's comments (e.g., if they provided an irrelevant response, any notable comments)

Content validity and acceptability of the MAT-PE codebook

The next phase of the study aimed to determine the codebook's content validity and acceptability among SDT researchers.

Methods

Participants

Four individuals (50% female) with a range of SDT experience, who were independent of the research team, were asked to use the codebook and associated instruction manual (see Appendix B) to code an additional transcript from Study 1 (Chapter Three). Two of the coders were academics in psychology/sport coaching with 10 and 11 years of experience in their area of interest, respectively. The other two coders were post-graduate students in performance psychology/psychology with four and six years in their area of study, respectively.

Procedure

A brief explanation of tool administration was given to all participants before being asked to read the instruction manual. Participants were then given time to code the designated transcript using the codebook and were asked to note down any thoughts or queries as they did this so that they would not have to remember any difficulties or questions that they had whilst using the codebook. A discussion was held after the coding was completed between each participant and the researcher. They were asked a series of content validity and acceptability questions regarding each part of the codebook. Content validity questions referred to relevance (*Is the code table relevant for the construct of interest? Are all code options independent of*

each other with no overlapping or ambiguous descriptions and examples?) comprehensiveness (*Are there any key concepts not covered by the codes?*) and comprehensibility (*Are the instructions understandable? Is the language used in the code table understandable?*) (Terwee et al., 2018). Acceptability questions were also included (*Were any sections difficult to complete? Would you change anything in the code table to improve it?*). Responses were captured through participants writing their answers to each question after completing the coding followed by a discussion between researcher and participants, which was recorded via Dictaphone. Written answers were inputted into a spreadsheet, recorded discussions were listened to, and any extra information which was provided verbally was added into the spreadsheet.

Results

Coding took approximately 30 minutes to complete (including the reading of the transcript and allocation of codes), which included note-taking for future discussion as they progressed through the coding process. All four individuals who completed the codebook content validity and acceptability agreed that for each construct (enjoyment, relatedness, autonomy, competence and behavioural-regulation) the codebook was relevant, comprehensive and understandable. When asked if they had any recommended changes that would make the codebook easier to use, the feedback included: provide more examples (enjoyment), put in place a way to keep track of the chosen equipment (autonomy), label the type of motivation in the instruction booklet (behavioural regulation). Where possible, these recommendations were taken on board, and the codebook was amended.

Inter-rater and intra-rater reliability of the MAT-PE codebook

The final phase of Chapter Four aimed to determine inter-rater and intra-rater reliability of researchers using the developed codebook.

Methods

Participants

Three individuals (100% female) with SDT knowledge were asked to determine the inter-rater reliability of the codebook. Individuals consisted of a post-graduate student who had helped determine the acceptability of the codebook, an academic and researcher in the area of psychology and SDT, and the author of this manuscript.

Measures and procedure

Each individual was given the codebook, the instruction manual and eight transcripts from eight different children provided through the MAT-PE tool to determine inter-rater reliability. Transcript data consisted of verbatim responses from children collected during the MAT-PE administration. Transcripts were randomly selected via a computerised number generator to include four from Study 1 (Chapter 3, phase 2) and four from a later time point (Chapter Five). Intra-rater reliability was examined by investigating the consistency between codes when the same eight transcripts were coded by the manuscript author on two separate occasions one week apart.

Data analysis

Statistical tests were completed using SPSS, version 24 [IBM SPSS Statistics Inc., Chicago, IL, USA]. For inter-rater and intra-rater reliability (IRR), intraclass correlation coefficients (ICC), two-way mixed single measures for absolute agreement with 95% confidence intervals (95% CI), were used to determine the level of agreement between three raters (inter-rater reliability) and between two time points (intra-rater reliability). The IRR was interpreted with cut-offs set at less than 0.40 (poor), between 0.40 and 0.59 (fair), between 0.60 and 0.74 (good) and between 0.75 and 1.0 (excellent; Cicchetti, 1994).

Results

Inter-rater reliability for PE enjoyment, relatedness, autonomy, competence, autonomous motivation, controlled motivation all had an ICC above 0.9, which is considered excellent (Cicchetti, 1994). As there was zero variance in the coding for amotivation for all eight transcripts, no ICC could be calculated for this construct. However, the scores had 100% agreement between the three raters. Intra-rater reliability for PE enjoyment, relatedness, autonomy, competence, autonomous motivation, controlled motivation all had an ICC above 0.9, which is considered excellent (Cicchetti, 1994). As there was zero variance in the coding for amotivation for all eight transcripts, SPSS could not generate an ICC for this construct; however, the scores had 100% agreement between the two time points.

Discussion

This study developed a codebook to analyse transcript data from the MAT-PE. The codebook was found to be acceptable by researchers with differing SDT experience, judged to have content validity via an independent sample of researchers, and demonstrated excellent inter- and intra-rater reliability. These findings suggest that researchers with various levels of SDT experience can use the codebook with consistency following minimal training.

Coding structure

The quantitative strand had priority within the tool (as it dictated the follow-up qualitative-based questions) but also within the coding structure as the child's initial response would have the coder place the child towards the top (for a more positive choice/response) or the bottom (for a more negative choice/response). Code choice was then solidified by the qualitative response, i.e., a deep or surface-level response.

If a child provided more information than was gathered within their initial quantitative response, then they were coded as providing a deep-level response. If a child provided no more information than was gathered within their initial quantitative response, then they were coded as providing a surface-level response. Deep-level responses were not always given a higher score; they could also be given a lower score. For example, a child who provided a justification, rationale or relevant explanation for their choice, which was positive, would get a higher code than a child who provided a surface level response. However, if a child chose a negative quantitative choice (e.g., felt disliked by the teacher), and provided a justification,

rationale or relevant explanation, they would be coded lower than a child who provided a surface-level response for the same initial choice. It is acknowledged that this is a novel approach. However, it felt necessary to incorporate the qualitative data into the coding calculation. Children who provided a deep-level response were thought to have a more substantial, more meaningful and higher quality motivation compared to children who provided no more information than was gleaned from their initial choice.

Typically, codebooks for quantitative analysis have an overarching theory, a behavioural checklist, and an incremental numbering system corresponding to the overarching theory (Rourke & Anderson, 2004). Within this study, the overarching theory was SDT, split into BPNT and OIT. The behavioural checklist was the examples of possible responses to the questions within the tool, and an incremental numbering system corresponded to these behaviours for each question. Therefore, this coding structure was very similar to other coding structures.

Children did not have to be verbally adept to obtain maximum scores through this coding structure; they only had to provide a little more information than their quantitative choice. The MAT-PE was designed to be an inclusive tool that is capable of facilitating responses from all young children with basic English language speaking and listening skills, thus avoiding bias to more verbally adept children. This consideration was also reflected in the tool's codebook. An instruction manual was also created for the codebook and can be seen in Appendix B.

Content validity

A matching task (like in Chapter Three) was not possible for this external content validity assessment for the codebook, due to its format. Independent researchers were asked questions in regard to the codebook's content validity. Their suggestions, such as to include more examples and to label the different types of behavioural were taken on board to make the codebook more acceptable.

Anecdotally, although the researchers were given an instruction manual, half of them did not use it ($n=2$), instead only working off the codebook, and were able to code the transcripts resulting in highly similar results. This anecdotal finding indicates that there was sufficient detail within the codebook to guide coders. However, it would be advocated for future coders to review the instruction manual before attempting to code, especially if they have some but limited SDT experience/knowledge.

Reliability

Three researchers with varying SDT experience completed inter-rater reliability of the codebook and ascertained "excellent" reliability (Cicchetti, 1994). It has been shown that raters with different backgrounds and experiences can provide differential assessments and including around 10 participants is adequate to account for these differences (Dunn et al., 1999). However, past quantitative content analysis studies have used three coders (Ash et al., 2017; Lock et al., 2016) and two coders (Ash et al., 2017; Döring et al., 2016). Therefore, procedures used by a variety of other studies within similar areas of research were followed and viewed three coders to be an acceptable sample size. This consideration is especially so, from a practical point

of view, as each transcript took around 30 minutes to code leading to around four hours of work per coder.

Strengths, limitations, practical implications, and future directions

Like the development of the MAT-PE, the codebook's development also spanned several months (~5 months), where multiple iterations were discussed (15 versions) in between research team members. This level of rigour is considered a strength as two of the research team members had prior codebook development experience, and all had SDT knowledge (Terwee et al., 2018). An independent sample of researchers ascertained the content validity and acceptability of the codebook, which is a strength as they were not involved in its development (Dunn et al., 1999). The codebook also obtained excellent inter-rater reliability, indicating that multiple researchers could use the codebook and produce reliable results, which would cut down coding time in a larger data set.

The administration time of the MAT-PE and codebook could be considered a limitation due to the length of time for administration and coding (~ 2 hours per child); however, it is worthwhile when considering the amount of depth and richness of data provided by young children. Any researcher with a background in SDT would be capable of using the codebook alongside the instruction manual. However, it would be advised that future researchers who wish to use the MAT-PE and codebook receive training; development of an appropriate training package is currently ongoing.

Future research should examine strategies to reduce coding times, such as conducting live coding alongside the MAT-PE administration or directly coding from

audio recordings without transcription. The former may require a second researcher to complete the coding process while the other administers the tool with the child, which would reduce the administration to around 45 minutes.

Conclusion

A codebook was specially designed for the MAT-PE so that quantitative content analysis could be conducted on the MAT-PE transcript data. Development was rigorous and systematic and resulted in a codebook which was judged to be acceptable and to have content validity by an independent sample of researchers. The codebook also demonstrated excellent inter-rater reliability. The MAT-PE was developed to examine motivational profiles, antecedents, consequences, and effect of interventions, and the codebook allows this through quantitative content analysis. The next steps were to evaluate the utility of the tool and its predictive validity, which are investigated in Chapter Five.

Chapter 5

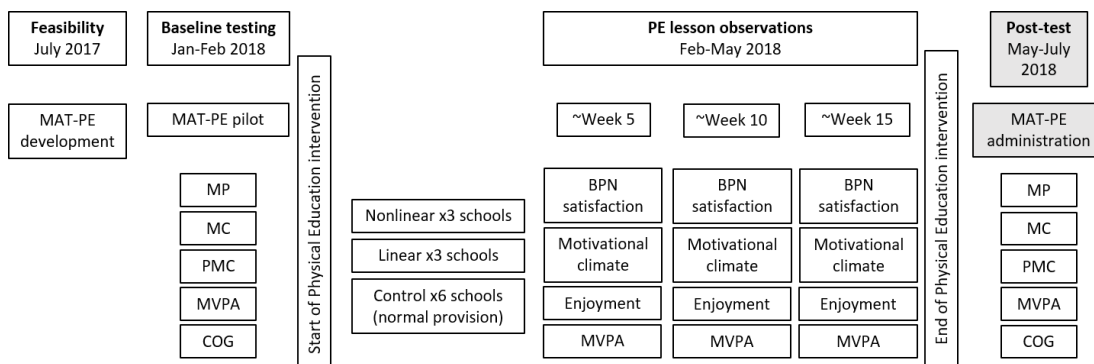
Utility and predictive validity
of the MAT-PE

Thesis study map

<p>Chapter Three (Study One):</p> <p>The development and content validity of the Motivation Assessment Tool for Physical Education (MAT-PE)</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop a mixed-method tool for assessing young children's enjoyment, BPNS and behavioural regulation within PE. • To ascertain the content validity of the tool through the research team and independent researchers. <p>Key findings:</p> <ul style="list-style-type: none"> • A seven-stage, mixed-method, activity-based tool was developed with the target population. • The tool's content validity was ascertained via a sample of independent SDT researchers.
<p>Chapter Four (Study One):</p> <p>The development, content validity, acceptability and reliability of the Motivation Assessment Tool for Physical Education codebook</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop codebook in order to integrate the quantitative and qualitative strands of the tool. • To ascertain content validity, acceptability, inter- and intra-rater reliability of the codebook. <p>Key findings:</p> <ul style="list-style-type: none"> • The specially developed MAT-PE codebook had content validity, acceptability, and reliability.
<p>Chapter Five (Study Two):</p> <p>Utility and predictive validity of the MAT-PE</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To investigate the utility of the tool and codebook. • To describe the motivational profiles of 79 children aged 5-6 years. • To ascertain the predictive validity of the MAT-PE and other PE outcomes such as motor proficiency, motor creativity and MVPA.

Figure 10

The Placement of Study 2 within the RCT (greyed).



Note. MAT-PE = Motivation Assessment Tool for Physical Education, MP = Motor Proficiency, MC = Motor Creativity, PMC = Perceived Motor Competence, MVPA = Moderate to Vigorous Physical Activity, COG = Cognition, BPN = Basic Psychological Needs

Abstract

Introduction: The MAT-PE and codebook were created to assess young children's enjoyment, BPNS, and behavioural regulations in PE. Motivation has shown to predict PE-based outcomes such as motor proficiency and PA in older children. However, due to the paucity of research in young children, it is not known whether young children's motivation predicts these outcomes. Exploring the predictive validity of the MAT-PE is also essential to establish, according to COSMIN guidelines. **Aims:** This chapter aims to explore the utility of the MAT-PE as well as explore its predictive validity. **Results:** The MAT-PE demonstrated its utility by capturing a range of motivational perceptions within the sample of young children. Children tended to enjoy PE, had high relatedness and competence and moderate autonomy. Most children found PE to be 'fun' (intrinsically motivated); however, all behavioural regulations were chosen, as well as amotivation. A high percentage of children provided a deep-level response to the behavioural regulations that they chose. The MAT-PE did not significantly predict

motor proficiency, motor creativity or MVPA; however, it did explain more of the variance in comparison to demographic and group predictor variables. Autonomy need satisfaction significantly and negatively predicted motor proficiency and identified regulation significantly and positively predicted MVPA. **Conclusion:** The MAT-PE demonstrated its utility in assessing young children's motivation and demonstrated that young children's motivation is somewhat important for PE-based outcomes.

Introduction

In Chapters Three and Four, the MAT-PE and its codebook were developed to assess and explore young children's contextual motivational perceptions within PE. Both have shown good content validity, and the codebook has demonstrated acceptability and excellent reliability. As argued elsewhere, content validity is said to be the most important type of validity to establish first. However, other types of validity are also necessary. Criterion validity includes such methods as predictive validity, which is the ability of a measure to predict performance on another outcome variable (Adams et al., 2014). Ascertaining the predictive validity of the MAT-PE, specifically, BPNS, behavioural regulation and enjoyment, can help researchers understand whether children's BPNS, fostering motivation and enjoyment are important for movement competence development in young children. Alongside this, the utility of the MAT-PE and its codebook is yet to be explored.

It is essential to determine the level of BPNS, behavioural regulation and enjoyment of young children in PE. Older children (ages eight to 12) have reported high levels of BPNS, intrinsic and identified regulations, moderate levels of introjected regulation, and low levels of external regulation and amotivation (Chen, 2014; Chen & Hypnar, 2014). Corpus et al. (2009) investigated intrinsic and extrinsic motivation, within the context of academic achievement, in third through eighth-grade children (ages eight to 14) and found that both types of motivation decreased with age. However, extrinsic motivation decreased to a greater extent in elementary children, while intrinsic motivation decreased to a greater extent in adolescents. This study indicates a complex motivational pathway that may be determined by age and

context. It may become more complex with the addition of enjoyment and the concept of liked and disliked behaviours. For example, liked behaviours can be intrinsically motivating across the age range; however, disliked behaviours have been reported to be driven by extrinsic motivation in younger children and through more internalised motivation for older children (Chandler & Connell, 1987). Regardless of this complexity, children's motivation within PE starts to decrease from at least the age of eight (Chanal et al., 2019). However, it is not known whether this decline begins earlier due to a lack of age-appropriate measurement tools. It is, therefore, necessary to investigate the utility of the MAT-PE in measuring motivational perceptions of younger children (ages five to six) so that we may start to understand their motivational processes. Sex differences have emerged in motivational research (Standage et al., 2005; Teixeira et al., 2012; Vecchione et al., 2014; Véronneau et al., 2005) within older children and adolescents, warranting investigation within a younger sample.

As has been explained in Chapter Two, BPNS influences the type of motivation children feel (Vallerand, 2007): intrinsic, extrinsic, or amotivation. One role of the PE teacher is to support children on their journey towards a lifelong commitment to a healthy lifestyle (Edwards et al., 2017) and another is to help young children develop mastery of movement skills so that they can participate in PA (Department of Education, 2013; UNESCO, 2013). It stands to reason that if a child is motivated within PE and enjoys taking part, they will spend more time-on-task (i.e., the outcome of the PE lesson) and therefore develop the movement skills necessary for PA participation. Supporting movement skills and PA is important as PA relates positively to physical

(Jansseen & LeBlanc, 2019), cognitive (Donnelly et al., 2016; Marques et al., 2018) and psychological factors (Biddle & Asare, 2011; Biddle et al., 2019).

Guidelines stipulate that children between five and 18 years of age should participate in, on average, 60 minutes of MVPA per day (UK Chief Medical Officers' Physical Activity Guidelines, 2019). Failure to meet these guidelines increases the likelihood of obesity (Poitras et al., 2016), poor mental health (Biddle & Asare, 2011), and lower quality of life (Wu et al., 2017). Therefore, it is necessary to understand whether motivation is important for PA in young children

Relationships between BPNS, behavioural regulation, enjoyment and MVPA

BPNS and behavioural regulation. The literature has demonstrated relationships between BPNS, behavioural regulations and MVPA; however, research in young children (below the age of eight) is non-existent. In adults, BPNS have been found to predict habitual PA (Rahman et al., 2011) and mediates the relationship between intrinsic goals and self-reported exercise behaviour (Sebire et al., 2009). In boys with a mean age of 14.36, self-determined motivation has positively and significantly predicted MVPA during PE and positively associated with leisure-time MVPA (Owen et al., 2013). A systematic review of youth (aged 10 to 17) has demonstrated moderate positive relationships between autonomous motivation and PA, and weak negative relationships between controlled motivation and amotivation and PA (Owen et al., 2014). In children, BPNS has associated positively with MVPA across two time points in children aged 8.9-12.5 years (Brunet et al., 2016). This study is the only study to be found that examined BPNS and MVPA in younger children. This

lack of research in younger children is most likely due to a lack of appropriate motivation measurement tools (Sebire et al., 2013).

Enjoyment. Literature is also limited within enjoyment and MVPA. Gråstén (2016) found positive correlations between PA level and PE enjoyment in nine to 13-year-old children. Simpson et al. (2017) did not find a significant relationship between enjoyment and objectively measured MVPA. However, they did find a significant positive relationship between enjoyment and self-reported participation in team sports and leisure activities in boys only, aged nine to 12 years. Enjoyment has a more substantial direct and total effect on PA than behavioural intention in seven to 11-year-old children (Lee et al., 2020). A narrative review found enjoyment to be a predictor of PA and also highlighted its importance in supporting movement skills (Bremer & Cairney, 2018). Kruk et al. (2018) conducted a longitudinal study in 5-11-year-old children, investigating the relationship between enjoyment and PA. They found that enjoyment at the first time point predicted higher levels of MVPA at time two. Gao (2008) found that enjoyment accounted for some variance within PA (16.5%) in children aged 11-14 years. There seems to be an association between enjoyment and MVPA; however, most studies have been conducted in older children. Research is needed to investigate whether enjoyment is important for MVPA in younger children.

Movement

FMS are an important determinant of PA (Hulteen et al., 2018; Stodden et al., 2008; Robinson et al., 2015) while also being a primary aim for PE curricula (Department of Education, 2013). Hulteen et al. (2018) suggest, through their

developmental model, that once children break through the FMS proficiency barrier, this then opens up opportunities for specialised movement skills attributable to different sports and PA. It is this ability to perform specialised movements within these opportunities that foster a lifetime of PA. FMS include locomotor (e.g., run, jump, and hop), object control (e.g., throw, kick, and bounce), and stability skills (e.g., static and dynamic). The meaning behind proficiency is the attainment of mastery which is suitable for motor skills measured via criteria (e.g., through the Test of Gross Motor Development). Therefore, within this thesis, the combination of locomotor, object control, and stability skills measured in this way will be referred to as motor proficiency.

Another type of movement that may be important for young children's development and a determinant of PA is motor creativity. Motor skill and motor creativity are two interrelated developmental processes within early childhood (Grammatikopoulos et al., 2012; Milić, 2014). Motor creativity is "the combination of perceptions into new and fresh motor patterns which can either be a solution to a preestablished problem or the expression of an idea or emotion by means of the human body" (Wyrick, 1968, in Cleland & Gallahue, 1993, p. 536). Divergent movement is related to motor creativity in that it consists of fluency (number of performed skills) and flexibility (thematic changes within performed skills), which are combined to produce a divergent movement score (Cleland & Gallahue, 1993). It could be argued that the ability of a child to adapt and attune their movements to the given moment may be beneficial in order to produce new and functional movement solutions across a variety of sport and physical activities. Children who can do this may potentially experience more success in their participation. However,

this particular area of research is limited. Currently, it is also unknown whether the satisfaction of young children's BPN, behavioural regulation and enjoyment are important for motor proficiency and motor creativity.

Relationships between BPNS, behavioural regulation, motor proficiency and motor creativity

BPNS and behavioural regulation. BPNS and behavioural regulation literature indicate a relationship with motor proficiency. A study in children with a mean age of 13.08 years found that a task-involving motivational climate influenced perceived competence, affecting self-determined motivation, which in turn, improved motor proficiency (Kalaja et al., 2009). Intrinsic motivation also improved balance (Kalaja et al., 2009). However, relatedness and autonomy need satisfaction were not assessed. A systematic review supported this work by highlighting that motivational climates within PE that encourage high autonomy may be critical in improving motor proficiency through supporting perceived competence (Tompsett et al., 2017). With slightly alternative results, a study by van Aart et al. (2017) investigated the relationships between BPNS and autonomous motivation as well as the relationship between BPNS and FMS in 9-12-year-old children within PE. They found that, apart from autonomy (for which there were problems with reliability and validity), there were moderate to strong correlations between BPNS and autonomous PE motivation. However, there were no significant positive relationships between BPNS and FMS, nor PE motivation and FMS. Thus, there seem to be inconsistencies within the literature regarding BPNS and their relationship to FMS.

Enjoyment. Much research conducted within the field of PE, movement proficiency and enjoyment have placed enjoyment as the outcome rather than the predictor (Gråstén et al., 2012; Scanlan & Lewthwait, 1986; Fairclough, 2003). Theeboom et al. (1995) demonstrated that eight to 12-year-old children subjected to a mastery-climate in PE had significantly higher enjoyment and motor skills; however, correlations between motor skills and enjoyment were not conducted.

The relationship between enjoyment, BPNS, behavioural regulation and motor creativity has yet to be established due to the limited literature within this area. Understanding how BPNS affects FMS development and motor creativity is essential, especially in younger children, where motor development is critical (Hardy et al., 2010).

Aims of the study

The first aim of this study was to identify young children's BPNS, behavioural regulations, and enjoyment towards PE and any sex differences. The second aim was to identify whether the MAT-PE has predictive validity, i.e., does BPNS, behavioural regulation and enjoyment predict important outcomes for this age group: MVPA, motor proficiency and motor creativity.

Method

Design

Data collection for this study took place during the post-test data collection period of the wider SAMPLE-PE project (Rudd et al. 2020, see Figure 10). Gatekeeper consent from headteachers and informed consent from parents, as well as assent

from children, were obtained before participation in the PE lessons and data collection.

Participants

MAT-PE data was collected from 78 children (male=48.71%, White British=57.70%, $age_m=6.34$ years, $SD=0.30$). One child did not provide ethnicity. Most children ($n=71$) were from the most disadvantaged areas of a large city in North West England. Most postcodes ranked within the most deprived tertile for the English population (deprivation rank: 1=50, 2=17, 3=4), determined by the 2015 English Indices of Deprivation Index (Ministry of Housing, Communities & Local Government, 2019). Six of the children within this sample were classed with Special Educational Needs (SEN). Mean BMI (raw) for the sample was 15.53 ($SD = 1.93$). BMI via International Obesity Task Force (IOTF; Cole & Lobstein, 2012) classed the majority of children at 'thinness grade 1' ($n=41$), followed by 'overweight' ($n=17$), 'thinness grade 2' ($n=8$), 'obese' and 'thinness grade 3' ($n=4$ each), and 'morbid obese' ($n=1$). BMI data from two children were not collected.

Measures

Motor proficiency

Locomotor and object control skills. The Test of Gross Motor Development-3rd Edition (TGMD-3; Ulrich, 2013) assesses children on 13 skills, split into two classes of movement: locomotor ($n=6$) and object control ($n=7$). Locomotor skills consist of the run, gallop, hop, skip, jump, and side gallop. Object control skills consist of the two-hand strike, one-hand strike, one-hand dribble, two-hand catch, kick, overarm throw, and underarm throw. Children's movements are scored on specific criteria (0=not present, 1=present). Children watched one demonstration per skill provided

by the trained administrator and then proceeded to have one practice trial before completing two recorded trials, which were assessed. The assessment duration was between 30 and 45 minutes, depending on the size of the group. All skills were video-recorded and coded by a trained coder. The TGMD-3 is a reliable test of motor performance in children aged four to 10 with inter- and intra-rater reliability above an Intraclass Correlation Coefficient (ICC) of .96 (Maeng et al., 2016), which is considered excellent (Cicchetti, 1994). Scores range from 0 (no criteria are present across two trials) to 100 (all criteria are present across two trials).

Stability. Stability was assessed with the Test of Stability Skills (TSS; Rudd et al., 2015). The TSS assesses children on three skills (log roll, rock, and back-support). All skills are assessed on varying numbers of criteria (0=not present, 1=present), depending on the skill. The TSS has good construct validity and is valid for children aged between six and ten years of age (Rudd et al., 2015). Children watched one demonstration per skill provided by a trained administrator and then proceeded to have one practice trial before completing two recorded trials. All skills were video-recorded and coded by a trained coder. The test duration was around 15 minutes, with a group of three to four children. Scores range from 0 (no criteria are present across two trials) to 24 (all criteria are present across two trials).

Motor creativity

Divergent movement. The Divergent Movement Ability Assessment (DMA) assesses children's fluency (total number of responses) and flexibility (number of thematic changes), which are combined to produce a divergent movement score (Cleland & Gallahue, 1993). The DMA consists of three stations: locomotor, object control, and stability. A child obtains fluency points by demonstrating different skills

such as running and jumping. A child obtains flexibility points by altering those skills in some way, for example, running backwards or jumping sideways. On the locomotor station, children were asked to move in as many different ways as they could. Children were asked to make as many shapes as possible with their bodies on the stability station. On the object control station, children were asked to play with the ball in as many different ways as they could. Children were given two trials of 90 seconds each at each station. The DMA takes approximately 15 minutes to complete with a group of three children (one on each station). Both trials were video-recorded and coded by a trained coder.

Physical activity

Moderate-to-vigorous-exercise (MVPA). Children wore an ActiGraph GT9X triaxial accelerometer (ActiGraph, USA) on their non-dominant wrist for seven days. The accelerometer was set to record at 30Hz over 1-second epochs to measure acceleration in a range of ± 8 g on x, y, and z axes. ActiLife software was used to download the acceleration data in 1-second epoch files and then exported to .csv format. GGIR version 1.11-0 from R software version 3.2.5 was used to classify the time spent in MVPA using age-appropriate validated cut-points (Crotti et al., 2020). PA data were analysed between 06:00 and 23:00. A valid day consisted of the child wearing the monitor for at least 10 hours. A valid week consisted of the child wearing the monitor for at least three school days and one weekend day. Wear time was calculated as default from GGIR package (Migueles et al., 2019; Van Hees, 2020; Van Hees et al., 2013). Mean wear time was 16.16 hours for the sample.

Anthropometry

Height was assessed with a portable stadiometer (Leicester Height Measure, SECA, Birmingham, UK), and body mass was assessed using digital scales (Tanita WB100-MA, Tanita Europe, Netherlands). Height and weight were collected to determine children's Body Mass Index (BMI), which was then adjusted with age and sex through the International Obesity Task Force (IOTF) growth-reference (Cole & Lobstein, 2012).

Basic psychological needs and enjoyment

MAT-PE. The MAT-PE has been fully described in Chapters Three and Four. Briefly, the interactive, age-appropriate tool is underpinned by OIT and BPNT, resulting in five tasks, including enjoyment. Enjoyment of PE was captured through a Draw and Write task and coded on a 1-4 scale for like and dislike of PE. For a total enjoyment score, the dislike of PE code was subtracted from the like of PE code resulting in a scale from -3 to +3 (positive scores indicating a higher enjoyment of PE). Relatedness need satisfaction was captured through two sets of two cards, depicting relationships between the child and their PE teacher and between the child and their peers. Responses were coded on a 1-4 scale, across four questions, resulting in a score range from four to 16. Autonomy need satisfaction was captured through a sorting task and subsequent follow-up questions, which resulted in a score range between four and 15. Competence need satisfaction was captured through children judging their FMS ability and resulted in scores ranging from one to nine. The last task captured children's self-determined motivation by choosing their most important reasons for partaking in PE. Aside from the enjoyment activity, which is whole-class-based, all other tasks within the tool were administered one-to-one with a trained

administrator. The one-to-one section of the tool took approximately 20 minutes to complete and was recorded via Dictaphone, transcribed verbatim, and coded via codebook (described in Chapter Four).

Training and reliability of assessments

Training. Administrators of the TGMD-3 had prior experience of administering the TGMD-2. Two research assistants were trained to administer the TSS. Three research assistants had previous experience of administering the DMA. Research assistants received at least six hours of training on coding the TGMD (n=4 coders), DMA (n=5 coders), and stability videos (n=4 coders). Two postgraduate students were given two hours of training on the MAT-PE. Their administering of the tool was observed with two children each before the postgraduate students were cleared for independent administration.

Reliability. Skill data from ten children for the TGMD-3 and TSS and skill data from nine children for the DMA were assessed to ascertain inter- and intra-rater reliability. The same children were used across measures; however, one child did not partake in the DMA. Intraclass correlation coefficients (ICC) were run with two-way mixed, average measures for absolute agreement, with 95% confidence intervals. Table 11 shows the inter- and intra-rater mean ICC scores for the four raters of the TGMD-3 (total locomotor and object control scores) and TSS (total stability scores), and the five raters of the DMA (total fluency and flexibility scores), as well as the mean range for each outcome ICC. All mean ICC scores were “excellent” (Cicchetti, 1994).

Table 11*Inter- and -Intra rater mean ICCs for all physical outcome measures*

Measure	Outcome measure	Inter-rater reliability	Intra-rater reliability
		Mean ICC (range)	Mean ICC (range)
TGMD-3	Locomotor	.98 (.97 to .99)	.98 (.98 to .99)
	Object control	.97 (.95 to .97)	.97 (.95 to .98)
TSS	Stability	.98 (.98)	.98 (.97 to .98)
DMA	Creativity (fluency)	.96 (.93 to .98)	.97 (.96 to .99)
	Creativity (Flexibility)	.96 (.93 to .98)	.97 (.96 to .99)

Note. ICC = Intraclass Correlation Coefficient, TGMD-3 = Test of Gross Motor Development 3rd Edition, TSS = Test of Stability Skills, DMA = Divergent Movement Assessment

Procedure

The MAT-PE was run primarily during the morning sessions of each school's data collection period. The Draw-and-Write task was administered with the whole class, first thing in the morning, for 30 minutes. Children were then taken, on a one-to-one basis, for the remainder of the tool to a nearby classroom, where they could be seen but ensured relative quiet for the audio recordings. Motor proficiency assessments (TGMD-3 and TSS) were run concurrently. Groups of six to eight children took part in the TGMD-3 (split between locomotor and object control, then swapped over) either in the school hall or outside (depending on hall availability and weather). Groups of three to four children took part in the TSS in an empty classroom or outside (depending on room availability and weather). Motor creativity started once motor proficiency assessments had finished. Groups of three children were taken in turn to the school hall to complete the DMA. Anthropometry was mostly run towards the end of each school's data collection period.

Data analysis

All statistical tests were completed using SPSS, version 26 [IBM SPSS Statistics Inc., Chicago, IL, USA]. All movement videos (TGMD-3, TSS, and DMA) were independently coded by research assistants (after training and reliability check, described above). The codebook described in Chapter Four was used to code the MAT-PE data and then inputted into SPSS, and quotes were transferred to an excel file. For the MAT-PE, the numerical codes for each theoretical construct, assigned using quantitative content analysis as outlined in the MAT-PE codebook, were used in data analysis (higher numerical codes represented stronger motivational perceptions).

TGMD-3 and TSS scores were added together to create a 'motor proficiency' score. Fluency and flexibility scores across the three DMA stations were added together to create an overall DMA score and was inputted into SPSS. Daily averages (in minutes) of MVPA were also inputted.

Descriptive statistics for the MAT-PE data were computed for the overall sample, and boys and girls separately. Sex differences were examined using Mann-Whitney U tests due to the non-normal distribution of the data. Wilcoxon signed-rank tests were conducted to investigate differences in behavioural regulation choices. Kruskal-Wallis H tests were conducted for secondary analysis investigation of group differences within the motivational variables. Hierarchical multiple regressions were conducted to investigate the relationship between BPNS, behavioural regulation and enjoyment with motor proficiency, motor creativity, and MVPA to ascertain the tool's predictive validity over three separate analyses.

Missing data

With a modest sample size ($n=78$), it was vital to limit the amount of missing data so that enough power could be obtained within data analysis. Data can be missing completely at random (MCAR), missing at random (MAR), and missing not at random (MNAR; Rubin 1976). Multiple imputation (MI) is appropriate for data that is MCAR or MAR (Manly & Wells, 2015) and is superior to listwise deletion or other traditional methods (Allison, 2002; Buhi et al., 2008; Cox et al., 2014, in Manly & Wells, 2015). Data were missing from five of the variables included in the planned analysis: planned predictors - BMI (2.56%), relatedness (6.41%), planned dependant variables – Combined Motor Proficiency (TGMD+TSS; 17.95%), DMA (2.56%), and Total MVPA (35.90%). Imputation results are best with less than 10% missing data; however, none were over 50%, which can be problematic (Royston, 2004).

Reasons for missing data include children being absent on data collection days and, therefore, not assessed (e.g., BMI and TGMD/TSS). Other reasons include missed items on measures (e.g., relatedness, intrinsic regulation). The main reasons for missing data on total MVPA were that children did not wear the accelerometer for long enough to be given a value (worn fewer than three days during the week and one day at the weekend), or the children did not wear the accelerometer at all.

Little's MCAR test resulted in a Chi-Square statistic of 85.86 and a significance of .86. None of the variables were under .86 on estimated means; therefore, MI could be conducted. MI was conducted on SPSS, version 26 [IBM SPSS Statistics Inc., Chicago, IL, USA]. An automatic imputation method was used, resulting in five imputations where scale variables went through a linear regression model. Imputed

and original values can be seen in Table 12. The pooling procedure consisted of using the Output Management System (OMS) with tables as the “Output Type” frequencies as the “Command Identifiers” and statistics under “Table Subtypes for Selected Commands.” This pooling procedure resulted in a data set that consisted of mean values of the five imputations for each imputed variable.

Table 12

Means and standard deviations for five imputed variables: imputed and original data.

	Imputed values				Original values			
	<i>N</i>	Min	Max	Mean (SD)	<i>N</i>	Min	Max	Mean (SD)
BMI (z-score)	78	-1.65	3.69	-.01 (1.01)	76	-1.61	3.69	.00 (1.00)
Relatedness	78	11.00	16.00	14.98 (1.11)	73	11.00	16.00	14.99 (1.14)
Motor proficiency	78	12.00	99.00	66.90 (16.52)	64	12.00	99.00	66.92 (18.16)
Motor creativity	76	33.00	123.00	66.50 (17.57)	76	33.00	123.00	66.50 (17.57)
PA								
MPA	78	37.81	106.59	65.52 (11.50)	50	37.81	106.59	64.56 (13.82)
VPA	78	11.26	64.72	26.91 (9.60)	50	11.26	64.72	26.78 (11.36)
MVPA	78	58.57	163.83	92.43 (18.79)	50	58.57	163.83	91.34 (22.66)

Note. Min=Minimum, Max=Maximum, SD=Standard Deviation, BMI=Body Mass Index, PA=Physical Activity, MPA=Moderate Physical Activity, VPA=Vigorous Physical Activity, MVPA=Moderate to Vigorous Physical Activity

Hierarchical multiple regression predictors

The number of predictors used in the hierarchical multiple linear regression models had to remain quite conservative due to the small total sample size ($n=78$).

One general rule of thumb for the number of predictors within hierarchical multiple regression is 5:1 (five participants per predictor; Tabachnik et al., 1983). Certain variables could not be imputed (e.g., autonomy need satisfaction, intrinsic motivation, amotivation), which decreased the number of cases. Through ensuring that the assumptions (detailed below) were met, certain cases had to be removed from the analysis (e.g., outliers), lowering the total sample size for the three respective analyses. Fifty was the smallest resultant sample size (MP and behavioural regulations), and 64 was the largest sample size (MVPA and BPNS and behavioural regulations). Applying the rule of thumb to this sample size equates to a maximum of 10 predictors. The following will describe each level inputted into the hierarchical multiple linear regression models and the justification for their inclusion and placement in the models.

Level 1 (covariate). Group was inputted since data collection was completed during the post-test time point of the wider SAMPLE-PE project (Rudd et al., 2020a). Therefore, group allocation may have impacted PA and movement outcomes and needed to be controlled for in the analyses.

Due to “group” being a polytomous variable and not dichotomous, dummy variables were created for each level of “group” (NLP, LP, and control). A dummy variable for NLP was set as 1 while LP and control were set as 0. A dummy variable for LP was set as 1 while NLP and control were set as 0. A dummy variable for control was set as 1 while LP and NLP were set 0. Two were inputted into the model and compared with the level not inputted, which, in this case, was control.

Level 2 (covariate). Particular demographic data were included in the model.

Sex was inputted as a predictor as FMS literature has established a difference between boys and girls on motor proficiency (Bardid et al., 2016; Goodway & Rudisill, 1997; Spessato et al., 2013b) and MVPA (Trost et al., 2002; Sherar et al., 2007). Decimal age was inputted due to past literature demonstrating an age effect upon motor proficiency (Barnett et al., 2016; Bardid et al., 2016), MVPA (Belcher et al., 2010; Trost et al., 2002), and divergent movement (Cleland & Gallahue, 1993). BMI z-score was inputted due to literature demonstrating its relationship with motor proficiency (Chowdhury et al., 2017; Barnett et al., 2016) and MVPA (Hjorth et al., 2014; Valentini et al., 2020). Ethnicity was not included in the model as predictors had to remain low, and the same reason was given for the exclusion of SEN and deprivation decile. A correlational check supported the omission of ethnicity, deprivation decile and SEN from the analyses.

Level 3 (potential predictors). Two versions of analyses were conducted and diverged at this level. The first included relatedness, autonomy, and competence need satisfaction as well as enjoyment at this level of the hierarchical multiple regression. These predictors were placed in last due to uncertainty over how young children's perceptions of their BPN, captured by a new tool (MAT-PE), would predict each physical outcome. The second version of the analyses included intrinsic and identified regulations as predictors at this level. These predictors were entered together at this level due to past literature indicating that autonomous types of regulation strongly correlate.

Level 4 (potential predictors). The second version of analysis included a fourth level where external (approach), external (avoid) and introjected regulation were entered. These regulation types were entered separately to autonomous regulations (level 3) due to the controlling nature of these regulations and thus should not correlate strongly with autonomous types of regulation.

Nine predictors were entered into the first hierarchical multiple regression (see Table 13). Ten predictors were entered into the second hierarchical multiple regression analysis (see Table 14).

Table 13

Order of predictors into the hierarchical multiple regression analyses: enjoyment and BPNS.

Model 1	Model 2	Model 3
Group (NLP ^a)	Group (NLP ^a)	Group (NLP ^a)
Group (LP ^b)	Group (LP ^b)	Group (LP ^b)
	Sex	Sex
	Decimal Age	Decimal Age
	BMI (z-score)	BMI (z-score)
		Enjoyment
		Relatedness
		Autonomy
		Competence

Note. BMI = Body Mass Index, NLP = Nonlinear pedagogy, LP = Linear pedagogy, ^a = coded as 1, LP and control coded as 0, ^b = coded as 1, NLP and control coded as 0, Sex = girls coded as 1, boys coded as 2.

Table 14

Order of predictors into the hierarchical multiple regression analyses: Behavioural regulations.

Model 1	Model 2	Model 3	Model 4
Group (NLP ^a)	Group (NLP ^a)	Group (NLP ^a)	Group (NLP ^a)
Group (LP ^b)	Group (LP ^b)	Group (LP ^b)	Group (LP ^b)
	Sex	Sex	Sex
	Decimal Age	Decimal Age	Decimal Age
	BMI (z-score)	BMI (z-score)	BMI (z-score)
		Intrinsic	Intrinsic
		Identified	Identified
			External (approach)
			External (avoid)
			Introjected

Note. BMI = Body Mass Index, NLP = Nonlinear pedagogy, LP = Linear pedagogy, ^a = coded as 1, LP and control coded as 0, ^b = coded as 1, NLP and control coded as 0, Sex = girls coded as 1, boys coded as 2.

Results

The utility of the MAT-PE

The MAT-PE descriptive data for the overall sample, as well as boys and girls, is presented in Table 15. The overall sample and by sex results are presented per construct.

Enjoyment

For enjoyment, while the group median value was 0, the interquartile range (IQR) indicates that 75% of coding fell between 0 and 3 (maximum score), signifying that overall, the majority of children enjoy PE to a greater extent than they dislike PE. A Mann-Whitney U test showed no significant differences between girls and boys for enjoyment ($U=7.38.50$, $p=0.79$). For the lower order construct *liking PE*, 75% of coding fell at a maximum of 4, indicating that the majority of children provided deep

level responses for liking at least one aspect of PE. Conversely, for the lower order construct *dislike of PE*, approximately 25% of the sample were coded as 4 (maximum score), indicating that they provided deep level responses for disliking at least one aspect of PE.

Basic psychological needs

For the overall sample, the median value was 35, with 75% of coding between 34 and over (maximum score 39). Higher coding in the majority of the sample of this summary construct indicates that overall, all three BPN are highly satisfied. A Mann-Whitney U test showed no significant differences between girls' and boys' total BPN ($U=459.00$, $p=0.37$).

Relatedness

The overall relatedness median code and IQR indicated that the basic psychological need for relatedness in PE was highly satisfied within the majority of the sample, with no significant sex differences observed ($U=636$, $p=0.73$). High need satisfaction in the majority of the sample was consistent across the relatedness items, with 75% of participants coded as 4 (maximum score) for *liked by PE teacher*, *like their PE teacher*, and *includes their peers in PE items*. *Inclusion by peers* was high but marginally lower, with 75% of coding at 3 or above.

Table 15*Descriptive statistics for the overall sample and according to sex*

Code construct (PSR)	Group (N=78)			Sex					
				Girls (n=40)			Boys (n=38)		
	Min	Max	Median (IQR)	Min	Max	Median (IQR)	Min	Max	Median (IQR)
Enjoyment (-3 to +3)	-1	+3	0.00 (0.00,3.00)	-1	+3	0.00 (0.00,3.00)	-1	+3	0.00 (0.00,3.00)
<i>Like PE (1-4)</i>	2	4	4.00 (4.00,4.00)	2	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)
<i>Dislike PE (1-4)</i>	1	4	4.00 (1.00,4.00)	1	4	4.00 (1.00,4.00)	1	4	4.00 (1.00,4.00)
BPNS Total (9-40)	25	39	35.00 (34.00,37.00)	31	38	36.00 (34.00,37.00)	25	39	35.00 (33.25,37.00)
Relatedness (4-16)	11	16	15.00 (15.00,16.00)	12	16	15.00 (15.00,16.00)	11	16	15.00 (14.50,16.00)
<i>Liked by PE teacher (1-4)</i>	3	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)
<i>Like of teacher (1-4)</i>	3	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)
<i>Inclusion by peers (1-4)</i>	1	4	3.50 (3.00, 4.00)	1	4	3.00 (3.00,4.00)	1	4	4.00 (3.00,4.00)
<i>Inclusion of peers (1-4)</i>	1	4	4.00 (4.00,4.00)	3	4	4.00 (4.00,4.00)	1	4	4.00 (4.00,4.00)
Autonomy (4-15)	7	15	11.00 (11.00,13.00)	9	15	12.00 (11.00,12.75)	7	15	11.00 (11.00,13.00)
<i>Pictorial (1-6)</i>	2	6	4.00 (4.00,6.00)	2	6	4.00 (4.00,5.50)	2	6	4.00 (4.00,6.00)
<i>Move/activities (1-3)</i>	1	3	1.00 (1.00,2.00)	1	3	1.00 (1.00,2.00)	1	3	1.00 (1.00,2.00)
<i>Listened to (1-3)</i>	1	3	3.00 (3.00,3.00)	1	3	3.00 (3.00,3.00)	1	3	3.00 (3.00,3.00)

Table 15*Descriptive statistics for the overall sample and according to sex*

Code construct (PSR)	Min	Max	Median (IQR)	Min	Max	Median (IQR)	Min	Max	Median (IQR)
<i>Questions answered (1-3)</i>	1	3	3.00 (3.00,3.00)	3	3	3.00 (3.00,3.00)	1	3	3.00 (3.00,3.00)
Competence (1-9)	2	9	9.00 (8.00,9.00)	7	9	9.00 (8.00,9.00)	2	9	8.50 (8.00,9.00)
Autonomous (1 to 5)	1	5	3.50 (3.00,4.00)	1	5	4.00 (3.00,4.00)	2	5	3.25 (3.00,4.00)
<i>Intrinsic (1-5)</i>	1	5	3.00 (3.00,5.00)	1	5	3.00 (3.00,5.00)	1	5	3.00 (3.00,5.00)
<i>Identified (1-5)</i>	1	5	3.50 (3.00,5.00)	1	5	3.00 (2.25,5.00)	1	5	4.00 (3.00,5.00)
Controlled (1 to 5)	1	4.5	2.25 (1.50,2.75)	1	3.75	2.13 (1.50,2.50)	1	4.5	2.50 (1.50,2.81)
<i>External reward (1-5)</i>	1	5	3.00 (2.00,4.25)	1	5	3.00 (1.00,3.00)	1	5	3.00 (3.00,5.00)
<i>External punishment (1-5)</i>	1	4	1.00 (1.00,2.00)	1	3	1.00 (1.00,2.00)	1	4	1.00 (1.00,2.00)
<i>Introjection (1-5)</i>	1	5	2.00 (1.00,3.00)	1	5	2.00 (1.00,3.00)	1	5	2.50 (1.00,3.00)
Amotivation (1-5)	1	5	1.00 (1.00,1.00)	1	5	1.00 (1.00,1.00)	1	3	1.00 (1.00,1.00)

PSR = Possible Score Range, BPNS = Basic Psychological Needs Satisfaction, Min = Minimum, Max = Maximum, IQR = Inter Quartile Range. Autonomous and controlled motivation scores are mean scores of the sub-constructs within them (e.g., Autonomous motivation = (intrinsic + identified)/2) with higher scores indicating stronger motivation

Autonomy

The overall autonomy median and IQR values indicate that the basic psychological need for autonomy was moderately satisfied within 50% of the sample, and highly satisfied in 25% of the sample (see Table 3). No significant sex differences were found ($U=527.50$, $p=0.41$). When looking at the individual items under autonomy, very high levels of need satisfaction were found in the majority of the sample for the *listened to* and *questions answered by PE teacher* items. High levels of procedural and organisational autonomy need satisfaction was found in the majority of the sample for the *choice of equipment and peers* (pair- and group-work) in the pictorial activity. Lower median codes and IQR values were found for cognitive autonomy need satisfaction in terms of choice of movement/activities in PE, with 75% of coding falling at 2 and under (maximum of 3).

Competence

The overall competence median and IQR values indicate that there were very high levels of perceived competence across most of the sample. Approximately 50% of children achieved the maximum code. A Mann-Whitney U test showed no significant differences between girls and boys for competence ($U=644.00$, $p=0.20$).

Behavioural regulation

As shown in Table 16, the most prevalent behavioural regulations for taking part in PE were intrinsic, identified, and external reward (87.17%, 84.62%, 79.49%, respectively) with introjected and external punishment as less popular behavioural regulations for taking part in PE (66.67% and 33.33% respectively). The least chosen

was amotivation (2.56%). Table 3 also shows a higher percentage of children chose identified, intrinsic and external reward as their “first choice” when ranking their chosen reasons for taking part in PE (50.00%, 33.33% and 29.49% respectively). In contrast, introjected, external punishment, and amotivation were ranked first far less often (7.69%, 3.85% and 1.28%, respectively). This finding indicates that at least a third of the sample ranked an autonomous form of motivation as their first choice, and at most, a third of the sample chose a controlled form of motivation as their first choice for taking part in PE. A much smaller contrast can be observed within the percentages of “other choice” regulations. Most children (97.44%) did not pick amotivation; in contrast, only 12.82% did not pick intrinsic motivation. High percentages of children gave deep level responses (coherent and relevant answers) for choosing amotivation, external reward, intrinsic, and identified (100%, 85.48%, 85.29%, and 84.85% respectively) reasons. A reasonable number of children provided deep level responses for introjection (65.38%), while less than half gave deep level responses to external punishment (48%).

Figure 11 shows the number of regulation types (out of six types) children chose across the sample. Children were able to choose as many regulation types as applicable to themselves. Figure 11 shows that there is a varied distribution of the number of regulation types chosen. This variety indicates that children can not only explain how the different motivational regulations relate to them (Table 16) but can also reflect and differentiate between the different types of regulation by choosing between the different types, rather than picking them all.

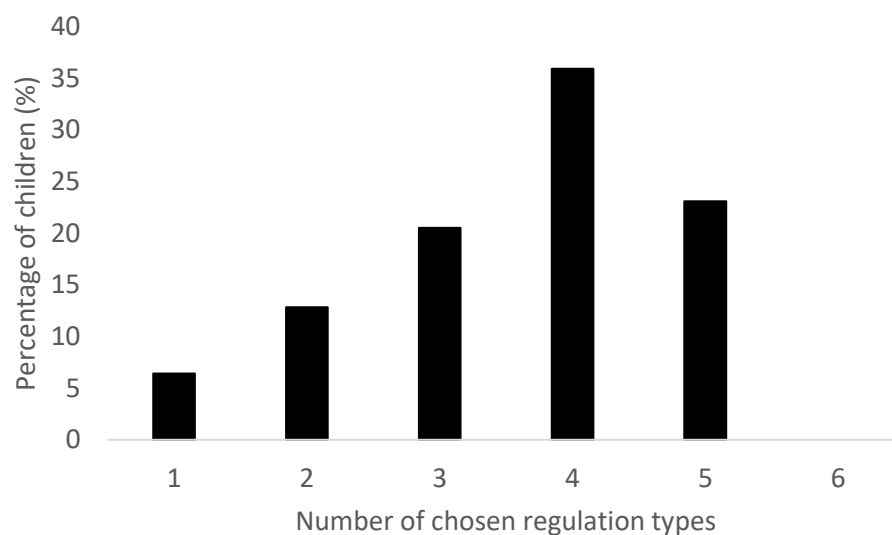
Table 16

Number and percentage of behavioural regulations chosen overall, as first choice, as other choice and not picked by children.

Type of regulation	No. of children (Total _n =78)	1 st choice	"other" choice	Not Picked
Autonomous Motivation				
Intrinsic	68 (87.18%)	26 (33.33%)	42 (53.85%)	10 (12.82%)
Identified	66 (84.62%)	39 (50.00%)	27 (34.62%)	12 (15.38%)
Controlled Motivation				
Introjected	52 (66.67%)	6 (7.69%)	46 (58.97%)	26 (33.33%)
External reward	62 (79.49%)	23 (29.49%)	39 (50.00%)	16 (20.51%)
External punishment	26 (33.33%)	3 (3.85%)	23 (29.49%)	52 (66.66%)
Amotivation	2 (2.56%)	1 (1.28%)	1 (1.28%)	76 (97.44%)

Figure 11

The Number of Regulation Types Chosen by Children (N = 78)



Autonomous motivation

The overall autonomous motivation median and IQR values indicate that the majority of children were experiencing moderately high levels of autonomous motivation, with no significant differences found between girls and boys ($U=610.00$, $p=0.82$). Within the sample, 75% of the numerical coding values were 3 or above (maximum possible was 5) for autonomous motivation, and also specifically within intrinsic and identified regulation items.

Controlled motivation

The overall controlled motivation median and IQR values indicate that the majority of children were experiencing low to moderate levels of controlled motivation in PE, with no significant differences observed between girls and boys ($U=619.50$, $p=0.16$). 50% of the numerical coding values fell between 1.5 and 2.75, with 25% of codes falling at 1.5 or below (scoring range 1-5). When looking at the median and IQR values for items under controlled motivation, differences were noted between *external reward*, *external punishment*, and *introjected regulations*, with moderate to high levels of controlled motivation found for *external reward*, moderate to low levels for *introjection*, and low levels of controlled motivation for *external punishment*. A Wilcoxon signed-rank test showed a statistical difference between external positive regulation and external negative regulation ($Z=-6.69$, $p<0.001$), external positive regulation and introjected regulation ($Z=-3.94$, $p<0.001$), and external negative and introjection ($Z=-5.21$, $p<0.001$). This finding indicates that the types of controlled regulations were chosen and responded to differentially.

Amotivation

The overall amotivation median and IQR values indicate that although amotivation is very low in this sample, it is still present. A Mann-Whitney U test showed no significant differences between girls and boys for amotivation ($U=759.50$, $p=1.00$).

Predictive validity of the MAT-PE

Six separate hierarchical multiple linear regression analyses were conducted, one for each physical variable, the first with BPNS and enjoyment and predictors and the second with behavioural regulations as predictors. The three physical variables included movement proficiency (combined score from the TGMD and TSS), movement creativity through DMA, and MVPA through accelerometry. Means and standard deviations for each physical outcome within this sample can be found in Table 17. Results for each hierarchical multiple linear regression analyses will be presented in turn as well as the assumption criteria, starting with motor proficiency.

Table 17

Means and standard deviations for each physical outcome variable.

	N	Minimum	Maximum	Mean (SD)
Motor proficiency	78	12.00	99.00	66.90 (16.52)
Motor creativity	76	33.00	123.00	66.50 (17.57)
MPA	78	37.81	106.59	65.52 (11.50)
VPA	78	11.26	64.72	26.91 (9.60)
MVPA	78	58.57	163.83	92.43 (18.79)

Note. SD = standard deviations; MPA = moderate physical activity, VPA = vigorous physical activity, MVPA = moderate to vigorous physical activity

Motor proficiency

BPNS, enjoyment and motor proficiency. The first hierarchical multiple regression was run to predict motor proficiency from group (LP and NLP), age, sex, BMI, enjoyment, and BPNS. Regression coefficients and standard errors can be found in Table 18. There was linearity, as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 2.21. Homoscedasticity was assumed through inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. Inspection of studentised deleted residuals led to no case removals as all were between ± 3 standard deviations. Six cases had values greater than 0.2 on leverage values and were removed from the analysis. There were no values for Cook's distance above 1, resulting in 63 cases remaining in the final analysis. The assumption of normality was met, as assessed by a Q-Q Plot.

The first model within the hierarchical regression statistically predicted motor proficiency $F(2, 62) = 3.43, p = .04, \text{adj. } R^2 = .07$. The third and last model best fit the data (see Table 18). R^2 for the overall model was 24% with an adjusted R^2 of 11%. The group (NLP; $p = .01$), group (LP; $p = .05$), and autonomy need satisfaction ($p = .04$) added statistically to the prediction. Regarding the latter, motivational predictor, this result indicates that a unit increase in autonomy need satisfaction predicts that motor proficiency will decrease by -3.36. Due to the cross-sectional nature of this study, this also indicates that a unit increase in motor proficiency predicts that autonomy need satisfaction will decrease by -3.36.

Table 18

Regression coefficients and standard errors for covariates, enjoyment, BPNS and motor proficiency.

	R ²	B	SE B	LCI	UCI	β	<i>p</i>
Model 1	.10						
Constant		62.07	3.00	56.08	68.06		.00
<i>Covariates</i>							
Group (NLP)		11.37	4.71	1.95	20.80	.32	.02
Group (LP)		9.25	4.97	-.69	19.19	.25	.07
Model 2	.13						
Constant		-7.94	46.22	-100.49	84.61		.86
<i>Covariates</i>							
Group (NLP)		12.08	4.81	2.45	21.70	.34	.02
Group (LP)		8.91	5.09	-1.30	19.11	.24	.09
Sex		-.17	4.42	-9.01	8.67	-.00	.97
Age		11.02	7.43	-3.85	25.89	.19	.14
BMI(z-score)		-.90	2.57	-6.03	4.24	-.05	.73
Model 3	.24						
Constant		46.53	63.10	-80.04	173.10		.46
<i>Covariates</i>							
Group (NLP)		13.48	4.89	3.67	23.29	.38	.01
Group (LP)		10.72	5.39	-.07	21.53	.29	.05
Sex		-1.11	4.37	-9.88	7.65	-.03	.80
Age		9.83	7.59	-5.39	25.06	.17	.20
BMI(z-score)		.46	2.60	-4.76	5.67	.02	.86
<i>Predictors</i>							
Enjoy		1.34	1.38	-1.42	4.11	.12	.33
Relate		-1.34	2.19	-5.74	3.06	-.08	.54
Aut		-3.36	1.56	-6.48	-.24	-.30	.04
Comp		1.40	2.70	-4.02	6.79	.07	.61

Note. $\Delta R^2 = .03$ from Model 1 to Model 2, $\Delta R^2 = .10$ from Model 2 to Model 3, $\Delta R^2 = .13$ from Model 1 to Model 3; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; Enjoy = Enjoyment; Relate = relatedness; Aut = autonomy; Comp = competence; ΔR^2 = change in coefficient of determination

Behavioural regulations and motor proficiency. The second hierarchical multiple regression was run to predict motor proficiency from group (LP and NLP), age, sex, BMI, enjoyment, and behavioural regulations. Regression coefficients and standard errors can be found in Table 19. There was linearity, as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 2.63. Homoscedasticity was assumed through inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. Inspection of studentised deleted residuals led to no case removals as all were between ± 3 standard deviations. Seven cases had values greater than 0.2 on leverage values and were removed from the analysis. There were no values for Cook's distance above 1, resulting in 50 cases remaining in the final analysis. The assumption of normality was met, as assessed by a Q-Q Plot.

None of the models or predictors significantly predicted motor proficiency. However, the 4th and last model best fit the data (see Table 19). R^2 for the overall model was 25% with an adjusted R^2 of 6%.

Table 19*Regression coefficients and standard errors for covariates, behavioural regulations and motor proficiency*

	R ²	B	SE B	LCI	UCI	β	<i>p</i>
Model 1	.01						
Constant		71.75	3.16	65.36	78.11		.00
<i>Covariates</i>							
Group (NLP)		-1.68	4.83	-11.39	8.02	-.06	.73
Group (LP)		1.32	4.83	-8.39	11.02	.04	.79
Model 2	.17						
Constant		-19.48	44.83	-109.83	70.88		.66
<i>Covariates</i>							
Group (NLP)		2.01	4.80	-7.66	11.69	.07	.68
Group (LP)		.84	4.65	-8.53	10.21	.03	.86
Sex		5.54	4.23	-2.97	14.06	.20	.20
Age		12.95	7.20	-1.57	27.47	.27	.08
BMI(z-score)		-3.49	2.01	-7.54	.57	-.25	.09
Model 3	.22						
Constant		4.85	48.53	-93.09	102.79		.92
<i>Covariates</i>							
Group (NLP)		2.17	4.81	-7.53	11.87	.07	.65
Group (LP)		.58	4.62	-8.74	9.91	.02	.90
Sex		4.07	4.30	-4.62	12.75	.15	.95
Age		11.15	7.28	-3.55	25.85	.23	.13
BMI(z-score)		-3.23	2.00	-7.27	.81	-.23	.11
<i>Predictors</i>							
Intrinsic		-2.80	1.81	-6.46	.85	-.25	.13
Identified		-.18	1.48	-3.15	2.80	-.02	.91

Table 19*Regression coefficients and standard errors for covariates, behavioural regulations and motor proficiency*

	R ²	B	SE B	LCI	UCI	β	<i>p</i>
Model 4	.25						
Constant		4.45	52.42	-101.58	110.49		.93
<i>Covariates</i>							
Group (NLP)		1.49	5.22	-9.07	12.05	.05	.78
Group (LP)		1.56	4.84	-8.23	11.35	.05	.75
Sex		4.84	4.52	-4.31	13.98	.18	.29
Age		10.95	7.69	-4.61	26.52	.23	.16
BMI(z-score)		-3.58	2.08	-7.79	.63	-.26	.09
<i>Predictors</i>							
Intrinsic		-2.14	2.31	-6.82	2.53	-.19	.36
Identified		.55	1.93	-3.34	4.44	.06	.78
External (approach)		-.04	1.92	-3.92	3.85	-.00	.99
External (avoidance)		-4.45	3.91	-12.35	3.46	-.21	.26
Introjection		.80	2.37	-4.00	5.60	.06	.74

Note. $\Delta R^2 = .16$ from Model 1 to Model 2, $\Delta R^2 = .05$ from Model 2 to Model 3, $\Delta R^2 = .03$ from Model 3 to Model 4, $\Delta R^2 = .24$ from Model 1 to Model 4; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; ΔR^2 = change in coefficient of determination

Motor Creativity

BPNS, enjoyment and motor creativity. Table 20 shows the results of the hierarchical multiple regression to examine predictors of divergent movement, including group, age, sex, BMI, enjoyment, and BPNS. There was linearity as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 1.41. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. When studentised deleted residuals were inspected, one case was above three standard deviations and

was removed from the analysis. Four cases had values greater than 0.2 on leverage values and were removed from the analysis. There were no values for Cook's distance above 1, resulting in 62 cases remaining in the final analysis. The assumption of normality was slightly negatively skewed, as assessed by a Q-Q Plot. However, multiple regression is deemed robust enough to handle slightly skewed data.

None of the models significantly predicted motor creativity. However, the 3rd and last model fit the data the best (see Table 20). R^2 for the overall model was 19% with an adjusted R^2 of 5%. NLP emerged as a significant predictor in Model 2, and effects disappeared in Model 3 (see Table 20).

Table 20

Regression coefficients and standard errors for covariates, enjoyment, BPNS and motor creativity.

	R^2	B	SE B	LCI	UCI	β	p
Model 1	.07						
Constant		64.21	3.41	57.40	71.03		.00
<i>Covariates</i>							
Group (NLP)		9.24	5.28	-1.33	19.80	.24	.09
Group (LP)		-1.86	5.90	-13.67	9.96	-.04	.75
Model 2	.12						
Constant		42.03	51.85	-61.84	145.90		.42
<i>Covariates</i>							
Group (NLP)		11.19	5.40	.38	22.01	.29	.04
Group (LP)		-.67	5.93	-12.55	11.22	-.02	.91
Sex		9.08	5.05	-1.04	19.20	.25	.08
Age		1.22	8.35	-15.51	17.95	.02	.88
BMI(z-score)		-1.32	2.64	-6.60	3.96	-.07	.62

Table 20

Regression coefficients and standard errors for covariates, enjoyment, BPNS and motor creativity.

	R ²	B	SE B	LCI	UCI	β	p
Model 3	.19						
Constant		-6.62	64.70	-136.46	123.22		.92
<i>Covariates</i>							
Group (NLP)		8.29	5.61	-2.97	19.54	.21	.15
Group (LP)		-4.75	6.36	-17.51	8.01	-.11	.46
Sex		8.85	5.04	-1.28	18.97	.24	.09
Age		4.71	8.56	-12.45	21.88	.07	.58
BMI(z-score)		-.88	2.81	-6.52	4.77	-.05	.76
<i>Predictors</i>							
Enjoy		.29	1.59	-2.91	3.49	.02	.86
Relate		-1.23	2.49	-6.22	3.76	-.07	.62
Aut		3.35	1.75	-.16	6.86	.28	.06
Comp		.98	2.68	-4.39	6.35	.05	.72

Note. $\Delta R^2 = .05$ from Model 1 to Model 2, $\Delta R^2 = .07$ from Model 2 to Model 3, $\Delta R^2 = .12$ from Model 1 to Model 3; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; Enjoy = Enjoyment; Relate = relatedness; Aut = autonomy; Comp = competence; ΔR^2 = change in coefficient of determination

Behavioural regulation and motor creativity. Table 21 shows the results of the hierarchical multiple regression to examine predictors of divergent movement, including group, age, sex, BMI, enjoyment, and BPNS. There was linearity as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 1.62. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. When studentised deleted residuals were inspected, one case was above three standard deviations and was removed from the analysis. Five cases had values greater than 0.2 on leverage

values and were removed from the analysis. There were two values for Cook's distance above 1, resulting in 60 cases remaining in the final analysis. The assumption of normality was met, as assessed by a Q-Q Plot.

Table 21

Regression coefficients and standard errors for covariates, behavioural regulations, and motor creativity.

	R ²	B	SE B	LCI	UCI	β	<i>p</i>
Model 1	.09						
Constant		61.11	2.61	55.89	66.34		.00
<i>Covariates</i>							
Group (NLP)		9.33	4.28	.76	17.89	.30	.03
Group (LP)		.54	4.20	-7.87	8.94	.02	.90
Model 2	.13						
Constant		72.89	39.65	-6.61	152.38		.07
<i>Covariates</i>							
Group (NLP)		10.13	4.38	1.36	18.91	.32	.02
Group (LP)		.96	4.24	-7.54	9.45	.03	.82
Sex		6.18	3.84	-1.53	9.45	.22	.11
Age		-3.37	6.42	-16.24	9.50	-.07	.60
BMI(z-score)		-.05	1.94	-3.93	3.83	-.00	.98
Model 3	.14						
Constant		65.39	42.72	-20.34	151.13		.13
<i>Covariates</i>							
Group (NLP)		9.47	4.56	.32	18.62	.30	.04
Group (LP)		1.06	4.28	-7.53	9.66	.04	.81
Sex		5.54	3.97	-2.43	13.50	.20	.17
Age		-2.61	6.56	-15.78	10.55	-.06	.69
BMI(z-score)		.03	1.98	-3.95	4.00	.00	.99
<i>Predictors</i>							
Intrinsic		-.09	1.69	-3.48	3.30	-.01	.96
Identified		1.16	1.42	-1.69	4.00	.12	.42

Table 21

Regression coefficients and standard errors for covariates, behavioural regulations, and motor creativity.

	R ²	B	SE B	LCI	UCI	β	p
Model 4	.20						
Constant		49.90	46.52	-43.59	143.39		.29
<i>Covariates</i>							
Group (NLP)		7.71	4.75	-1.83	17.24	.25	.11
Group (LP)		.44	4.44	-8.48	9.36	.01	.92
Sex		5.12	4.06	-2.98	13.33	.19	.21
Age		-1.60	6.86	-15.39	12.18	-.03	.82
BMI(z-score)		.21	2.02	-3.85	4.28	.02	.92
<i>Predictors</i>							
Intrinsic		1.08	2.18	-3.30	5.47	.10	.62
Identified		2.34	1.90	-1.47	6.15	.25	.22
External (approach)		2.25	1.71	-1.19	5.69	.22	.20
External (avoidance)		-4.66	3.78	-12.26	2.95	-.20	.22
Introjection		.57	2.82	-4.02	5.16	.04	.80

Note. $\Delta R^2 = .04$ from Model 1 to Model 2, $\Delta R^2 = .01$ from Model 2 to Model 3, $\Delta R^2 = .06$ from Model 3 to Model 4, $\Delta R^2 = .11$ from Model 1 to Model 4; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; ΔR^2 = change in coefficient of determination

None of the models significantly predicted motor creativity. However, the 4th and last model fit the data the best (see Table 21). R^2 for the overall model was 20% with an adjusted R^2 of 3%. NLP emerged as a significant predictor in Model 1, and effects disappeared in Model 4 (see Table 21).

Moderate-to-vigorous-physical-activity

BPNS, enjoyment and MVPA. Hierarchical multiple regression was run to predict MVPA through accelerometry from group, age, sex, BMI, enjoyment, and BPNS. There was linearity as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 1.69. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. When studentised deleted residuals were inspected, one case was above three standard deviations and was removed from the analysis. Three cases had values greater than 0.2 on leverage values and were removed from the analysis. There were no values for Cook's distance above 1, resulting in 64 cases remaining in the final analysis. The assumption of normality was met, as assessed by a Q-Q Plot. None of the models significantly predicted MVPA; however, the 3rd and last model best fit the data (see Table 22). R^2 for the overall model was 22% with an adjusted R^2 of 9%. Sex emerged as a predictor in Model 3 (see Table 22).

Behavioural regulation and MVPA. Hierarchical multiple regression was run to predict MVPA through accelerometry from group, age, sex, BMI, enjoyment, and BPNS. There was linearity as assessed by partial regression plots and a plot of studentised residuals against the predicted values. Residuals were independent, as assessed by a Durbin-Watson statistic of 2.26. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance

values greater than 0.1. When studentised deleted residuals were inspected, two cases were above three standard deviations and was removed from the analysis. Four cases had values greater than 0.2 on leverage values and were removed from the analysis. There were no values for Cook's distance above 1, resulting in 64 cases remaining in the final analysis. The assumption of normality was met, as assessed by a Q-Q Plot.

None of the models significantly predicted MVPA; however, the 4th and last model best fit the data (see Table 23). R^2 for the overall model was 19% with an adjusted R^2 of 4%. Age emerged as a predictor in model 4 ($p = .03$) as well as identified regulation ($p = .02$).

Table 22

Regression coefficients and standard errors for covariates, enjoyment, BPNS and MVPA.

	R^2	B	SE B	LCI	UCI	β	p
Model 1	.02						
Constant		91.77	4.79	82.18	101.35		.00
<i>Covariates</i>							
Group (NLP)		-5.38	7.50	-20.38	9.62	-.10	.48
Group (LP)		3.10	8.21	-13.31	19.52	.05	.71
Model 2	.12						
Constant		-14.92	72.36	-159.77	12.46		.84
<i>Covariates</i>							
Group (NLP)		-2.52	7.49	-17.51	12.48	-.05	.74
Group (LP)		4.48	8.08	-11.70	20.65	.08	.58
Sex		12.64	6.92	-1.20	26.48	.25	.07
Age		13.70	11.62	-9.55	36.96	.15	.24
BMI(z-score)		.25	3.65	-7.05	7.56	.01	.95

Table 22

Regression coefficients and standard errors for covariates, enjoyment, BPNS and MVPA.

	R ²	B	SE B	LCI	UCI	β	p
Model 3	.22						
Constant		-20.37	87.57	-195.94	155.19		.82
<i>Covariates</i>							
Group (NLP)		-4.91	7.63	-20.20	10.38	-.09	.52
Group (LP)		-1.35	8.59	-18.57	15.87	-.02	.88
Sex		13.65	6.77	.07	27.22	.27	.05
Age		19.19	11.63	-4.13	42.51	.21	.11
BMI(z-score)		.32	3.81	-7.32	7.96	.01	.93
<i>Predictors</i>							
Enjoy		-2.43	2.16	-6.75	1.90	-.14	.27
Relate		-6.39	3.38	-13.18	.39	-.26	.06
Aut		3.72	2.36	-1.01	8.45	.22	.12
Comp		3.17	3.65	-4.15	10.50	.12	.39

Note. $\Delta R^2 = .10$ from Model 1 to Model 2, $\Delta R^2 = .10$ from Model 2 to Model 3, $\Delta R^2 = .20$ from Model 1 to Model 3; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; Enjoy = Enjoyment; Relate = relatedness; Aut = autonomy; Comp = competence; ΔR^2 = change in coefficient of determination

Secondary analysis

As this study was situated at the end of a pedagogical-based intervention, it was necessary to investigate any intervention group differences within the MAT-PE data. A Kruskal-Wallis H test showed no statistical difference in enjoyment ($\chi^2(2) = .33$, $p = .85$), relatedness ($\chi^2(2) = .262$, $p = .27$), competence ($\chi^2(2) = .70$, $p = .70$), autonomy needs satisfaction ($\chi^2(2) = .503$, $p = .08$), intrinsic ($\chi^2(2) = .122$, $p = .54$), identified ($\chi^2(2) = .541$, $p = .07$), external (approach; $\chi^2(2) = .148$, $p = .48$), external (avoidance; $\chi^2(2) = .280$, $p = .25$), introjection ($\chi^2(2) = 1.72$, $p = .42$), or amotivation ($\chi^2(2) = .84$, $p = .66$) between intervention groups.

Table 23

Regression coefficients and standard errors for covariates, behavioural regulations and MVPA.

	R ²	B	SE B	LCI	UCI	β	<i>p</i>
Model 1	.02						
Constant		91.59	2.95	85.70	97.48		.00
<i>Covariates</i>							
Group (NLP)		-4.66	4.79	-14.24	4.92	-.13	.34
Group (LP)		-2.91	4.63	-12.17	6.36	-.09	.53
Model 2	.07						
Constant		20.39	44.09	-67.87	108.64		.65
<i>Covariates</i>							
Group (NLP)		-3.45	4.84	-13.13	6.23	-.10	.48
Group (LP)		-3.71	4.67	-13.06	5.64	-.11	.43
Sex		2.97	4.17	-5.37	11.31	.10	.48
Age		10.50	7.09	-3.69	24.69	.20	.14
BMI(z-score)		-.94	2.17	-5.28	3.40	-.06	.67
Model 3	.11						
Constant		-3.09	47.55	-98.35	92.16		.95
<i>Covariates</i>							
Group (NLP)		-5.30	4.97	-15.25	4.65	-.15	.29
Group (LP)		-3.72	4.67	-13.08	5.64	-.11	.43
Sex		2.18	4.31	-6.45	10.81	.07	.62
Age		12.66	7.21	-1.78	27.10	.24	.08
BMI(z-score)		-.96	2.20	-5.36	3.44	-.06	.66
<i>Predictors</i>							
Intrinsic		.92	1.73	-2.55	4.38	.08	.60
Identified		2.37	1.50	-.63	5.36	.23	.12

Table 23

Regression coefficients and standard errors for covariates, behavioural regulations and MVPA.

	R ²	B	SE B	LCI	UCI	β	p
Model 4	.19						
Constant		-33.20	49.88	-133.24	66.84		.51
<i>Covariates</i>							
Group (NLP)		-7.76	5.06	-17.91	2.39	-.22	.13
Group (LP)		-3.68	4.85	-13.41	6.06	-.11	.45
Sex		.90	4.36	-7.85	9.65	.03	.84
Age		16.38	7.40	1.53	31.23	.31	.03
BMI(z-score)		-.52	2.21	-4.95	3.91	-.03	.82
<i>Predictors</i>							
Intrinsic		2.78	2.03	-1.28	6.84	.23	.18
Identified		4.15	1.75	.63	7.66	.40	.02
External (approach)		2.92	1.67	-.42	6.26	.26	.09
External (avoidance)		-8.06	4.39	-16.87	.75	-.26	.07
Introjection		-.84	2.37	-5.59	3.91	-.05	.72

Note. $\Delta R^2 = .05$ from Model 1 to Model 2, $\Delta R^2 = .04$ from Model 2 to Model 3, $\Delta R^2 = .08$ from Model 3 to Model 4, $\Delta R^2 = .17$ from Model 1 to Model 4; Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; NLP = Nonlinear; LP = Linear; ΔR^2 = change in coefficient of determination

Discussion

This study aimed to explore the utility and the predictive validity of the MAT-PE. This chapter provides evidence that the tool and the codebook demonstrated utility in assessing young children's motivation in PE and provided novel descriptive data on the BPNS and behavioural regulation in young children within PE. Young children's BPNS, as measured by the MAT-PE, did not significantly predict motor proficiency, motor creativity or MVPA. However, autonomy need satisfaction negatively predicted motor proficiency and identified regulation positively predicted MVPA alongside certain demographic predictors. These are discussed below, as well as the fit of the final model for each analysis. The MAT-PE's utility is discussed first.

The utility of the MAT-PE

Descriptive results from the MAT-PE and codebook showed promising sensitivity and range in this sample of children. Despite some motivational tools focusing upon intrinsic motivation (Gottfried, 1986, 1990), collapsing introjection and external regulations (Guay et al., 2010), and excluding amotivation, the MAT-PE demonstrates that when given a choice, young children are capable of choosing the types of motivational regulation underlying their participation in PE. Furthermore, children provided a wide range of need satisfaction responses, supporting the potential utility of the tool in capturing high and low levels of BPN.

Enjoyment

Enjoyment is a major component of intrinsic motivation (Deci & Ryan, 1991; Ryan & Deci, 2017). This study found that most children were able to discuss at least one aspect of PE that they liked and an aspect they disliked, though overall PE was

perceived as enjoyable. The high enjoyment reported in this study aligns with the few studies that have included children under the age of seven (Coulter and Woods, 2011). In slightly older populations, PE enjoyment has also been reported as high (Baron & Downey, 2008). Domville et al. (2019) found that enjoyment was related to autonomy, competence and relatedness need support which ultimately influenced intrinsic motivation in seven to 11-year-old children. The findings of the present study are generally in line with the previous literature; however, where other studies have found sex differences (Baron & Downey, 2007; Cairney et al., 2012; Carroll & Loumidis, 2001), this study did not. The MAT-PE can be used by researchers to identify what young children like and do not like about PE. This information can help to develop appropriate intervention strategies to support children's enjoyment and increase intrinsic motivation within PE.

Basic psychological need satisfaction

The MAT-PE demonstrated its utility as children across the sample selected all possible responses for BPNS items (i.e., less favourable responses as well as favourable). In terms of relatedness need satisfaction, many children felt liked by their PE teacher, they liked their PE teacher, felt included by their peers and included their peers within PE. A systematic review and meta-analysis of SDT-based PE studies (Vasconcellos et al. 2019) outlined that peers have more of an effect on relatedness than PE teachers. This current study found high scores for PE teacher and peer-related relatedness; however, inclusion by peers was marginally lower. Young children's relatedness need satisfaction within this sample may be highly satisfied due to the PE teachers fostering an inclusive social environment, utilising peer-work-

based activities and creating effective relationships between themselves and their students through respect and care (Ryan & Deci, 2020).

Regarding autonomy need satisfaction, the MAT-PE demonstrated its utility due to children choosing each possible response across the autonomy related items. Overall, autonomy need satisfaction was relatively high for procedural (i.e., equipment) and organisational autonomy (i.e., peer selection) but lower for cognitive autonomy (i.e., activities and movements). This finding partially reflects a teacher-centred approach (where the teacher makes the majority of decisions; De Meyer et al., 2016) as children felt some choice within PE. A meta-analysis (Patall et al., 2008) found a strong positive relationship between choice and intrinsic motivation, including “instructionally irrelevant” choices (such as choosing the colour of beanbag). Choice of activity, level, pace, and peers to work with positively impact competence and relatedness need satisfaction in 12 to 13-year-old children (De Meester et al., 2020). Given that seemingly “irrelevant” and relevant choices influence children’s sense of autonomy, PE teachers should seek to provide these types of choices to buffer children’s autonomy need satisfaction and facilitate more intrinsic motivation within PE (Cordova & Lepper, 1996; Patall et al., 2008). It is important to note that autonomy is more than providing choice, for example, providing task rationale and showing interest also support autonomy (Ryan & Deci, 2020).

Children across the sample chose every type of star-rating (1 to 5), indicating the MAT-PE’s utility. Consistent with previous research examining PMC in 4-7-year-old children (Noordstar et al., 2016; Spessato et al., 2013b), competence need satisfaction was high within this sample. High perceived competence could be due to

young children conflating effort with their ability (Nicholls, 1978). High competence need satisfaction is positive as children's perceptions of competence influence their adherence to an activity (Harter, 1978, 1988) whereby children who feel 'good at something' will continue with that activity regardless of whether they are good at the activity or not. These findings indicate that PE teachers should structure and design activities that enable young children to experience success and competence so that they maintain high competence need satisfaction and remain engaged in PE as they grow older.

Behavioural regulation

The MAT-PE provided utility in determining behavioural regulation as all types of regulation were chosen by children across the sample. This choice variety indicates that the tool is capable of allowing children to differentiate between personally relevant regulations as all were comprehensible to them. Most children (87%) found PE 'fun' and chose intrinsic motivation as a reason for partaking in PE. However, not all children chose intrinsic regulation as one of their behavioural regulation choices, demonstrating that not all young children find PE 'fun'. Most children chose identified regulation as their first choice, indicating that many children meaningfully identify with the benefits of PE. High autonomous motivation corresponds with previous research (Chandler & Connell, 1987; Corpus et al., 2019).

External (reward) regulation was chosen the most out of the three types of controlling choices. This prevalence may be because the use of rewards is considered prevalent within the education system (Deci et al., 2001). The decision to separate external regulation into reward and punishment for the tool was justified as 79.5% of children chose the reward aspect, while only 32% chose the punishment aspect. From

a self-efficacy perspective, rewarding consequences informs and motivates individuals (Bandura & Walters, 1977); however, it has also been found that verbal punishment can increase performance to a greater extent than rewards (Firestone & Douglas, 1977). Although many children chose extrinsic reward as a reason to take part in PE, all children who chose this type of regulation also chose at least one autonomous type of regulation indicating that they are not predominantly externally motivated. Only 48% of children who chose external punishment could provide a deep level response as to why. This low percentage may be because they had less experience with this type of regulation.

Amotivation typically stems from a lack of perceived competence or lack of interest in the activity (Ryan & Deci, 2017). Although only two children in our sample chose amotivation, they both provided deep level responses to the follow-up question indicating that with larger samples it could be further explored what forms of amotivation young children demonstrate in PE. Within a sample of 390 14- to 15-year-olds, only 21 (15 girls, 6 boys) were identified as being amotivated within PE (Ntoumanis et al., 2004). This finding demonstrates that the prevalence of amotivation is relatively low in younger and older samples of children and adolescents.

Predictive validity of the MAT-PE

Predictive validity of the MAT-PE was sought to explore whether the motivation of young children could predict other outcomes such as motor proficiency, motor creativity and MVPA. These will be discussed in turn.

Motor proficiency

BPNS and enjoyment. The last model, with the addition of BPNS and enjoyment as predictors, explained more of the variance in motor proficiency (23%) than without (14%). Autonomy need satisfaction demonstrated a significant negative relationship with motor proficiency (LL=-6.48, UL=-.24). This finding indicates that high autonomy need satisfaction was associated with low motor proficiency. Alternatively, low motor proficiency was associated with having high autonomy need satisfaction. Motor proficiency was assessed with a process-oriented measure, i.e., there was a standard template to follow in which to perform the skill and points were awarded for 'present' criteria. As a result, children did not have any choice over how they performed their skills. Autonomy is satisfied when individuals perceive that they are the origin of their choices and decisions (Adie et al., 2008). Interestingly, this was explicitly picked up by the MAT-PE as it demonstrated that children felt lower cognitive autonomy (choice over movements and activities) in comparison to organisational (choice of peers) and procedural (choice of equipment).

It is usually advocated for autonomy to be supported wherever possible as it leads to better wellbeing and performance (Ryan and Deci, 2017). However, van Aart et al. (2017) did not find significant relationships between autonomy need satisfaction and motor skills in nine to 12-year-old boys, where the direction was negative between these variables. In girls of the same age, associations were positive between autonomy need satisfaction, locomotor and object control skills; however, a significant positive relationship was found between autonomy need satisfaction and balance skills. More research is needed for longitudinal and intervention studies

in this younger age group to fully understand the relationships between autonomy need satisfaction and motor proficiency.

No significant relationships were found between relatedness (LL=-5.74, UL=3.06) and competence need satisfaction (LL=-4.02, UL=6.79) and motor proficiency. In contrast, previous research has found significant negative associations between teacher relatedness need satisfaction and motor proficiency in boys only (van Aart et al., 2017), and significant positive associations between competence need satisfaction and motor proficiency in four-year-olds (Robinson, 2011). Research has generally demonstrated that children under the age of eight cannot accurately judge their competence levels (Fox, 2010; Harter, 1999). More recent empirical evidence (Washburn & Kolen, 2018) has supported this in children aged eight to 12. They found that judgements became more accurate with age; however, over half were still unable to accurately judge their competence level where older children were more likely to underestimate their competence. This inability to make accurate judgements may account for the lack of significance between competence need satisfaction and motor proficiency in this study.

No significant relationship was found between enjoyment and motor proficiency. Past literature has found that children who had higher enjoyment after experiencing a mastery-oriented PE intervention, also had higher motor skills (Theeboom et al., 1995). It may be that, within this study and regardless of ability, children reported PE to be highly enjoyable. Thus, a consistent significant pattern between the two variables could not emerge.

Behavioural regulations. The last model, with the addition of behavioural regulations, explained more of the variance in motor proficiency (23%) than without

(17%), although not to a significant extent. No relationship emerged between intrinsic motivation and motor proficiency (LL=-6.82, UL=2.53). This finding may be due to a ceiling effect in the intrinsic regulation data and low prevalence of high motor proficiency in this sample. Past research has shown that eight to 12-year-old children who reported higher levels of intrinsic motivation (qualitatively) also had higher motor skills (Theeboom et al., 1995). It may be that, in this younger age group, there is not a predicted pattern between intrinsic motivation and motor proficiency. That is, regardless of ability, children perceive PE to be fun and thus may explain the non-significant association between these two variables. More research is needed in this age group to either replicate or refute this finding.

No relationship emerged between identified regulation and motor proficiency (LL=-3.34, UL=4.44). Previous research in nine to 12-year-olds demonstrates a complicated relationship between autonomous types of motivation and physical skills with significant and non-significant, positive and negative relationships emerging (van Aart et al., 2017). However, in an older population (mean age of 21.02 years), participants who reported higher autonomous motivation also demonstrated higher performance skills in badminton (Behzadnia et al., 2019). These studies, along with the current study, may indicate that the relationship between more autonomous types of motivation in younger populations is more complicated than that in older populations and warrants further attention.

No relationship emerged between either type of external regulation (approach or avoidance) and motor proficiency (LL=-3.92, UL=3.85; LL=-12.35, UL=3.46, respectively). This finding is perhaps surprising when reflecting upon previous literature. Often rewards are used within education to incite particular

behaviours (Deci et al., 2001), indicating that the application of a reward in PE may lead to more engagement and higher motor proficiency. Despite this, Ryan and Deci (2000) also explain that children who feel externally regulated generally display less interest, value and effort, indicating less engagement and lower motor proficiency. Perhaps in this sample, the role of rewards and punishment was not crucial to the development or impediment of motor proficiency. No relationship emerged between introjection and motor proficiency (LL=-4.00, UL=5.60). Introjection has a complex role within motivated behaviour (Ryan & Deci, 2017) and has demonstrated itself to be moderately associated with positive outcomes (Chen, 2014; Chen & Hypnar, 2015).

Motor creativity

BPNS and enjoyment. None of the models significantly predicted motor creativity; however, the third and last model, with the addition of BPNS and enjoyment, best fit the data with 19% explained variance; 7% more than with the covariates in model two. Based on the confidence intervals, autonomy need satisfaction looked to almost be a significant positive predictor (LL=-.16, UL=6.86). This positive relationship may exist because the assessment allowed children to move in ways that they chose. It may be that with a larger sample size, the model might have had more power, and the positive significant predictive relationship may have emerged.

No significant relationships emerged between enjoyment (LL=-2.91, UL=3.49), competence (LL=-4.39, UL=6.35) and motor creativity. However, both indicated a positive relationship, which would theoretically be expected. However, research is minimal within the motor creativity domain, making the comparison to literature

difficult. Perhaps with a larger sample, these expected positive relationships may become significant and thus add to motor creativity literature. No significant relationship emerged between relatedness and motor creativity (LL=-6.22, UL=3.76). However, a negative association was indicated. The reason behind this is unclear and warrants further investigation in longitudinal and intervention research.

Behavioural regulations. The addition of autonomous types of regulation explained 1% more of the variance in comparison to covariates alone; however, the addition of the controlled types of regulation explained a further 7%, although neither model significantly predicted motor creativity as did none of the individual regulations. Though non-significant, most of the associations were in the expected direction; however, external (approach; LL=-1.19, UL=5.69) and external (negative; LL=-12.26, UL=2.95) regulations had a positive and negative association with motor creativity, respectively. This finding adds support to the splitting of these regulations within the tool. The external approach had a positive relationship, indicating the want for rewards would lead to higher motor creativity, and vice versa. Whereas, participating so that the child would not get into trouble could have led to lower effort and interest (Ryan & Deci, 2000) and lower motor creativity. Overall, this work adds to the minimal literature within the motor creativity area, and more research is necessary to explore this difference in external regulations effect upon motor creativity.

MVPA

BPNS and enjoyment. None of the models significantly predicted MVPA; however, the third model, with the addition of BPNS and enjoyment, best fit the data and explained 22% of the variance, which was 10% more than with the covariates

alone. None of the BPN or enjoyment significantly predicted MVPA. Past research has found older girls (mean age 13.1 years) to have a negative association between PE enjoyment and MVPA (Fairclough, 2003); however, in this current study, sex was controlled for. Other research failed to find a relationship between PE enjoyment and MVPA in 11-13-year-old children (Gråstén & Yli-Piipari, 2019), which corresponds with the current study.

Relatedness need satisfaction trended towards a negative relationship with MVPA (LL=-13.18, UL=.39), suggesting that higher MVPA was associated with lower relatedness need satisfaction, and vice versa. In contrast, Sebire et al. (2013) found a significant positive association between relatedness need satisfaction and MVPA in 7.84 to 11.09-year-old children. Within this current study, relatedness need satisfaction was constrained to PE, whereas PA was measured inside and outside school; therefore, relatedness need satisfaction in PE may not reflect wider PA relatedness need satisfaction. Without knowing what type of activities children were partaking in, inside and outside of school, it is difficult to surmise why this may be.

No significant associations emerged between autonomy (LL=-1.01, UL=8.45), competence need satisfaction (-4.15 UL=10.50) and MVPA; however, the direction of association indicated a positive association. These findings align with previous research in older children (mean age 10.8) where a longitudinal investigation found need satisfaction to predict MVPA positively, and vice versa, concluding that both could be targeted for intervention if aiming to increase need satisfaction or MVPA (Gunnell et al., 2016). It is unclear why these associations were not significant in this sample as perceived competence was high, and autonomy was moderate while

MVPA was relatively high (mean 92.43 minutes). These associations warrant further investigation with a larger sample.

Behavioural regulations. None of the models significantly predicted MVPA; however, the last model with the addition of all behavioural regulations best fit the data and explained 12% more of the variance than with the covariates alone. Identified regulation positively and significantly predicted MVPA (LL=.63, UL=7.66) indicating that the more children recognised the benefit of PE (“I do PE because I want to be healthy and strong”) the higher their MVPA, and vice versa. It is unclear as to why intrinsic motivation was not a significant predictor (LL=-1.28, UL=6.84) as most children chose intrinsic regulation, and MVPA was relatively high. Sebire et al. (2013) found a significant positive relationship between intrinsic regulation and PA in children aged 7.84 to 11.09 years old, alongside a positive but non-significant relationship between identified regulation and MVPA. It may be that a larger sample is necessary to see this significance emerge between intrinsic regulation and MVPA.

External (approach) had a positive but non-significant relationship with MVPA (LL=.63, UL=7.66), while external (avoidance) had a negative but non-significant relationship with MVPA (LL=-16.87, UL=.75). Children were more likely to participate in MVPA if they felt they could have a reward (“I do PE because I might get a reward”) whereas MVPA was lower if they felt that they would get into trouble (“I do PE because I don’t want to get into trouble”). This latter finding is strange and perhaps counterintuitive, as to participate in PE, and to not get into trouble, children should be active. However, those that are externally motivated are said to put less effort into an activity (Ryan & Deci, 2000), which in actuality, makes the positive association between external approach and MVPA to be strange. It may be that, for young

children, the prospect of a reward is more powerful. Sebire et al. (2013) found external regulation to be positively but non-significantly related to MVPA in their sample of 7.84 to 11.09-year-old children which is in alignment with this current study. However, due to differences in the presentation of external regulation between the current study and that of Sebire et al. (2013), it is difficult to compare these results directly. The current study found no relationship between introjection and MVPA, which is echoed by Sebire et al. (2013). However, they found a positive association, whereas this study found a negative association. This difference in direction may be due to the stems that were used. In the current study, introjection was presented as “I do PE because I want my PE teacher and classmates to like me” which emulates an imagined-approval aspect of introjection (Ryan & Deci, 2017). In contrast, Sebire et al. (2013) used “When I’m not active I feel bad” which emulates the guilt aspect of introjection. More research is necessary with perhaps a more comprehensive array of introjection items to fully explore this type of regulation in younger children.

Practical implications and future research

Regarding the MAT-PE’s utility, overall, it demonstrated range. However, it is not fully known how children with language difficulties and special educational needs (SEN) will interact with this tool. Future research would look to purposefully investigate the tool’s utility with children from a variety of backgrounds and needs with a larger sample size. The MAT-PE tool assesses motivation from a contextual motivation level (Vallerand, 2007). Therefore, test-retest reliability and responsiveness should be conducted to assess the motivational stability of young

children within PE. The tool could help to bridge the gap between research and practice whereby data from the MAT-PE could help inform PE teacher practice.

Regarding the predictive validity of the tool, the addition of motivation-related variables helped account for more of the variance within each type of movement. Autonomy need satisfaction emerged as a significant negative predictor of motor proficiency. The implication here is that if PE teachers focus on proficiency, as is the current trend in PE, this may negatively affect children's autonomy need satisfaction. It should also be understood that if PE teachers wish to promote autonomy need satisfaction, this may have a negative effect on motor proficiency. The reason for this relationship is unclear and warrants further study and replication in a larger sample. Identified regulation was a positive and significant predictor of MVPA, and vice versa, therefore, PE teachers should support children's knowledge of the benefits of PA to help sustain this positive relationship.

Strengths and limitations

Limitations included a lack of generalisability due to the inclusion of children from only low SES areas. This concentration on low SES was due to the aim of the RCT to improve motor competence in disadvantaged children. Also, the sample size was relatively small ($n=78$), which was reduced further by missing variables that could not be imputed. A larger sample size may have given the models more power, and more predictors may have emerged as significant. This study was also cross-sectional, which meant that any associations were bi-directional. A longitudinal design should be conducted to understand causality. A strength of this study was the inclusion of a variety of movement types which meant a more comprehensive investigation of young children's movement and their potential predictors. This study contributes to

young children literature in movement proficiency and creativity as well as MVPA. It also adds to the motivation literature for young children.

Conclusion

This chapter sought to investigate the utility and predictive validity of the MAT-PE. The tool was able to distinguish between children who were higher and lower on BPNS and behavioural regulation, and in doing so, provided a novel insight into young children's motivational profiles. Through this, research can help inform teachers about motivating styles and their practice within early primary PE. This study also demonstrated that motivation is somewhat important for movement in young children. This finding indicates that with a larger sample, motivation may predict movement and should, therefore, have a more significant focus within PE teachers' planning of PE.

So far, Chapters Three, Four and Five have set about investigating young children's motivation at the contextual level through the MAT-PE. This work sat within a larger RCT which looked to improve motor proficiency and motor creativity in young children. During the intervention, children experienced either one of two pedagogies underpinned by Motor Learning Theory or continued with their normal PE provision. As young children's perceptions around enjoyment and BPNS within PE is a highly under-researched area, the opportunity was taken to investigate young children's situational enjoyment and BPNS and is one investigative route within Chapter Six. The other investigatory route within Chapter 6, which provides a more comprehensive understanding of motivational processes within this age group, is the investigation into whether motivational climates differ between NLP, LP, and control, and if the lower-order dimensions differ between intervention groups.

Chapter 6

Influence of linear and nonlinear pedagogy on motivational climate, need satisfaction and enjoyment among 5-6-year-old children in physical education.

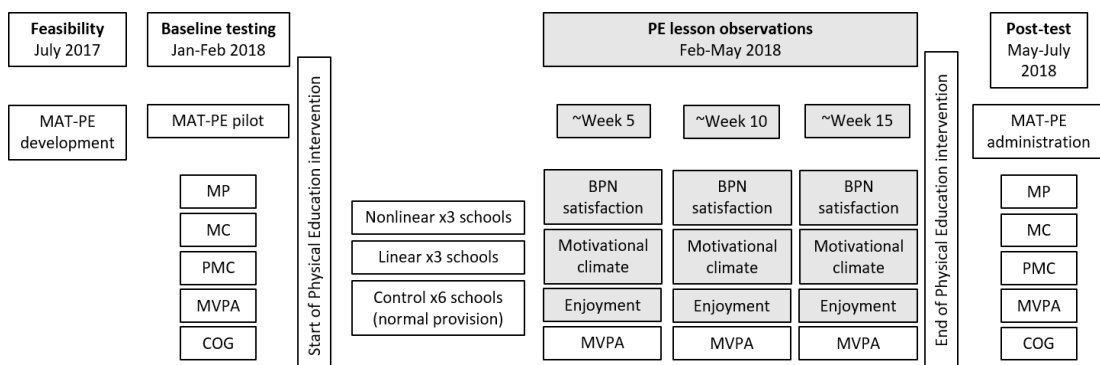
Thesis study map

<p>Chapter Three (Study One): The development and content validity of the Motivation Assessment Tool for Physical Education (MAT-PE)</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop a mixed-method tool for assessing young children's enjoyment, BPNS and behavioural regulation within PE. • To ascertain the content validity of the tool through the research team and independent researchers. <p>Key findings:</p> <ul style="list-style-type: none"> • A seven-stage, mixed-method, activity-based tool was developed with the target population. • The tool's content validity was ascertained via a sample of independent SDT researchers.
<p>Chapter Four (Study One):</p> <p>The development, content validity, acceptability and reliability of the Motivation Assessment Tool for Physical Education codebook</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To develop codebook in order to integrate the quantitative and qualitative strands of the tool. • To ascertain content validity, acceptability, inter- and intra-rater reliability of the codebook. <p>Key findings:</p> <ul style="list-style-type: none"> • The specially developed MAT-PE codebook had content validity, acceptability, and reliability.
<p>Chapter Five (Study Two): Utility and predictive validity of the MAT-PE</p>	<p>Objectives:</p> <ul style="list-style-type: none"> • To investigate the utility of the tool and codebook. • To describe the motivational profiles of 79 children aged 5-6 years. • To ascertain the predictive validity of the MAT-PE and other PE outcomes such as MP, MC, and MVPA. <p>Key findings:</p> <ul style="list-style-type: none"> • Children demonstrated high levels of competence and relatedness, and moderate levels of autonomy need satisfaction.

	<ul style="list-style-type: none"> • Most children placed intrinsic, identified, and external (approach) regulations as their 'first choice' for PE participation. • The MAT-PE did not predict movement outcomes (MP, MC, MVPA) but did explain more of the variance. • Autonomy need satisfaction negatively and significantly predicted motor proficiency. • Identified regulation positively and significantly predicted MVPA.
Chapter Six (Study Three): Influence of Linear and Nonlinear Pedagogy on Motivational climate, need satisfaction and enjoyment in Physical Education among 5-6-year-old children.	<p>Objectives:</p> <ul style="list-style-type: none"> • To explore the potential for two pedagogies underpinned by Motor Learning Theory (NLP and LP) in providing empowering and disempowering motivational climates in comparison to usual PE provision. • To explore to what extent both pedagogies support empowering and disempowering environmental dimensions. • To explore young children's BPNS and enjoyment within PE.

Figure 12

Placement of Study 3 within the RCT (greyed).



Note. MAT-PE = Motivation Assessment Tool for Physical Education, MP = Motor Proficiency, MC = Motor Creativity, PMC = Perceived Motor Competence, MVPA = Moderate to Vigorous Physical Activity, COG = Cognition, BPN = Basic Psychological Needs

Abstract

Introduction: A lack of knowledge around how children learn to move alongside other constraining institutional factors has led to a highly structured and prescriptive teacher-centred delivery. A criticism of this approach to PE is a failure to address the motivational needs of children. To move towards an informed and developmentally appropriate pedagogy for young children, it has been proposed to underpin PE with Motor Learning Theory. **Aims:** 1) to explore the potential for two pedagogies underpinned by Motor Learning Theory (NLP and LP) in providing empowering and disempowering motivational climates in comparison to usual PE provision, 2) explore to what extent both pedagogies support empowering and disempowering environmental dimensions, at the contextual and situational level, and 3) explore the influence of pedagogy upon young children's BPNS and enjoyment within PE. **Method:** Forty-four PE lessons across three conditions were video recorded and subsequently coded by two trained researchers using the Multidimensional Motivational Climate Observation System. BPNS and enjoyment data were gathered from 203 year 1 children (aged 5-6 years) every five weeks. A MANOVA and Bonferroni posthoc test was run for each research aim. An ANOVA was run to explore group and sex differences for enjoyment. **Results:** All PE lessons were highly empowering but demonstrated significant group differences for disempowering motivational climates. Significant group differences were found for autonomy support and structure environmental dimensions, as well as for autonomy and relatedness needs satisfaction. **Conclusion:** Motor Learning Theory pedagogies nor the control (standard practice) were found to be detrimental to children in the short-term. However, PE teachers should be aware of the long-term motivational

consequences of pedagogies. This study provides evidence that underpinning PE with theories of motor learning is a viable and beneficial alternative to traditional PE practice.

Introduction

Chapters Three, Four, and Five followed the development of the MAT-PE from development to utility and predictive validity. This chapter seeks to provide a more comprehensive exploration of the motivational processes associated with different types of pedagogies. This exploration was prudent as this thesis sits within a wider RCT (Rudd et al., 2020a); therefore, providing opportunity to explore the motivational climates of the pedagogies delivered by the SAMPLE-PE coaches.

Enriched and varied movement experiences in childhood are considered crucial for sustained participation in PA (Kirk, 2005; Rudd et al., 2020b; Savelsbergh & Wormhoudt, 2019). Further to this, enjoying PE during school positively affects future attitudes and intentions towards PA (Ladwig et al., 2018). A frequent criticism levelled at PE is that, often, it is delivered with a *physical-education-as-sport-technique* where the structure and status in the educational institution are rigid and inflexible. This approach leads to a constrained teacher with little option but to provide a child with a narrow multi-skills or team sports curriculum (Kirk, 2010). From the learners' perspective, the experience can be prescriptive where they receive constant instructions/corrective feedback for reproducing forms of movements or patterns of play (Davids et al., 2012; Chen et al., 2008). It is argued that due to the rigidity and one size fits all approach, it fails to consider the motivational needs of the child (Haerens et al., 2011). Learning of movement skills enhances children's capacity to participate meaningfully in play, games, and activities supporting ongoing physical literacy (Whitehead, 2010; Robinson et al., 2015; Rudd et al., 2020b). As a result, learning of movement skills is an integral aspect of PE curriculums globally

(Department of Education 2013; UNESCO 2013). A PE curriculum that is developed upon how children learn may alleviate the problem that a highly prescriptive, teacher-centred approach poses.

In summary, while criticism has been levelled at current PE practice, no one has yet empirically evaluated the motivational impact of this standard practice on children's motivation and enjoyment in early PE. To undertake an effective evaluation of this, we first need to understand how motivational theories can inform our understanding of the motivational climate.

Motivation

Motivational climate

Motivational theories can help us better understand the environmental climate of PE pedagogies. Duda (2013) advanced our understanding of empowering and disempowering motivational climates through the integration of AGT (mastery-oriented and ego-oriented motivational climates; Nicholls 1989) and SDT (autonomy, competence, and relatedness need support; Deci and Ryan, 1985; Ryan and Deci, 2017). AGT is a socio-cognitive motivation theory that explains the how and the why behind individuals' participation in achievement contexts (Nicholls, 1989). SDT distinguishes between types of motivation based on the reasons that move individuals towards a particular behaviour (Deci & Ryan, 1985).

Within AGT, mastery-oriented climates foster intrinsic motivation and enjoyment (Duda & Nicholls, 1992), while an ego-oriented climate decreases intrinsic motivation (Duda et al., 1995). PE teachers who instil a mastery-oriented motivational climate use a self-referenced criterion for defining success such as

personal improvement and task-mastery. In contrast, PE teachers who instil an ego-oriented motivational climate use an other-referenced criterion for defining success, such as demonstrating a superior ability to others (Seifriz et al., 1992).

The model of empowering and disempowering motivational climates is discussed in Chapter Two. Briefly, a coach within an empowering motivational climate tends to promote feelings of autonomy supportive, socially-supportive, and task-involving behaviours. The more task-involving the learner perceives the motivational climate to be, the more positive impact upon their BPNS and higher likelihood of autonomous motivation. In contrast, within a disempowering motivational climate, the learner is more likely to perceive an ego-involving climate which is more likely to frustrate the BPN and lead to more controlled motivation or amotivation (Duda et al., 2018). Literature that has been underpinned by this model have found differences in motivational climates between training and competition environments (Smith et al., 2017), differences between pedagogical practice in adolescents within PE (Choi et al., 2020), and has shown that an empowering motivational climate can positively impact daily MVPA (Fenton et al., 2017).

In regards to pedagogical impact upon motivation, no study has investigated children under the age of nine (Teraoka et al., 2020). One study with children aged nine to 13 years found differential effects of a PE programme based on game-based pedagogy (i.e., Tactical Games; Mitchell et al., 2020) upon motivation according to age (Harvey Gil-Arias et al., 2017). In another study, nine to 11-year-old children reported fun, optimal challenge, and perceived competence within another game-based pedagogical programme (i.e., Teaching Games for Understanding; Bunker & Thorpe, 1982) but also reported boredom (Mandigo et al., 2008). The only study to

include young children (aged five to 11 years) found that a need-supportive motivating style improved moderate to vigorous PA in PE (Escrivia-Bolley et al., 2018). Although this study included young children, its focus was on PA rather than motivational outcomes.

Basic psychological needs satisfaction and enjoyment

BPNS consists of autonomy (the need for actions to be volitional and a sense of choicefulness), competence (the need for satisfaction in demonstrating capabilities) and relatedness (the need to seek out connected relationships with others; Deci & Ryan, 2000; Vansteenkiste et al., 2015). BPNS predicts autonomous motivation in PE for children as young as eight (Chen, 2014) and nine (van Aart et al., 2017). However, no BPNS research has been conducted with children under the age of eight within the context of PE (Vasconcellos et al., 2019). Chanal et al. (2019) found motivation to decrease from the age of eight; however, it is unknown if and how motivation changes before this age. It is essential to study this younger age group (below eight years of age) to try and understand their motivations to understand better how best to support their motivation.

There are also limited studies that investigate enjoyment for PE in young children. Of the studies that have been conducted, enjoyment in PE seems to be experienced differently between girls and boys where boys experience higher enjoyment related to higher perceived competence (Carroll & Loumidis, 2001; Cairney et al., 2012). Girls perceive PE to be more enjoyable than boys when they get to participate in dance and gymnastics (Baron & Downey, 2007). This difference needs to be investigated further as “fun” is considered a crucial element of meaningful experiences in PE and towards supporting intrinsic motivation (Beni et

al., 2017). There is limited research examining the effect of PE pedagogy on young children's motivational climate, need satisfaction and enjoyment of PE and more research is required.

Pedagogies underpinned by motor learning theory

To effectively support children's learning of motor skills, PE pedagogies should be underpinned by theories of motor learning. Information Processing Theory (Schmidt, 1975), suggests that movement skill learning is linear where skills progress through observable learning stages (i.e., cognitive, associate, and autonomous) moving from simple to complex (see Table 24), and from this point on, will be referred to as LP. LP has the *theoretical* potential to differentially support the environmental dimensions of empowering (autonomy-supportive, task-involving, relatedness supportive, and structure) and disempowering (controlling, ego-involving, and relatedness thwarting) motivational climates. For example, due to the highly linear structure and constrained nature of LP, opportunities for the *autonomy-supportive* dimension may be limited, which may negatively impact autonomy need satisfaction. However, for the same reason, the *structure* domain may be well supported, which may positively impact competence need satisfaction. Regarding the disempowering dimensions, creating an optimal technique may automatically align itself with the *ego-involving* dimension as it involves other-referenced rather than self-referenced progression (Nicholls, 1989). Pedagogically, it is not expected that LP would support the *controlling* and *relatedness-thwarting* domains.

Ecological dynamics (Davids et al., 1994; Warren, 2006) is a contemporary Motor Learning Theory which underpins NLP. Ecological dynamics views learners as complex, adaptive systems and, as a result, individuals learn to perceive affordances

at each moment, relative to their current intrinsic dynamics (including skill competence, cognitive, and affective development; Adolph & Hoch, 2019). Furthermore, system changes involve a nonlinear process (Chow et al., 2015) where a small but critical change in one sub-system will cause a cascade across the whole system, resulting in the emergence of a new movement solution during exploratory activity (Davids et al., 2008b; Chow et al., 2015). As a function of learning and experience, movement skills tend to stabilise within the dynamic system. The teacher's role is, therefore, to create a learning landscape through the manipulation of the environment and task to encourage functional movement solutions. Once a functional movement solution has stabilised, the teacher manipulates environment or task constraints to de-stabilise the movement requiring children to find different movement solutions to the task (see Table 24).

Like LP, NLP has the potential to support the various dimensions within motivational climates differently. For example, due to NLP's ethos to explore-discover-adapt, the *autonomy-supportive* dimension may be well supported as children have much control over their intentions, decisions, and movements within the lesson, which may positively impact children's autonomy need satisfaction. However, due to the same ethos, the *structure* dimension may not be as well supported, which may negatively impact children's competence need satisfaction. Nevertheless, through well-designed learning environments that are representative to the child, for example, using storytelling, games, or music, may provide a natural structure negating this potential issue. Pedagogically, it is not expected that NLP should support the *controlling*, *relatedness-thwarting*, or *ego-involving* domains due to its task-oriented approach.

Table 24*Characteristics of the Linear and Nonlinear Pedagogies.*

	Linear Pedagogy	Nonlinear Pedagogy
1	A singular optimal movement pattern for each fundamental movement skill that the PE teacher/coach develops via repetition within a sport-related activity/drill.	A functional set of movements for each fundamental movement skill that the PE teacher/coach facilitates via manipulating constraints (task, environmental, individual).
2	Movements are broken down into components by the PE teacher/coach during instruction.	Movements are kept whole by the PE teacher/coach manipulating the environment for the children.
3	Movement variability is squashed through the repetition of a particular skill in order to create an efficient, reliable, and accurate movement skill performance.	Movement variability is encouraged through perturbations in the learning environment and self-organisation in the children.
4	An internal focus of attention is encouraged by the PE teacher/coach through demonstration and verbal instruction.	An external focus of attention is encouraged by the PE teacher coach through the use of analogies.
5		A representative learning environment where the PE teacher/coach embeds the whole lesson within a performance environment where the warm-up and practice activities are related to each other and to the performance environment in which they are based.

Both pedagogies have the potential to support motivational climates. However, the extent to which these pedagogies do this is yet to be empirically explored. Few studies have investigated NLP and LP's effect upon motivation during PE. Moy et al. (2016) found that NLP demonstrated more significant improvements in enjoyment, effort and intrinsic motivation over LP; however, it should be noted that this was in young adults (mean age of 20.5 years). Qualitatively NLP has been found to facilitate perceived competence, autonomy, and relatedness (Lee et al., 2017) in nine to 10-year-old children within PE; however, no differences in intrinsic motivation were found between NLP and LP. At the time of writing, no research in this research area has been undertaken with young children within PE. This study

seeks to fill this gap so that PE teachers can understand the impact that movement learning underpinned by pedagogies have upon young children's motivation and enjoyment during PE.

This study aimed to (1) explore the potential for two pedagogies (NLP and LP), underpinned by contrasting Motor Learning Theories in providing empowering and disempowering motivational climates in comparison to usual PE provision, (2) explore to what extent both pedagogies support the empowering and disempowering environmental dimensions, and (3) explore the influence of pedagogy upon young children's BPNS and enjoyment within PE.

Methods

This study formed an aspect of the process evaluation of the SAMPLE-PE cluster RCT (Rudd et al. 2020a; see Figure 12) with data collected during a 15-week PE intervention that ran from February 2018 until May 2018. Twelve schools were randomly allocated into an intervention condition (LP: n=3 schools; NLP: n=3 schools) or control group (n=6 schools) using a computer-based random number producing algorithm by an independent researcher not associated with the study. The intervention contained three blocks of five weeks, where a different movement discipline was the focus (dance, gymnastics, and ball skills) for both NLP and LP. The control group carried on with their normal provision; however, consistency was sought in regards to dosage between all groups with PE held two times a week for 60 minutes. The institutional research ethics committee approved this study (Reference 17/SPS/031). Gatekeeper consent was obtained from headteachers, informed

consent from parents and coaches and informed assent from children before participation in the PE lessons and data collection.

Intervention

The PE curricula content were developed over three months as well as a training course for prospective coaches within the study. All recruited coaches attended a bespoke five-week training programme which consisted of one session a week lasting three hours, split evenly between theory and practical. Three qualified sports coaches received NLP theoretical and practical training, and two qualified coaches received LP theoretical and practical training. Coaches were assigned to schools according to their availability as schools scheduled PE on different days and times throughout the week. At the end of the training period (15 hours over five weeks), each coach received a scheme of work and pedagogical framework for each PE subject (dance, gymnastics, and ball skills). They also received a resource pack covering key elements of their respective pedagogical approach. Each coach was supported by the research team in designing lesson plans. Recordings of the theoretical and practical training sessions were accessible to them online.

Linear pedagogy

LP followed a traditional lesson plan (see Appendix C), which consisted of a warm-up, skill development (i.e., drills), and finished with a performance environment structure (i.e., a game). Emphasis was placed upon the coach to demonstrate optimal movements for the children to replicate within low environmental variability activities. As skill improved, coaches placed the children in gradually more variable and dynamic learning environments. To train and support

coaches with this process, we used Gentile's taxonomy (Gentile, 2000). In each lesson, children were taught a new skill movement following this taxonomy for linear progression before transitioning into a game. Coaches were trained on Fitts and Posner's stages of skill learning (Fitts & Posner, 1973) to determine when to progress the children and trained to differentiate tasks through the challenge point framework (Guadagnoli & Lee, 2004).

Nonlinear pedagogy

NLP followed a novel lesson plan created for SAMPLE-PE (see Appendix D). The research team worked with the coaches to identify typical constraints between schools (e.g., class sizes, lesson duration) and children (e.g., age, socioeconomic demographic) to design each lesson plan. This constraint identification created an expected range of variation that could be planned for to design more meaningful and individualised lessons for the children. Coaches created representative learning environments that would encourage children firstly to explore (safely) but then to also afford movement opportunities that were aligned to the coach's learning outcome. For example, setting out benches and spots on the ground, spaced at a specific distance to afford different types of jumping. Coaches were trained to follow and utilise two models within their teaching: Newell's model of motor learning (Newell, 1986) in order to identify movement skill capacity of the children (coordination, control or skill), and the STEP framework (Space, Task, Equipment, and People; Youth Sport Trust, 2018). The STEP framework involves the manipulation of the task and environmental constraints, which increase and decrease affordances,

thereby making it easier or more challenging for the children to find a functional movement solution.

Control

The control schools were asked to provide their normal PE provision where the only requirement was that they ensure that the children took part in two sessions of PE a week, last 60 minutes each so that the dose was comparable with the intervention groups. The control schools followed mainly ball-skills and running activities during the study period (Table 25) with no gymnastics or dance lessons, or apparent indications of planning or implementation of pedagogical principles.

Table 25

Observed lesson content and the particular focus of the control schools over three time points.

Timepoint			
Wider content – focus			
School	T1	T2	T3
1	Obstacle course relay – Jump	Object control send and receive – Bean bags	Obstacle course relay - Running
2	Ball games – Mat-ball	Obstacle course relay – Balance component	Obstacle course relay – Running
3	Tag games – “Foxes and rabbits.”	Object control send and receive – Different passages with the ball	Tag games – “Jailbreak.”

Note. T1=Time 1, T2=Time 2, T3=Time 3

Participants

Coaches

Three coaches were recruited from the in-house coaching provider within a University in North West England who were also enrolled on an undergraduate sports coaching course, alongside two coaches who were members of the research team (coaches 1-5). All held the minimum operating standard to coach (i.e., a level 2 qualification), meaning that they had the experience of independently planning, preparing, and delivering sessions as well as basic emergency first aid, safeguarding, and protecting children certification.

Children and procedure

For this aspect of the study, only nine schools (of the 12 within SAMPLE-PE (Rudd et al., 2020a)) took part in this aspect of the evaluation. Schools were situated in deprived areas across a large metropolitan city in North West England, UK. Forty-five PE lessons were observed and need satisfaction and enjoyment data was collected from 203 children from 15 Year 1 (ages 5-6) classes (5 x LP (n=77), 5 x NLP (n=77), 5 x control (n=49) every five weeks immediately after each observed PE lesson. BPNS data was captured from children on a one-to-one basis with a researcher at the end of each observed lesson. As children left to return to class, the children with approved ethical consent tapped one of three emoticon posters to assess their enjoyment and were recorded on a GoPro camera.

PE lessons were video-recorded via a stationary GoPro positioned at an optimum position within the PE hall or outside area so that the whole class of children and the coach were covered throughout the lesson duration. Video recordings were

made so that motivational climate coding could be conducted at a later date. Each coach was asked to wear a wireless radio mic (Sennheiser, series ew 100 G2) during the PE lesson so that audio and video recordings could be analysed using the Multidimensional Motivational Climate Observation System (MMCOS; Smith et al. 2015). Researchers recorded the start and end time of PE lessons to record the duration of each lesson across the NLP, LP, and control groups. The aim was to run and capture 60 minutes per PE lesson; however, due to reasons such as school schedule and variation in children's changing times, the duration of lessons varied across all groups, ranging from 19 minutes and 29 seconds to 48 minutes and 1 second. However, when lesson duration was averaged across the 15 lessons for each group, no statistically significant differences were found between the groups for time spent in PE ($p = .06$). Although 45 lessons were recorded, one lesson within the control group could not be used due to a microphone malfunction, resulting in 44 captured lessons.

Measurement

Pedagogical fidelity

Thirteen of the 44 PE lessons were coded by two trained research assistants to establish pedagogical fidelity. Each lesson was quartered by time, and pedagogical behaviours were coded on a sliding scale between Pedagogy A and Pedagogy B. Coding occurred according to an especially developed pedagogical checklist. The checklist (which can be found in Appendix E) consisted of seven motor learning categories that were coded for every quarter lesson (e.g., Pedagogy A: *Children learn the skill first in closed decontextualised environments then apply new skills in a*

performance environment; Pedagogy B: Movements are always learnt in context (music, storytelling, scenarios or games)), and two global categories (e.g., Pedagogy A: Lesson progression is through a clear and linear structure, warm-up, drills, game/performance and cool down; Pedagogy B: Lesson evolves through storytelling, scenarios or games). Global categories were judged for the overall lesson, rather than within quartiles. Both coders were blind to school allocation within the intervention. For information on coder training, please see Appendix F.

Motivational climates

The MMCOS (Smith et al., 2015) integrates SDT and AGT to assess the psychological potency of the environment the coach has created. The MMCOS has a hierarchical structure. The observer codes the coach according to two higher-order factors (empowering and disempowering), seven environmental dimensions (autonomy support, relatedness support, task-involving, controlling, relatedness thwarting, ego-involving, and structure) and 32 lower-order coach behaviour strategies.

The coder splits the videoed session into quarters and for every quarter provides a code for each of the seven environmental aspects based on observations of the 32 coaching behaviours via a 4-point potency scale (0=*not at all*, 1=*weak potency*, 2=*moderate potency*, 3=*strong potency*). After the full session has been viewed, the coder provides an overall rating for the amount the climate was empowering or disempowering based on a similar 4-point potency scale used for the individual environmental dimensions. Therefore, the tool produces seven mean scores (one per environmental dimension) and two overall hierarchical mean scores

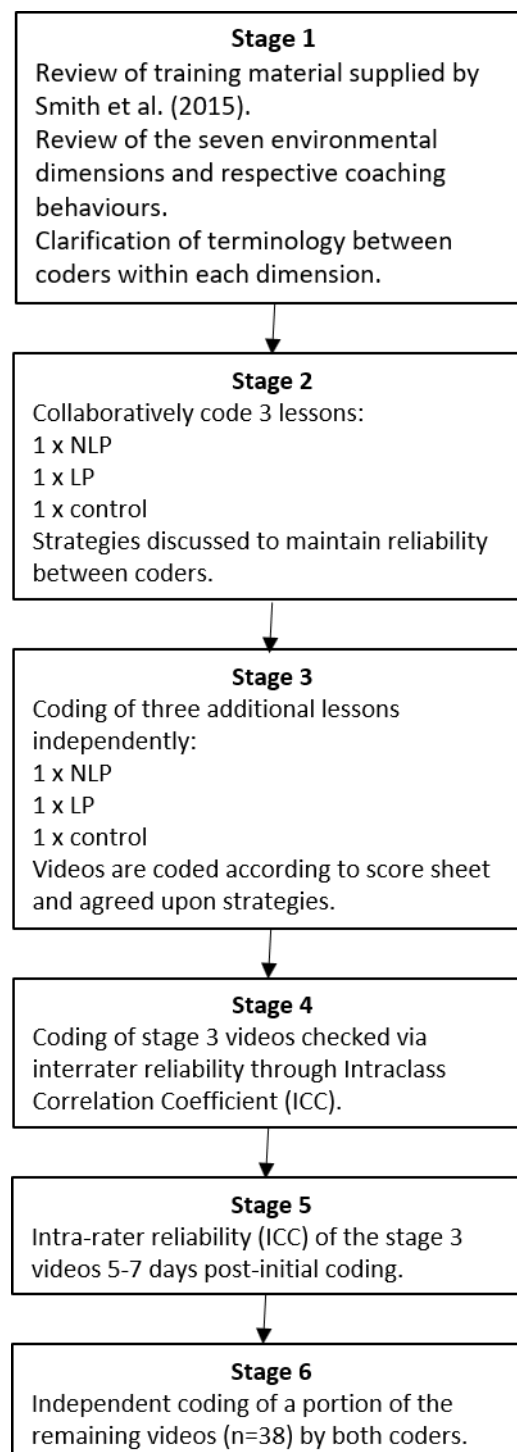
(the extent the whole lesson was empowering or disempowering). Higher and lower scores on both the empowering and disempowering motivational dimensions indicate stronger and weaker potency, respectively. Two coders (first author and postgraduate student) followed the training and coding protocol outlined by Smith et al. (2015). The process taken by the two coders included six stages (Figure 13). The first author could not be blinded against the allocation of schools into their respective groups, whereas the second coder was blinded to group allocation.

Need satisfaction

Immediately after each observed PE lesson, children in all three conditions of the study were asked on a one-to-one basis by a researcher to complete brief measures of relatedness, competence, and autonomy need satisfaction where one global question was included for each need. For relatedness, the quantity of social interaction was examined in line with Sebanc (2003), where children were asked to identify which children they had interacted with (played or worked with) during that particular PE lesson. The children identified their peers through pointing at photographs provided by the school displayed on an A3 piece of paper. Relatedness was scored from 0 (worked/played with no one) to the maximum number of children in the class (~30).

For competence need satisfaction, each child was asked, “how good were you at doing things during that PE lesson?” A 5-point star chart was shown to each child where 1 meant not very good, and 5 meant very good.

Figure 13. Flow diagram of the six stages of the coding process.



For autonomy need satisfaction, children were asked, “did you get to do any choosing during that PE lesson?” The answer format was on a two-layer response where they first chose ‘yes’ or ‘no’ and then, depending on their initial answer, were

asked if it was 'always yes' (score of 4) or 'sometimes yes' (score of 3) or 'sometimes no' (score of 2) or 'always no' (score of 1). This response format is in line with work by Harter and Pike (1984) and Barnett et al. (2015). High scores indicated that children felt they experienced choice, whereas low scores indicated a lack of choice. All questions were located on the same sheet and took around five minutes to complete per child.

Enjoyment

Enjoyment was measured through children tapping one of three posters displaying three emoticon faces depicting fun, ok, or boring situated on the door as they exited the PE lesson (see Appendix G). Their responses were video-recorded via GoPro by a researcher. *Fun* was scored as 3, *ok* was scored as 2, and *boring* was scored as 1. Completing the enjoyment measure for the whole class took around five minutes.

Data analysis

Interrater reliability for need support

Interrater reliability (Stage 4 of Figure 13) was determined by using the coded video data from stage 3 of the training procedure. Intraclass correlation coefficients (ICC) were run with a two-way mixed, average measures for absolute agreement, with 95% confidence intervals resulting in ICCs between 0.75 and 1 for autonomy support, task-involving, relatedness support, relatedness thwarting, and structure which is deemed excellent (Cicchetti, 1994). As there was zero variance for ego involving and controlling behaviours between raters, SPSS could not generate an ICC

for these dimensions; however, the scores had 100% agreement between raters. Intra-rater reliability (test-retest) took place 5-7 days after coding for interrater reliability. Both coders were above 0.75 for all dimensions except for controlling and relatedness thwarting where zero variance was found for both coders and one coder respectively on those dimensions (however, there was 100% agreement on scores over the two time points). Two interrater reliability checks were made to avoid drift: the first after independently coding nine videos each and the second check after a further four videos. Interrater reliability checks consisted of independently coding the same PE lesson and comparing scores.

Interrater reliability for pedagogical fidelity

Interrater reliability was determined by using the coded video data from 10 PE lessons. Intraclass correlation coefficients (ICC) were run with two-way mixed, average measures for absolute agreement, with 95% confidence intervals. All category items (n=7) and both global items had ICCs of .97 and above, which is considered excellent (Cicchetti 1994). One interrater reliability check was made, consisting of three PE lessons to avoid drift. Coders were blinded to group allocation.

Statistical analysis

All statistical tests were completed using SPSS, version 26 [IBM SPSS Statistics Inc., Chicago, IL, USA]. Descriptives, including mean and standard deviation, were produced for each variable. Overall mean scores of the three time points were used in order to capture an overview of the motivational climates within PE pedagogies over a relatively long period, in this case, almost four months. To investigate the motivational climate: differences in empowering and disempowering motivational

climates (aim 1) and motivational dimensions (aim 2) were computed via MANOVA due to multiple dependent variables. For need satisfaction (aim 3), a MANOVA was also conducted. Bonferroni posthoc tests were conducted to explore any significant differences between intervention groups. Group sizes were not significantly different; therefore, if the Box's M test demonstrated significance ($p < .001$), Pillai's Trace was reported. As enjoyment was expected to correlate with sex (Baron and Downey 2007), a two-way ANOVA was run with sex and group as fixed factors and enjoyment as the dependent variable. Post-hoc tests for sex were conducted through a t-test.

Results

Observed PE lessons

The number of observed lessons delivered by each coach within the intervention groups and the control group can be seen in Table 26. Due to staffing issues during the intervention, coach 3 in the NLP group had to deliver two lessons (out of the 15) in the LP group, and coach 5 had to deliver one lesson (out of 15) in the NLP group. Coaches 3 and 5 were members of the research team and considered experts in their knowledge and practical experience of NLP and LP. When checked statistically, removal of these crossover lessons bore no influence upon the overall results for empowering and disempowering climates or upon the individual environmental dimensions within each climate.

Table 26

The Number of Observed Lessons for each Coach within each Experimental Group.

Experimental group					
Nonlinear Pedagogy		Linear Pedagogy		Control	
Coach	No. of lessons	Coach	No. of lessons	Coach	No. of lessons
1	3	3	2	6	4
2	7	4	9	7	3
3	4	5	4	8	6
5	1			9	2

Pedagogical fidelity

Means and standard deviations for each category and global items can be seen in Table 27. It can be seen that for each category, each pedagogy has a mean score within its own section of the sliding scale (NLP: 4 and 5, LP: 1 and 2), indicating that NLP characteristics were represented in the NLP group and LP characteristics were represented in the LP group. Global mean scores also indicate that the overall pedagogical judgement based on these categories was aligned with the expected pedagogy. The control group indicated a stronger representation of LP characteristics than NLP.

Table 27

Means and Standard Deviations for each Category and Global Item of the Fidelity Checklist for each Intervention Group.

	Category							Global	
	Mean (SD)							Mean (SD)	
	1	2	3	4	5	6	7	1	2
Nonlinear	5.00 (.00)	5.00 (.00)	4.90 (.28)	3.95 (.78)	4.05 (.77)	4.73 (.41)	4.58 (.43)	5.00 (.00)	5.00 (.00)
Linear	1.40 (.64)	1.48 (.85)	1.20 (.41)	1.77 (.94)	1.20 (.41)	1.63 (.88)	1.63 (.75)	1.40 (.74)	1.33 (.82)
Control	2.10 (.83)	2.15 (1.04)	2.19 (.88)	1.44 (.97)	2.33 (.87)	2.21 (.75)	2.50 (.54)	2.00 (1.08)	1.92 (1.11)

Table 28 shows the mean percentages of the overall pedagogical impression held by the two coders for each observed lesson within the intervention. NLP was found to be judged as 100% nonlinear in its delivery. LP was found mostly to be linear in its delivery; however, there was a slight crossover with NLP (3.33%). 8.33% of overall judgement within LP found neither pedagogy to be more represented than the other. The control group was free to carry on with normal provision. When checked against the fidelity checklist, the control group was found to display mostly linear characteristics and few nonlinear characteristics. 30.77% of the time, overall judgement within control found neither pedagogy to be more represented than the other.

Table 28

Mean Percentages of the Overall Pedagogical Impression of Lessons within each Group.

	Linear (Pedagogy A)	Nonlinear (Pedagogy B)	Neither
	Mean%	Mean%	Mean%
Nonlinear	0	100	0
Linear	88.33	3.33	8.33
Control	59.62	9.62	30.77

Motivational climate

Overall hierarchical empowering and disempowering climate (aim 1)

Motivational climate descriptive data are presented in Table 29. A one-way MANOVA was conducted with the intervention group (Control, NLP, and LP) as the fixed factor and overall hierarchical empowering and disempowering climate scores as dependent variables.

Table 29

Means and standards deviations of overall total hierarchical empowering and disempowering climates according to the intervention group.

Intervention group												
Control (n=4)					Nonlinear (n=5)				Linear (n=5)			
Mean (SD)					Mean (SD)				Mean (SD)			
Hierarchical construct	T1	T2	T3	Overall	T1	T2	T3	Overall	T1	T2	T3	Overall
Empowering	2.00 (.00)	2.00 (.00)	1.80 (.84)	1.92 (.32)	2.00 (.00)	2.60 (.55)	2.60 (.55)	2.40 (.28)	1.60 (.55)	2.40 (.55)	2.40 (.55)	2.13 (.38)
Disempowering	1.00 (.00)	1.00 (.00)	1.00 (.00)	1.00 ♦* (.00)	1.00 (.00)	.60 (.55)	.60 (.55)	.73♦*■* (.15)	1.20 (.45)	1.00 (.00)	1.00 (.00)	1.07■* (.15)

Note. ♦ Statistically significant difference between control and nonlinear, ■ Statistically significant difference between linear and nonlinear

T1 = Timepoint 1, T2 = Timepoint 2, T3 = Timepoint 3

* $p < .05$

There was a statistically significant difference in motivational climate based on intervention group, $F(4, 20) = 4.06, p = .01$; Wilk's $\Lambda = .31$, partial $\eta^2 = .45$. Intervention group had a statistically significant effect on total disempowering climate ($F(2, 11) = 9.48; p = .004$; partial $\eta^2 = .63$) but not on total empowering climate ($F(2, 11) = 2.43; p = .13$; partial $\eta^2 = .31$). Bonferroni posthoc test showed that mean scores for overall hierarchical disempowering environments were statistically significant, with control scoring higher than NLP ($p = .029$). LP also scored higher on disempowering than NLP ($p = .005$). There was no difference between LP and control ($p = 1.00$).

Empowering and disempowering dimensions (aim 2)

Table 30 includes the means and standard deviations of the overall mean scores for each environmental dimension within empowering and disempowering climates. Higher and lower scores on both the empowering and disempowering motivational dimensions indicate stronger and weaker potency, respectively. Particularly high scores can be seen for the *relatedness supportive* dimension across all groups (> than a score of 2) within the empowering motivational climate construct. Lower scores can be seen for *autonomy-supportive* within the control and LP groups (< than a score of 2).

A one-way MANOVA was conducted with the intervention group (control, NLP, and LP) as the fixed factor and overall hierarchical empowering and disempowering dimension provision scores as dependent variables. There was a statistically significant difference in motivational dimension provision based on intervention group, $F(14, 10) = 4.06, p = .002$; Wilk's $\Lambda = .009$, partial $\eta^2 = .91$.

Table 30. Means and standard deviations of total empowering and disempowering sub-constructs scores for each intervention group.

		Empowering Climate Constructs - Mean (SD)				Disempowering Climate Constructs - Mean (SD)		
Group (no. classes)		AS	TI	RS	S	C	EI	RT
Control (n=4)	T1	1.69 (.31)	1.06 (.55)	2.44 (.66)	1.94 (.51)	.56 (.24)	.50 (.35)	.38 (.60)
	T2	1.75 (.59)	2.00 (.47)	2.35 (.42)	2.00 (.59)	.95 (.33)	.30 (.41)	.20 (.21)
	T3	1.10 (.72)	.75 (1.15)	2.90 (.14)	1.50 (.83)	.85 (.42)	.35 (.34)	.35 (.22)
Total Mean (SD)		1.46 (.29) ♦*	1.29 (.44)	2.58 (.18)	1.71 (.34) ▲**	.77 (.08)	.33 (.15)	.31 (.13)
Nonlinear (n=5)	T1	2.05 (.21)	1.25 (.31)	2.70 (.33)	2.35 (.29)	.80 (.48)	.10 (.14)	.10 (.22)
	T2	2.30 (.41)	1.40 (.22)	2.75 (.35)	1.60 (.49)	.65 (.52)	.10 (.22)	.00 (.00)
	T3	2.00 (.53)	2.40 (.58)	2.65 (.29)	2.60 (.49)	.60 (.45)	.10 (.14)	.25 (.35)
Total Mean (SD)		2.12 (.28) ♦* □*	1.68 (.27)	2.70 (.25)	2.18 (.16) ■*	.68 (.27)	.10 (.11)	.12 (.11)
Linear (n=5)	T1	1.00 (.18)	1.75 (.68)	1.90 (.78)	2.70 (.41)	.90 (.68)	.40 (.29)	.25 (.43)
	T2	1.55 (.60)	2.15 (.58)	2.55 (.62)	2.35 (.58)	.85 (.34)	.45 (.27)	.05 (.11)
	T3	1.05 (.72)	1.75 (.68)	2.65 (.34)	2.90 (.22)	1.00 (.43)	.00 (.00)	.10 (.22)
Total Mean (SD)		1.20 (.38) □*	1.88 (.59)	2.37 (.22)	2.65 (.27) ▲***	.92 (.37)	.28 (.15)	.13 (.15)

Note. ♦ = Significant difference between control and NLP, □ = Significant difference between NLP and LP, ▲ = Significant difference between control and LP, ■ = Significant difference between LP and NLP

No. = number of, T1=Time point 1, T2=Time point 2, T3=Time point 3, AS=Autonomy Supportive, TI = Task-Involving, RS = Relatedness Supportive, S = Structure, C = Controlling, EI = Ego-Involving, RT = Relatedness Thwarting, SD = Standard Deviations; * $p < .05$, ** $p = .001$

Intervention group had a significant effect on empowering dimensions: autonomy support ($F(2, 11) = 10.74$; $p = .003$; partial $\eta^2 = .66$) and structure ($F(2, 11) = 14.70$; $p = .001$; partial $\eta^2 = .73$). Intervention group had no significant effect on empowering dimensions: task-involving ($F(2, 11) = .89$; $p = .19$; partial $\eta^2 = .26$), or relatedness support ($F(2, 11) = 2.88$; $p = .09$; partial $\eta^2 = .35$). Intervention group had no significant effect on the disempowering dimensions: ego-involving ($F(2, 11) = 3.73$, $p = .06$; partial $\eta^2 = .40$), controlling ($F(2, 11) = .89$; $p = .44$; partial $\eta^2 = .14$), and relatedness thwarting ($F(2, 11) = 2.95$; $p = .09$; partial $\eta^2 = .35$).

Bonferroni posthoc test showed that mean scores for the autonomy-supportive dimension were statistically significant between control and NLP ($p = .03$), with NLP scoring significantly higher than control, and between NLP and LP ($p = .003$), where NLP scored significantly higher than LP. However, no statistically significant differences were found between LP and Control ($p = .77$). Mean scores for the structure dimension were statistically significant between control and LP ($p = .001$), with LP scoring significantly higher than control, and between NLP and LP ($p = .04$) with LP scoring significantly higher than NLP, but no statistically significant difference between control and NLP ($p = .60$). Ultimately, the empowering environmental dimensions were better represented across the groups in comparison to the disempowering environmental dimensions where scores were consistently lower across all groups. Relatedness supportive scored the highest across the groups, and relatedness thwarting and ego-involving scored the lowest across the groups.

Basic psychological need satisfaction (aim 3)

Descriptive statistics can be seen in Table 31 for enjoyment as well as relatedness, autonomy, and competence need satisfaction mean scores. Table 31 shows that enjoyment was rated highly by the children across the three groups. The maximum score for relatedness needs satisfaction was the number of children within the class. Generally, no class held more than 30 children, indicating that children worked/played with a select number of children across the three time points and the groups. The exception to this was one control school during the third time point who combined classes resulting in a class size of 43. Six children during this time point reported that they worked/played with everyone, which resulted in a score of 43. To check whether these children significantly impacted the results, a MANOVA was conducted with and without the six children. The MANOVA analyses resulted in similar results when included and excluded; therefore, it was decided that they remain in the analysis. Table 31 also indicates that children across the groups felt competent over the three time points while children felt moderate levels of autonomy during a ball skills lesson across the groups.

A one-way MANOVA was conducted with the intervention group (control, NLP, and LP) as the fixed factor and mean scores for relatedness, competence, and autonomy needs satisfaction as dependent variables. There was a statistically significant difference in needs satisfaction based on intervention group, $F(6, 414) = 3.90$, $p = .001$, Wilk's $\Lambda = .90$, partial $\eta^2 = .05$.

Table 31

Means and standard deviations for enjoyment and BPNS from three time points.

Group (n)	Need Satisfaction			
	Mean (SD)			
Group (n)	Enjoyment	Relatedness	Competence	Autonomy
Control (49)	2.66 (.52)	7.80 (6.43)♦♦	4.78 (.46)	2.31 (.90)■*□*
Nonlinear (77)	2.52 (.48)	5.33 (3.69)♦♦	4.65 (.60)	2.79 (.82)■*
Linear (77)	2.55 (.49)	5.82 (5.72)	4.66 (.58)	2.73 (.91)□*

Note. ♦ = Significant difference between control and NLP, ■ = Significant difference between control and NLP, □ = Significant difference between control and LP

* $p < .05$

There was a statistically significant effect on total relatedness need satisfaction ($F(2, 209) = 4.17$; $p = .03$; partial $\eta^2 = .04$) and autonomy need satisfaction ($F(2, 209) = 5.40$; $p = .005$; partial $\eta^2 = .05$) but not on total competence need satisfaction ($F(2, 209) = 1.12$; $p = .33$; partial $\eta^2 = .01$).

A Bonferroni posthoc test showed that mean scores for relatedness need satisfaction was statistically significant between control and NLP ($p = .01$), with control scoring significantly higher than NLP, but not between control and LP ($p = .15$) or between NLP and LP ($p = .91$). Mean scores for autonomy need satisfaction was statistically significant between NLP and control ($p = .007$), with NLP scoring significantly higher than control, LP scored significantly higher than control ($p = .02$), but no significant difference was found between LP and NLP ($p = 1.00$).

Enjoyment

As enjoyment was expected to correlate with sex, an ANOVA was conducted with sex and group (control, LP and NLP) as fixed factors and enjoyment as the

dependent variable. There was a significant difference in enjoyment mean scores between boys and girls ($F(1, 218) = 31.74, p = .00, \text{partial } \eta^2 = .13$). There were no significant differences in enjoyment mean scores between groups ($F(2, 218) = 1.91, p = .15, \text{partial } \eta^2 = .02$) and there was not an interaction effect between group and sex ($F(2, 218) = .21, p = .81, \text{partial } \eta^2 = .002$). As sex has two groups, post-hoc tests within the ANOVA could not be conducted; therefore, an independent t-test was run to investigate the difference in enjoyment between boys and girls. Girls ($M = 2.72, SD = .05$) in comparison to boys ($M = 2.37, SD = .54$) reported significantly higher enjoyment scores, $t(222) = -5.74, p = .00$.

Effects of PE subjects

The analyses above explored the overall motivational climates, as well as relatedness, competence, autonomy needs satisfaction and enjoyment across the three time points between all three intervention groups. The LP and NLP groups experienced the same curriculum outcomes (e.g., sending a ball, receiving a ball); however, the way children were taught and the way children learned were designed to be different. The previous analyses demonstrated that specific dimensions of motivational climates and certain need satisfactions differed between pedagogies. However, it is not clear whether these differences existed at certain time points, i.e., during dance, gymnastics, and ball skills. The next step in the analysis was to explore motivational differences according to the PE subject, or rather, at the situational level (Vallerand, 2007). MANOVAs could be conducted with accumulative scores for the motivational climate. However, due to the low number of cases per pedagogy ($n=5$), per time point, it was deemed that this data would not have enough power to explore

pedagogical differences according to PE subject. It was, therefore, decided only to explore need satisfaction and enjoyment data between pedagogies (LP and NLP only) for each PE topic.

Time 1: Dance. A MANOVA was run to determine the effect of pedagogy on motivational outcomes during a dance lesson within PE. Three measures of motivational outcomes were assessed at this time point: enjoyment, competence, and relatedness. Preliminary assumption checking revealed that data was not normally distributed, as assessed by the Shapiro-Wilk test ($p = .00$). There were 16 cases of univariate outliers, as assessed by boxplot; however, removal of these outliers did not affect the outcome and were, therefore, retained in the final analysis. There were five cases of outliers, as assessed by Mahalanobis distance ($p = < .001$). Removal of these outliers did not affect the outcome and were, therefore, retained in the final analysis. There were non-normal distributions, as assessed by scatterplot. However, MANOVA is considered sufficiently robust to handle non-normal distributions. There was no multicollinearity; however, homogeneity of variance-covariance matrices, as assessed by Box's M test was violated ($p = .00$); however, sample sizes were highly similar and considered a non-problem. Pupils in the LP group scored higher than pupils in the NLP group on relatedness ($M = 4.65$, $SD = 7.61$; $M = 4.54$, $SD = 4.71$, respectively), competence ($M = 4.55$, $SD = .91$; $M = 4.45$, $SD = 1.09$, respectively), and enjoyment ($M = 2.49$, $SD = .69$; $M = 2.46$, $SD = .77$). The differences between the pedagogies on the combined dependent variables was not significant ($F(3, 189) = .18$, $p = .91$; Pillai's Trace = .003; partial $\eta^2 = .003$).

Time 2: Gymnastics. A MANOVA was run to determine the effect of pedagogy on motivational outcomes during a gymnastics lesson within PE. Three measures of motivational outcomes were assessed at this time point: enjoyment, competence, and relatedness. Preliminary assumption checking revealed that data was not normally distributed, as assessed by the Shapiro-Wilk test ($p = .00$). There were 30 cases of univariate outliers, as assessed by boxplot; however, removal of these outliers did not affect the outcome and were, therefore, retained in the final analysis. There were six cases of outliers, as assessed by Mahalanobis distance ($p < .001$). However, the removal of these outliers did not affect the outcome and were, therefore, retained in the final analysis. There were non-normal distributions, as assessed by scatterplot; however, MANOVA is considered sufficiently robust to handle non-normal distribution. There was no multicollinearity, and homogeneity of variance-covariance matrices was met, as assessed by Box's M test ($p = .001$). Pupils in the LP group scored higher than pupils in the NLP group on relatedness ($M = 5.36$, $SD = 6.62$; $M = 4.37$, $SD = 3.36$, respectively). Pupils in the NLP group scored higher than pupils in the LP group on competence ($M = 4.80$, $SD = .55$; $M = 4.76$, $SD = .56$, respectively). Pupils in the LP and NLP reported the same level of enjoyment ($M = 2.51$, $SD = .79$; $M = 2.51$, $SD = .80$, respectively). The differences between the pedagogies on the combined dependent variables was not significant ($F(3, 178) = .67$, $p = .57$; Wilks' $\Lambda = .01$; partial $\eta^2 = .01$).

Time 3: Ball skills. A MANOVA was run to determine the effect of pedagogy on motivational outcomes during a ball skills lesson within PE. Four measures of motivational outcomes were assessed at this time point: enjoyment, competence, and relatedness, and autonomy. Preliminary assumption checking revealed that data

was not normally distributed, as assessed by the Shapiro-Wilk test ($p = .00$). There were 41 cases of univariate outliers, as assessed by boxplot; however, removal of these outliers did not affect the outcome and were, therefore, retained in the final analysis. There was one outlier, as assessed by Mahalanobis distance ($p = < .001$). However, the removal of this outlier did not affect the outcome and was, therefore, retained in the final analysis. There were non-normal distributions, as assessed by scatterplot; however, MANOVA is considered sufficiently robust to handle non-normal distributions. There was no multicollinearity and homogeneity of variance-covariance matrices was met, as assessed by Box's M test ($p = .014$). Pupils in the LP group scored higher than pupils in the NLP group on relatedness ($M = 7.09, SD = 9.29$; $M = 6.14, SD = 6.48$, respectively), competence ($M = 4.69, SD = .72$; $M = 4.54, SD = .99$, respectively), and enjoyment ($M = 2.60, SD = .72$; $M = 2.58, SD = .73$, respectively). Pupils in the NLP group scored higher than pupils in the LP group on autonomy ($M = 2.74, SD = .88$; $M = 2.71, SD = .89$, respectively). The differences between the pedagogies on the combined dependent variables was not significant ($F(4, 173) = .52, p = .72$; Wilks' $\Lambda = .52$; partial $\eta^2 = .01$).

Gender differences

Previous analysis demonstrated that when gender and group were placed as fixed factors, a significant difference was found between boys and girls on enjoyment while no significant group differences emerged, nor did a significant interaction between group and gender. Past literature has found that significant gender differences in enjoyment exist between boys and girls within different PE subjects (dance, gymnastics, and ball skills; Baron & Downey, 2007) and this was investigated

next. Potential gender differences upon relatedness, competence and autonomy were also explored, per PE topic. These analyses excluded the control group as the control group did not partake in dance, gymnastics, and ball skills. Three MANOVA analyses were run to determine the effect of gender on motivational outcomes during a dance, gymnastics and ball skills lesson within the LP and NLP groups. In the following analyses, Wilks' Lambda was reported for data that met the assumption of equality of covariance matrices, and Pillai's Trace was reported for data that did not meet the assumption. The assumption can be unmet if group sample sizes are similar, which they were in the following analysis.

Dance. In dance, boys reported higher relatedness in comparison to girls ($M = 4.75$, $SD = 6.56$; $M = 4.45$, $SD = 6.10$, respectively). Boys and girls reported highly similar competence levels ($M = 4.49$, $SD = 1.07$; $M = 4.50$, $SD = .93$). Girls reported higher enjoyment in comparison to boys ($M = 2.69$, $SD = .56$; $M = 2.25$, $SD = .81$). The difference between genders on the combined dependent variables was statistically significant, $F(3, 189) = 6.54$, $p = .00$, Wilks' $\Lambda = .91$; partial $\eta^2 = .09$. Girls were found to report statistically significantly higher scores on enjoyment in comparison to boys, $F(1, 191) = 19.34$, $p = .001$; partial $\eta^2 = .09$.

Gymnastics. In gymnastics, boys reported higher relatedness in comparison to girls ($M = 5.25$, $SD = 6.31$; $M = 4.97$, $SD = 5.14$, respectively). Girls reported higher competence in comparison to boys ($M = 4.75$, $SD = .64$; $M = 4.63$, $SD = .92$, respectively) and enjoyment ($M = 2.67$, $SD = .67$; $M = 2.30$, $SD = .89$, respectively). The difference between genders on the combined dependent variables was statistically significant, $F(3, 185) = 3.75$, $p = .01$; Pillai's Trace = .06. Girls were found

to report statistically significantly higher enjoyment in comparison to boys, $F(1, 187) = 10.52, p = .001$; partial $\eta^2 = .05$.

Ball skills. In ball skills, boys reported higher relatedness in comparison to girls ($M = 6.75, SD = 8.12$; $M = 6.47, SD = 7.85$, respectively), and higher autonomy ($M = 2.81, SD = .85$; $M = 2.65, SD = .91$, respectively). Girls reported higher competence in comparison to boys ($M = 4.68, SD = .78$; $M = 4.53, SD = .97$, respectively), and enjoyment ($M = 2.71, SD = .63$; $M = 2.46, SD = .80$). There was not a significant difference between genders on the combined dependent variables ($p = .07$); however, girls were found to report statistically significantly higher enjoyment in comparison to boys, $F(1, 176) = 5.28, p = .02$, partial $\eta^2 = .03$.

Discussion

In early years and lower primary school, national PE curriculums across the globe focus upon the acquisition of movement skill development and, consequently, a rigid and inflexible PE experience for the child that has been coined *physical-education-as-sport-technique* approach to PE (Haerens et al., 2011; Kirk, 2010). The first aim of this study was to explore the motivational climates that LP and NLP create and found the Control and LP groups to be significantly more disempowering than the NLP group. The second aim explored potential differences between pedagogies on the different environmental dimensions and found the NLP group to be significantly more autonomy-supportive and the LP group to significantly provide more structure. The third aim explored young children's BPNS and enjoyment and found children in the control group to experience significantly more relatedness need satisfaction and children in the NLP and LP groups to experience significantly more

autonomy need satisfaction. No between-group differences were found for enjoyment. No group differences were found for BPNS or enjoyment when explored per PE topic (dance, gymnastics, and ball skills). However, girls reported significantly higher enjoyment than boys for each PE topic. A fidelity check confirmed that both pedagogies carried out their respective set of pedagogical characteristics.

Motivational climates and their environmental dimensions

In general, the empowering motivational climate was well supported across all PE groups (NLP, LP, and control), resulting in no significant differences between them. When investigating the empowering environmental dimensions (autonomy-supportive, task-involving, relatedness supportive, and structure), NLP provided significantly more of the autonomy-supportive dimension compared to the LP and control groups, and LP provided significantly more of the structure dimension compared to NLP and control groups. Video observations saw that the coaches in the NLP and LP groups allowed children choice; however, this was to a greater degree in NLP. For example, children in the NLP group could choose which equipment they used and at what time (e.g., benches and mats in gymnastics). Children had more volition as they were encouraged to take the initiative (e.g., by finding multiple movement solutions) *and* could ask questions (e.g., ideas for movements). Children in the LP and control groups did not get the opportunity to explore as they learned a set movement technique through repetition; however, they were sometimes allowed to choose partners and equipment. This finding demonstrates the importance of providing enriched environments for children to allow them space and time to find functional movement solutions.

This inference can be made with confidence as NLP and LP were coded in-line with their respective sides of the sliding scale for Global item 1 of the fidelity check. Lessons where children were encouraged to explore more (i.e., NLP group) resulted in a prevalence of the *encourages initiative-taking* behavioural characteristic of the motivation coding system (MMCOS). NLP lessons were judged to *provide meaningful choices* through making all equipment available to children. Supporting this sort of choice may not seem meaningful to adults; however, it has been found that instructionally irrelevant choices (e.g., colour of beanbag) influence children's autonomy need satisfaction and intrinsic motivation (Cordova & Lepper, 1996; Patall et al., 2008). Therefore, these sorts of choices may be considered meaningful to young children, especially in an environment that is usually highly controlled (e.g., *physical-education-as-sport-technique* in PE).

A challenge for LP, motivationally, is that the learner's role is a passive one, limits the responsibility the learner has over their movement and has a very narrow window of decision making (Moy et al., 2016). LP did, however, provide children with more structure as the lessons followed clear task-by-task instructions and a set structure, not only for how to learn movement skills but also for the transitions between practice tasks and environments. This inference is supported by Global item 2 of the fidelity check (Pedagogy A (LP): *Lesson progression is through a clear and linear structure, warm-up, drills, game/performance and cool down*; Pedagogy B (NLP): *Lesson evolves through storytelling, scenarios or games*). This amount of structure meant that children knew what was expected of them at a set time (a structure characteristic; Jang et al., 2010). The structure within NLP may have been more subtle, and therefore, not entirely captured by the observation measure (i.e.,

the MMCOS). Structure was arguably present as tasks were typically guided through story-telling or music.

Experiencing an empowering motivational climate, or more specifically, 'mastery lessons' have demonstrated a significant positive relationship with movement skills in five to six-year-old children, in comparison to 'low autonomy lessons' (Martin et al., 2009). This study indicated that young children could physically benefit from a need-supportive PE environment. This finding has been further supported in the literature in five to six-year-old children (Valentini & Rudisill, 2004a) and five to 10-year-old children (Valentini & Rudisill, 2004b). The current study did not measure movement skills; however, it has successfully demonstrated that NLP provided more autonomy support and that LP provided more structure. Therefore, Motor Learning Theory may have a larger impact on their movement skills and is worth investigating in future research.

The control group and the LP group provided a disempowering motivational climate to a significantly greater degree than the NLP group. However, it should be reiterated that all the groups scored low on the disempowering motivational climate potency scale, which should be kept in mind when discussing the implications of this finding. A systematic review of motivational climate interventions in PE found that maladaptive outcomes such as anxiety, ego-orientation, competitive strategies, and boredom were largest in performance climate conditions (Braithwaite et al., 2011). Although this review included studies conducted in younger children (five years old), these maladaptive outcomes were not addressed within these particular studies (i.e., focused upon movement skills). The current study assessed BPN and enjoyment as

child-based outcomes, which were found to be high in this sample. Nevertheless, maladaptive outcomes were not assessed in the current study. Maladaptive outcomes should be targeted in future research to obtain a more holistic understanding of children's pedagogical experiences.

It was thought that LP might support the ego-involving disempowering dimension only. In contrast, NLP was not hypothesised to support any disempowering dimension (controlling, ego-involving, and relatedness-thwarting). It seems that these dimensions were more represented within the LP and control groups, in comparison to the NLP group. The controlling dimension, out of the three, was the most represented (as can be seen by the means in Table 30). This dimension included characteristics such as the use of extrinsic rewards, use of controlling language (want, need, must), intimidation, negative conditional regard, overt personal control, and devalues players' perspectives.

Although a strict log was not taken of how many times these characteristics appeared in every quarter of the PE lessons, anecdotally, the extrinsic rewards and use of controlling language seemed to be the most prevalent (out of the six). Examples of extrinsic rewards included introducing a piece of equipment for the children to play on if they behaved and verbal praise for behaviour (regarded differently to instructional feedback, including praise based on task performance). These are both examples of task-contingent rewards (Ryan et al., 1983) and are especially detrimental to intrinsic motivation as they are more readily recognised as attempts to control behaviour (Ryan & Deci, 2017).

Examples of controlling language included statements such as “I want you to jump as high as you can” and “you need to take part”. This use of extrinsic rewards is unsurprising as, for example, extrinsic rewards are used frequently within educational settings (Deci et al., 2001). With the emergence of operant conditioning (Skinner, 1948), it became evident that extrinsic rewards can have a powerful effect on behaviour. We can be sympathetic to a PE teacher who is in charge of 30 young children, released into the gym hall after a day staying still and concentrating in class, and their use of extrinsic rewards to control these children’s behaviour. However, the LP and control PE teachers displayed more of these characteristics than the NLP PE teachers.

It may be that pedagogical delivery automatically reduces the risk of producing these characteristics. For example, a typical behaviour within NLP is for the PE teacher to ask questions when directing children’s behaviour towards an outcome (Chow et al., 2015). Examples of such questions include “how high can you jump?” “can you come over here?” “can you think of other ways to move?” Questioning encourages children to solve the movement problem, and the PE teacher acts as a facilitator rather than an instructor. This form of communication places ownership and responsibility for learning on the child, who then gets to choose how they react to the questions (feelings of autonomy) rather than being told what to do. This characteristic of NLP automatically reduces the risk of using controlling language.

As for the use of extrinsic rewards, this is less easily explained through pedagogical characteristics. Neither pedagogy includes characteristics that promote the use of extrinsic rewards. However, neither necessarily inherently reduce the use

of extrinsic rewards either. It may be that the children within the LP and control groups were more excited on the observation days and the PE teachers felt it necessary to use extrinsic rewards. In the short-term, this is not overly detrimental. However, it has been found that the introduction of extrinsic rewards can impede individuals' intrinsic motivation for a particular activity (Deci et al., 2001). More specifically, contingent rewards are more detrimental than non-contingent rewards, and PE teachers should be mindful about the type of rewards they use in their classes.

Basic psychological need satisfaction

Children within both PE curriculums underpinned by Motor Learning Theory (NLP and LP) reported significantly higher autonomy need satisfaction in comparison to the children in the control group. The NLP group was coded higher on autonomy support; therefore, it follows that children within that group would report higher autonomy need satisfaction. However, children in the LP group also reported higher autonomy need satisfaction, although their PE lessons were coded lower on the autonomy support. This finding both supports and contradicts the SDT literature, which states that perceived BPN support is positively associated with BPNS and highlights the complexity of pedagogy (Ryan & Deci, 2017). Children in LP and NLP reported similar levels of choice (need satisfaction); however, for need support, the observational measure may have captured elements of volition which were represented to a higher degree in the NLP lessons in comparison to the LP lessons. A temporal aspect may be present in the association between need support and need satisfaction. As Teraoka et al. (2020) noted, a minimum of eight weeks may be necessary to observe significant changes in BPN in older children and adolescents.

This current sample included younger children and therefore, may require more than 15 weeks to demonstrate group differences and warrants further investigation.

Synergies were observed between volitional autonomy and the NLP pedagogical principles built upon ecological dynamics. For example, children in NLP lessons were encouraged to explore their environments, taking control of their learning. Deci and Ryan (2000) state that autonomy concerns the experience of integration and freedom, volition, and the organismic desire to self-organise experience and behaviour (Angyal, 1965; Deci, 1980; Ryan & Connell, 1989; Sheldon & Elliot, 1999). Exploration of enriched environments is fundamental to ecological dynamics within NLP, be that the imaginary landscape of the Gruffalo during gymnastics or playing a game of catch the hens in ball skills lessons. During such endeavours, children were given freedom for exploration and to self-organise to find a functional movement solution. The fact that both LP and NLP scored similarly for autonomy need satisfaction suggests that even simple teaching strategies such as providing the choice of equipment or allowing them to pick their partner, maybe sufficient for young children to feel satisfied. This type of choice positively relates to intrinsic motivation (Patall et al., 2008) and should, therefore, be incorporated into lessons as much as possible. It should be reiterated here that autonomy need satisfaction data was only gathered at the third time point, meaning that more research is needed to explore the relationship between pedagogical need support and needs satisfaction.

Relatedness need satisfaction has been found to have a significant positive relationship with PE engagement in 11-18-year-olds (Xiang et al., 2017) and with pro-

social behaviours in 10-15-year-olds within a variety of sports (Bolter & Kipp, 2018). Children's relatedness in PE is also essential for enjoyment (Domville et al., 2019). Therefore, the higher perceptions of relatedness, the greater experience of positive outcomes. In this study, children in the control group reported higher relatedness need satisfaction in comparison to the PE curriculums underpinned by Motor Learning Theory. Relatedness need satisfaction was measured through children identifying whom they had worked/played with during that particular PE lesson. They could report how many children that they interacted with, focusing on the number of social interactions rather than the quality of those interactions. This choice of measurement was made due to the lack of validated BPN measurements in younger children. Quality of interactions is more aligned with relatedness (Ryan & Deci, 2017) and is important for children's enjoyment (Domville et al., 2019) and efforts should be made in future to create a measure for younger children to explore interaction quality, rather than quantity.

When relatedness, competence and autonomy were explored according to PE subject (situational motivation), no differences were found between LP and NLP pedagogies, which agreed with the findings in the overall analyses. Significant differences were primarily found between control and the intervention groups, not between the intervention groups themselves.

Enjoyment

A significant difference in enjoyment was found where sex and not the intervention group was the determining factor. Overall, girls reported a significantly higher level of enjoyment in comparison to boys. Baron and Downey (2007)

investigated enjoyment according to sex and PE activity (dance, gymnastics, and ball skills) and found no difference between girls and boys for enjoyment within ball skills but did find that girls enjoyed dance and gymnastics to a significantly higher degree than boys. Other research has found boys to have higher PMC and, therefore, higher enjoyment within PE (Cairney et al., 2012). However, in this study, boys and girls rated themselves similarly within competence need satisfaction. This finding suggests that within this younger age group, girls experienced as much perceived competence as boys. Therefore, activities within PE (dance, gymnastics, and ball skills) may have become a stronger predictor of enjoyment rather than PMC, making this avenue worth investigating further, especially as children get older and gender norms may emerge in accordance to PE topic. As highlighted by Domville et al. (2019), autonomy and relatedness may enhance enjoyment; therefore, these associations should be investigated further in this younger age group.

Gender differences for all BPN and enjoyment were explored for each PE topic and found girls to report statistically significantly higher enjoyment across all PE subjects in comparison to boys. This finding agrees with Baron and Downey's (2007) research regarding dance and gymnastics; however, girls enjoyed ball skills to a greater degree than boys, which is in contradiction to this previous work. As stated before, Cairney et al. (2012) found that boys who had high PMC also had high enjoyment where, in their study, while girls had lower PMC. Whereas in this study, girls had comparable PMC to boys.

Motivational profiles based on motivational climates have a relationship with enjoyment. In 14- to 15-year-olds, Jaakola et al. (2015) found five clusters of students

in regards to perceptions of a task- and ego-involving, autonomy, and social relatedness supporting motivational climates in PE. Two of the clusters had a positive relationship with enjoyment. These clusters were: 1) high autonomy, relatedness, task, and moderate ego climate, and 2) high relatedness and task but moderate ego climate. Students who experienced low autonomy, relatedness, task and moderate ego climate had the lowest enjoyment in PE. This study shows that PE teachers should aim to support children's BPN as they may support the level of enjoyment children experience.

It is worth reiterating that enjoyment levels were high regardless of sex and adds to the enjoyment literature. Enjoyment has been found to negatively predict drop-out in nine to 15 years olds within football (Quested et al., 2013). Although children cannot drop-out of PE, they can become disengaged. Therefore, maintaining enjoyment is vital for continued engagement in PE so that they can reap the holistic benefits of PE engagement (physical, cognitive, affective, social; Bailey, 2006), especially as enjoyment for PE has been shown to decline from the age of nine (Prochaska et al., 2003).

Strengths, limitations, and future research

This study provides a valuable contribution to the investigation and integration of pedagogy and motivation. It has demonstrated that pedagogy can provide inherently different motivational climates which have a subsequent influence upon young children's need satisfaction and should be kept in mind when implemented by PE teachers. This inference is not to say that the pedagogies within this study had a detrimental effect on children. Only that motivational climates may

have an accumulative effect which may impact children's motivation in the long-term. This study also suggested empirical support for the alignment between NLP and SDT regarding autonomy support (Chow et al., 2015) and between LP and SDT regarding structure. The use of video analysis and excellent inter-rater reliability (Cicchetti, 1994) is also seen as a strength, as self-report can be unreliable due to bias (Koziol & Burns, 1986; Teraoka et al., 2020; Van de Mortel, 2008). It is also the first study to investigate the motivational climates within pedagogies underpinned by MLT within the real-world setting of primary school, which indicates good ecological validity. A fidelity check confirmed that both pedagogies carried out their respective set of characteristics, which is considered a significant strength.

Limitations include the use of a narrow focus, theoretically and in the number of items, within each BPN where: relatedness concentrated on the quantity of interactions and not quality and meaning, autonomy only measured choice and not volition, and competence consisted of one item. There is a need to develop young-child friendly measures of BPNS. Attempts have been made in this area (Fitton Davies et al., in review). However, the use of global items has shown to provide reliable data (Cashin et al., 1992; Hays et al., 2009). Future research should extend this research by implementing a more holistic measure of motivation. Also, autonomy need satisfaction was only captured during the last time point; therefore, this result could not be generalised across the PE subjects. In future, autonomy need satisfaction should be captured at all time points. Vallerand (2007) states that motivation can be considered on a global, contextual, or situational level. Situational data was captured during this study (captured directly after and relating to each observed PE lesson); however, it was contextualised through using mean scores across the three time

points. Future research should consider how motivational climates differ within dance, gymnastics, and ball skills and the natural constraints these different mediums of movement place upon children's situational BPNS. This line of enquiry is essential as this study demonstrated a sex effect for enjoyment with a curriculum inclusive of dance, gymnastics, and ball skills.

Practical implications and conclusion

This study is the first to investigate Motor Learning Theory-based pedagogies from a motivational perspective within a primary school setting. This study had three aims: to investigate the potential of pedagogies underpinned by Motor Learning Theory in supporting motivational climates, to explore whether these pedagogies differentially support motivational dimensions, and to explore the impact of these pedagogies upon young children's BPN and enjoyment. The findings of this study demonstrate promising links between Motor Learning Theory-based pedagogy and SDT; however, more research is necessary. Nevertheless, PE practitioners should keep in mind the motivational consequences of the pedagogies that they use.

Overall, the observed PE lessons in this study demonstrated more empowering than disempowering motivational climates, and children experienced high levels of BPN and enjoyment, which demonstrates a positive outlook of PE within this study. However, we now have a better understanding of how Motor Learning Theory-based pedagogies support young children's motivation and potentially provide meaningful experiences that will help to set children upon a lifelong journey of healthy living.

Chapter 7

Synthesis

Review of thesis

This synthesis chapter will bring together findings from across the thesis. Throughout this chapter, I will seek to discuss theoretical alignment and discrepancies between the findings of this thesis and the existing literature as well as highlighting how this thesis contributes to the existing literature. I will then discuss strengths and limitations, implications for research, policy, and practice, and propose avenues for future research. The last section will be a reflection of my experience of completing the PhD.

Aims and objectives

This thesis sat within a wider RCT called the SAMPLE-PE project (Rudd et al., 2020a), with related data collection points occurring at baseline (Study 1), post-test (Study 2) and during the intervention (Study 3). The overall aim of this thesis was to explore the motivational perceptions of five to six-year-old children within PE. The more specific aims that guided this thesis were to explore young children's enjoyment, BPNS and behavioural regulations in PE and to explore the motivational climates of PE pedagogies. The objectives of this thesis were to:

- a) Develop an age-appropriate mixed-method tool to assess young children's contextual BPNS, behavioural regulations, and enjoyment, and ascertain its content validity.
- b) Develop a codebook to analyse the data from the developed tool and ascertain its content validity, acceptability, and reliability.
- c) Assess the utility and predictive validity of the developed tool and codebook.

- d) Observe and assess the motivational climates of two contrasting pedagogies, as well as normal PE provision.
- e) Collect and assess situational basic psychological need and enjoyment data.

Research findings

A means to measure motivation: Study 1

It is well documented that there is a paucity of research investigating the development of motivation in young children (Vasconcellos et al., 2019). One of the main reasons for this is due to the lack of appropriate measurement tools (Sebire et al., 2013). The first aim of this thesis was to address this issue through the creation of a seven-stage, age-appropriate, mixed-method tool. Along with codebook, the tool was developed to assess PE-related contextual enjoyment, BPNS, and self-determined motivation in five to six-year-old children (i.e., the MAT-PE). As this was a new tool, the COSMIN framework was used to guide what constitutes good measurement properties (Mokkink et al., 2010). The advantage is that as motivation is not directly measurable, the subjective nature of the construct (i.e., motivation) demands that measurement instruments be valid and reliable. Directed by COSMIN guidelines (Terwee et al., 2018), it was ascertained that the MAT-PE and codebook had good content validity. The codebook was determined to be acceptable and to have excellent levels of reliability.

Once the MAT-PE, and its codebook, demonstrated their content validity, they were used to explore the motivational profiles of 78 children aged five to six years. Children reported high levels of enjoyment, relatedness and competence need satisfaction, and moderate autonomy need satisfaction. These findings are consistent

with previous research albeit found in slightly older children (Barnett et al., 2015; Barnett et al., 2015; Khodaverdi et al., 2016; Ntoumanis et al., 2009; van Aart et al., 2017).

The tool demonstrated that young children experienced more autonomous motivation (moderate to high levels) than controlled (low to moderate). The most frequently chosen types of regulation were intrinsic, identified, and external (approach) regulations. Identified regulation was most popular as first choice (for reasons to take part in PE). These findings are partially supported by previous literature (Chandler & Connell, 1987; Corpus et al., 2009). Autonomous motivation is linked to adaptive outcomes and is, therefore, a positive finding for children in their first year of formal PE. However, controlled motivation also had pronounced levels, which are linked to more maladaptive outcomes within the literature (Vallerand, 2007; Vasconcellos et al., 2019). Only a small number of children ($n=2$) reported being amotivated in PE within this sample, which aligns with previous research (Gao et al., 2013; Sánchez-Miguel et al., 2013). Feelings of amotivation typically stem from a felt lack of competence, a lack of interest, or defiance or resistance to influence (Ryan & Deci, 2017). Young children tend to have inflated perceived competence (Goodway & Rudisill, 1997; Spessato et al., 2013a), which drives their participation (Harter, 1988). Therefore, it seems unlikely that the two children were amotivated due to this reason. Due to the distinct lack of research investigating amotivation in young children, it is not possible to rule out defiance to resistance as a valid reason in this age group.

Most children enjoy PE (Coulter & Woods, 2011), but not all do. The two children in this sample may purely not enjoy PE, but by identifying these children, it is possible to find out why and make changes, if feasible. In summary, we should be concerned that amotivation has already manifested in a small number of children at this early age. This finding further illustrates the usefulness of MAT-PE to identify children that require intervention to support their engagement into PE.

Motivational importance in movement: Study 2

Mastering FMS and being physically active are crucial in the holistic development of young children. Predictive validity of the MAT-PE was conducted to explore the importance of enjoyment, BPNS, and behavioural regulations in young children's PA and movement skills, for which little is known. Autonomy need satisfaction emerged as a significant negative predictor of motor proficiency ($\beta = -.29$, $p = .04$). To help explain why this may have been, we need to consider how motor proficiency data was collected. The assessment is based upon a child performing and copying an adult demonstration of the 'ideal movement template'. After the adult demonstration, the child is asked to perform the same movement; this means the child gets very little to no choice on how they perform the movement. The significant negative relationship in this study may be because MAT-PE revolves around choice, including choice over how to perform movements. It is likely that children who felt that they had a choice over how they performed movements created movement variance when it came to assessment according to a particular template, creating a lower movement score. Alternatively, it may be the lack of choice in the assessment that created more structure, and more structure could have led to more actual competence. This finding is partially supported by previous research that has

demonstrated mixed relationships between autonomy and movement skills, but this again was conducted in older populations (Lewthwaite et al., 2015; van Aart et al., 2017).

Identified regulation emerged as a significant positive predictor of MVPA ($\beta = .40, p = .02$). Previous findings have been inconsistent in finding a significant positive relationship between identified regulation and MVPA (Owen et al., 2013; Sebire et al., 2013). The significant positive relationship found in this study may be due to the emphasis placed on the benefits of PE in this age group. Anecdotally, some PE teachers and coaches were observed in drawing attention to the importance of a healthy lifestyle and being active, and through informal discussions with class teachers, they commented on the emphasis placed upon the benefits of PE. It may be that the children who recognised these benefits as meaningful were active inside and outside of school, thus obtaining more minutes of MVPA. An increase of 4 minutes per day of MVPA is an important finding and suggests that teachers should educate children about the benefits of being active.

Motivational climates in PE: Study 3

Pedagogies that are underpinned by motor learning theories (NLP and LP) are important as one of the main outcomes of the National Curriculum is the development of movement skills (Department of Education, 2013; UNESCO, 2013). The ability to perform FMS is necessary for engagement in a variety of PA opportunities (Hulteen et al., 2018; Robinson et al., 2015; Stodden et al., 2008) as well as to engage in the 'physical culture of society' (Kirk, 2005, p.242). Both NLP and LP have demonstrated positive effects on motor skill development (Ayers et al., 2005;

Barris et al., 2014; Clark et al., 2016; Greenwood et al., 2016; Gusthart & Sprigings, 1989; Matvienko & Ahrabi-Fard, 2010). However, little is known about the motivational impact of these pedagogies upon young children or the type of motivational climates they provide. Therefore, the latter part of this thesis aimed to explore the motivational climates within NLP, LP, and within normal PE practice as well as to explore young children's BPNS and enjoyment through independent measures.

Forty-four PE lessons were observed, and the psychological potency within their environments was assessed. Psychological potency refers to how empowering (promotes feelings of autonomy, relatedness and task-oriented perception of competence) and disempowering (thwarts feelings of autonomy and relatedness, and promotes an ego-oriented perception of competence) were the PE environments (Duda, 2013; Smith et al., 2015). The LP and control groups were significantly more disempowering than the NLP group, NLP scored significantly higher than the LP and control groups on the autonomy-supportive dimension, and the LP group scored significantly higher than the NLP and control groups on the structure dimension. This study is the first to explore the motivational climates of these particular pedagogies and therefore adds a novel contribution to the existing body of work in this area. Despite the presence of a disempowering climate in this current study, albeit at a low level, the high levels of empowering motivational climates may have helped foster BPNS and enjoyment. Appleton & Duda (2017) demonstrated that a moderate to strong empowering climate 'tempered' the significant relationship between disempowering climate and outcomes. However, within this thesis, motivational

climates and BPNS were analysed in isolation, making this comparison solely theoretical.

All BPNS and enjoyment were high, aligning with previous research in older children (Ntoumanis et al., 2009; Taylor et al., 2010) with significant group differences for relatedness and autonomy need satisfaction and significant gender differences for enjoyment. High BPNS relates to many positive outcomes (Rahman et al., 2011; Reinboth et al., 2004; Sheldon & Bettencourt, 2002; Vansteenkiste & Ryan, 2013), indicating the children in this sample should also experience these positive outcomes. Future research should endeavour to explore these positive outcomes as a consequence of BPNS in younger children. The enjoyment-related findings in this thesis contribute new knowledge as boys' enjoyment was not necessarily attributed to high perceived competence, which has been previously observed (Cairney et al., 2012; Carroll & Loumidis, 2007). Nevertheless, the sex differences in enjoyment reported in this study, and in previous research, require PE teachers to be mindful. PE teacher should be mindful of how they plan and deliver different PE subjects, namely, dance and gymnastics, so that both boys and girls enjoy PE as much as possible.

Key themes

Hearing and listening to children's voices

The novel methods and approaches employed throughout this thesis add to our understanding of the importance of listening to 'children's voices'. It is just as important to listen to children as it is adults. Children are active participants in their own lives; they make decisions, they have feelings and attitudes towards and against

different aspects of life and are therefore warranted opportunities to be heard, especially when important decisions are being made. The young children involved in this research have shown me that they can be reflective, insightful and can offer their perspectives clearly when they are listened to. This experience is highlighted by the fact that most children were able to provide reasons for their choices and perspectives within the MAT-PE (i.e., deep level responses). Even during times of other data collection (e.g., TGMD-3, stability) when children were waiting for their turn, you could hear their ideas and reflections while observing others. They are active participants in their own lives and deserve opportunities to be heard. Fortunately, this particular area of listening to children has grown since the United Nations Conventions on the Rights of the Child (United Nations, 1989), which drew attention to the rights of children to participate in making decisions that shape their lives (Harcourt & Einarsdottir, 2011).

Despite this refocus on children's voices, to date, there are still limited areas of research exploring the 'child's voice', and this has been attributed to the notion that young children are challenging to conduct research with (Evans & Fuller, 1996, 1998). It is suggested that for any measurement tool to be valid and reliable, the development of said tools should include the target population (i.e., young children; Wiering et al., 2017). From my perspective, conducting research with young children is challenging but, more importantly, not impossible. This thesis sought to and has successfully provided a platform for young children's voices to be heard. It has provided rich new insights into young children's motivation through innovative methods. Further, it should be noted that frameworks exist now that can be very helpful in guiding this process as was the case for this thesis where the complexity

required in the tool development stage was made possible through following COSMIN guidelines.

This thesis has shown that developing an assessment tool to measure enjoyment, BPNS, and behavioural regulations with the target population is necessary; however, it was not without its challenges. Although I was a member of an experienced multidisciplinary research team, the development of the MAT-PE was not straight forward. Despite the support of a supervisory team with a wealth of SDT knowledge and experience of working with children, the initial tool underwent several changes and iterations, due to the feedback provided by the young children. This process indicates that the initial tool was underpinned by SDT and was age-appropriate (e.g., activities such as drawing, choosing, talking), and thus aligned with *our* needs. However, when piloted with children, it had to be developed and then re-developed to align with *their* needs.

When conducting any research with children, there is an inherent power dynamic between researcher and child where the risk is that children become subservient in their participation. This subservience may indeed stifle children rather than include them within the research as equals. Work conducted in this thesis sought to diminish this power dynamic between researcher and child. To this end, children were given an opportunity to assent and had an active voice in taking part in the project or not (Burgess, 1989). The risk of causing anxiety or stress (Kimmel, 1988) was decreased by not implementing a straight interview but to create an interactive set of activities. The MAT-PE also endeavoured to place children as experts through these interactive activities, primarily through the Write and Draw (Knowles et al.,

2013). By placing children at the centre of the activities, they were able to express their perceptions and feelings, where the child is put in a place of empowerment while the researcher acts as a facilitator within and between each activity. Although the researcher is still the one asking questions, the child has control over the pace and direction within each activity.

This thesis contributes to the literature by incorporating children's voices within the development of the MAT-PE and also by creating a means, via the tool, to help other researchers listen to future children's voices. Practically, the MAT-PE gave considerations to the developmental level of the children by simplifying stems and providing contextual cues within the tool's resources (Steward et al., 1993). The inclusion of older participants in participatory research within interventions has shown promising results (Verloigne et al., 2017; Voegtle, 2008). However, there is a limited research base in this type of research in younger children, and future research should seek to explore the efficacy of children's voices within research outcomes.

Advocating a mixed-method approach for motivational research (especially in children)

Mixed-methods is generally viewed as the combination of qualitative and quantitative data capture methods within a study design. For example, a quantitative strand is collected and analysed alongside a qualitative strand which is collected and analysed, which are compared, ending with an interpretation through the mixing of the strands (convergent parallel design; Creswell & Plano Clark, 2011). The MAT-PE aimed to be slightly different. This tool allowed for the collection of quantitative and qualitative data concurrently. That is, children were first provided with a quantitative

choice. The tool could have continued as a quantitative tool with an exclusive focus on children's quantitative choices throughout with the inclusion of pictorial resources and interactive activities. However, this would not have allowed children to use their voices and allow researchers the opportunity to understand the 'why' behind children's responses; this tool sought to go further.

Alternatively, the MAT-PE could have been a purely qualitative tool where children were only asked qualitative-based questions. This approach would have allowed children to exercise their voices and would have allowed researchers access to the 'why'. However, for purposes such as intervention and longitudinal research, it would be challenging to build motivational profiles. Therefore, the MAT-PE incorporated both types of approaches within its structure.

Past quantitative content analysis codebooks have primarily focused upon frequencies within written data (e.g., transcripts, books, articles; Rourke and Anderson, 2004). The MAT-PE's codebook aimed to mix both quantitative and qualitative elements to produce motivational profiles based on more substance than frequency alone. The codebook's structure, therefore, depended on both strands being present. Alternatively, and although not explored in this thesis, a thematic analysis could be conducted to provide even richer insights into a children's motivation. By adopting a mixed-method approach, motivational profiles could be built (e.g., higher or lower on BPNS) as well as providing an insight into why the children held these perceptions. This tool, therefore, enables the voices of children to be captured. Thus, the MAT-PE can be used as an evaluative tool to explore the effects of teaching practice within PE, and it can also be used to help inform PE-based

interventions, i.e., how best to keep highly motivated children motivated and how to foster motivation in those with lower motivation, thus contributing to the existing motivational research already conducted in older populations.

Basic psychological needs satisfaction, enjoyment and self-determined motivation

BPNS. BPNS leads to more autonomous types of motivation and consequently, more adaptive outcomes (Vallerand, 2007; Vasconcellos et al., 2019). Contextual relatedness, autonomy and competence satisfaction was captured in this thesis through the MAT-PE during the post-test data collection point of the SAMPLE-PE RCT (Rudd et al., 2020a). Situational BPNS was captured at three time points during the SAMPLE-PE RCT (apart from autonomy, which was captured at the third time point only).

Overall, competence and autonomy need satisfaction levels were similar at the contextual and situational level of analysis. This finding aligns with the bi-directional relationship between contextual and situational levels of analysis posited within the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 2007). The reason behind this may lie in how each construct was presented to the children. Both competence measures aimed to understand children's perceptions around their competence in regard to 'doing things' in PE. The only difference between the contextual and situational approach was that in the MAT-PE, children were presented with an array of FMS pictures. In contrast, within the independent measure, children were asked to reflect on the lesson they had just had, without the aid of pictures. Despite this difference, children reported similar competency levels.

In the autonomy measures, the emphasis was placed upon choice (rather than volition). In the MAT-PE children were asked if they felt they had a choice over equipment use, how to perform movements and choice of activities. In contrast, in the independent measure, they were asked if they felt they had any choice during that particular lesson (prompted by general examples if they were unsure). It was perhaps this alignment in framing within autonomy that led to similar reports of moderate autonomy. The main difference between the two measures was that the MAT-PE included two questions on interaction with the PE teacher and children's views on being heard, which was not an aspect included within the independent measure.

The only discrepancy between contextual and situational level need satisfaction occurred with relatedness. In the MAT-PE, children were asked about the quality of relationships that they had with their PE teacher and peers. Within the independent measure, children were asked how many children they had played/worked with. This difference resulted in higher scores at the contextual level (MAT-PE) and lower scores at the situational level (independent measure). Due to the emphasis upon the quality of relationships which was captured in the MAT-PE, I would argue that this was the better measure and a better reflection of children's relatedness need satisfaction.

This thesis makes a novel contribution to the existing literature by investigating and measuring young children's BPNS at the contextual and situational level, which has rarely been investigated. Overall, this research aligns with research conducted in similar and older age groups (Barnett et al., 2015; Cheon et al., 2016;

Khodaverdi et al., 2016; Ntoumanis et al., 2009; Taylor et al., 2010; Taylor & Lonsdale, 2010; van Aart et al., 2017). However, this work is the starting point towards a more robust understanding of children's relatedness, autonomy and competence.

Enjoyment. Enjoyment is a crucial element of intrinsic motivation (Deci & Ryan, 1991) and was also captured at the contextual and situational level. Across the studies of this thesis, children reported high levels of enjoyment. Despite the similarity in high levels of enjoyment reported across the two levels of analysis, the way that enjoyment was assessed differed. At the contextual level, the MAT-PE captured overall enjoyment through children discussing their drawings or written explanations of what they liked and did not like about PE. The researcher then coded their responses, and an enjoyment score was calculated (like of PE minus dislike of PE). At the situational level, enjoyment was captured at the end of a PE lesson through children tapping a poster which said either "fun", "ok", or "boring". No significant between-group differences were found at the contextual or situational level. However, the situational measure captured a significant gender difference, while the MAT-PE (contextual) did not.

The sex difference may have emerged due to methodological, temporal, or conceptual reasons. The contextual measure aimed for children to reflect on their total experience of PE, not focusing upon any PE topic, in particular, allowing children to think unguided about their experiences. Perhaps overall, both boys and girls enjoy PE (they can equally think of things they like and equally cannot think of things they dislike) and this was reflected in their drawings and verbal descriptions. It may be that the situational measure allowed children to express their enjoyment for

particular PE subjects immediately after having experienced them. This approach led to girls expressing higher enjoyment for dance, gymnastics and ball skills in comparison to boys.

Regarding the potential temporal reason, the timing of the data collection may have caused the sex differences. It could be that children are unable to recall specific details when asked to reflect across an entire PE experience which may have led to children mainly remembering the things that they like about PE. When children were asked what they thought about individual lessons immediately after the children had experienced them, children could pinpoint exactly how they felt about that particular lesson. Within this case, it is challenging to extract methodological and temporal reasons from each other as they are intertwined within this thesis, i.e., write and draw only occurred after the PE intervention, tapping posters occurred immediately and only after each observed PE lesson. Therefore, it is difficult to decipher whether it was primarily a temporal or methodological reason for this difference in enjoyment for boys and girls.

As has been mentioned previously within this thesis, enjoyment is a complex construct which has led to multiple definitions (Kimiecik & Harris, 1996). This thesis aligned with the definition provided by Scanlan and Simons (1992), which concentrates on aspects of positive affect such as pleasure, liking, and experiences of fun. Liking of PE was the focus within the contextual measure, and fun was the focus within the situational measure. What this thesis demonstrated was that although both aspects (liking and fun) were conceptualised from the same definition of enjoyment, there was a lack of consistency in reported enjoyment between boys and

girls. This finding supports the perception that enjoyment is indeed a difficult concept to define. Nevertheless, this thesis adds to the growing enjoyment literature in young children within PE (Baron & Downey, 2007; Cairney et al., 2014; Coulter & Wood, 2011; Morano et al., 2019). More specifically the thesis adds to the emerging enjoyment literature that uses emoticons (Coulter & Woods, 2001; Morano et al., 2019) as well as the write and draw literature (Knowles et al., 2013; Porcellato et al., 2005; Woods et al., 2005) and expands knowledge in this area by investigating children under the age of seven.

Self-determined motivation. Within this thesis, the MAT-PE captured a propensity for identified (50%), intrinsic (33.33%), and extrinsic (approach) regulations (29.49%) as young children's primary reason ('first choice') for participating in PE. This particular finding corresponds well with other research in similarly aged (Chandler and Connell, 1987) and older children (Corpus et al., 2009). Looking across all chosen reasons for PE participation, 87.18% of children chose intrinsic, 84.62% identified, 79.49% external (approach) and 66.67% introjected, with far less choosing external (avoidance; 33.33%) and amotivation (2.56%).

A review of PE studies by Ntoumanis and Standage (2009) identified autonomous motivation as a predictor of vitality, positive affect, interest, health-related quality of life, concentration, effort, and intention to be physically active during leisure time. In contrast, the authors identified controlled motivation and amotivation as predictors of boredom, unhappiness, and an inverse association to be physically active during leisure time. Most children in our sample identified autonomous types of motivation as their reasons for PE participation; however, a

high proportion also chose controlled types of motivation. Therefore, PE teachers should perhaps be mindful of the motivational climate they are creating within their PE lessons.

Motivation is essential in supporting children's holistic development (Bailey, 2006; Bailey et al., 2009; Casey & Goodyear, 2015) and this thesis sought to explore whether young children's motivation as well as enjoyment and BPNS were specifically important for movement. The MAT-PE's predictive validity demonstrated a negative but significant relationship between autonomy need satisfaction and motor proficiency, no significant relationships between BPNS, enjoyment or behavioural regulations and motor creativity, and a positive and significant relationship between identified regulation and MVPA. These findings indicate that BPNS and behavioural regulation are somewhat important for the development of movement in children and requires further attention within this age group. The relationship between identified regulation and MVPA was an important one. It indicated that children pay attention in school when PE teachers talk of the physical benefits to PE, indicating that PE teachers should continue to do this in order to see more MVPA and more autonomous types of motivation for PE.

Careful considerations in creating learning environments

PE teachers would benefit from being mindful of the environments that they will create based upon their inherent pedagogical choices. A criticism of the physical-education-as-sport-pedagogy is that it fails to address the motivational needs of children (Haerens et al., 2011); however, no empirical research has been conducted on its motivational climate. Teaching and learning pedagogies that are underpinned

by Motor Learning Theory (i.e., NLP and LP) have had success in improving motor skills (Ayers et al., 2005; Barris et al., 2014; Clark et al., 2016; Greenwood et al., 2016; Gusthart & Sprigings, 1989; Matvienko & Ahrabi-Fard, 2010). However, it is unclear as to the motivational climates that are embedded and incorporated within these pedagogical approaches. In the current body of work, motivational climates were found to be highly empowering across each intervention group (NLP, LP and control). Disempowering climates were also present, although to a much lesser degree. These findings indicate that PE teachers should be mindful of the motivational climates that are embedded within the pedagogies they use. The reason why PE teachers should be mindful is discussed in the next section.

The autonomy-supportive and structure environmental dimensions were significantly different between pedagogies, where these particular empowering domains were more represented in NLP and LP, respectively. Pedagogical approaches prioritise different learning domains (i.e., psychomotor, affective or cognitive). Thus, it may be that the pedagogies included within this thesis (NLP and LP) are most appropriate for young children, based on the aims of the National Curriculum (i.e., FMS development). None of the conditions were highly disempowering, and this is a significant positive finding. This is the first year of formal PE lessons. The fact that these disempowering environmental dimensions were present, coupled with the recent finding that children's motivation in PE can decline from as early as eight (Chanal et al., 2019), indicate that the long-term consequences could be detrimental to children's motivation.

This the first study to investigate the motivational climates of these particular pedagogies, in comparison to each other and normal PE practice. Motor Learning Theory hopes to support the development of motor skills and also support an empowering motivational climate with NLP demonstrating the least disempowering motivational climate.

Original contributions to the literature

Study 1

- The development of a novel, mixed-method, age-appropriate assessment of contextual enjoyment, BPNS, and behavioural regulations in PE for young children.
- The development of a novel codebook to mix the quantitative and qualitative strands of the MAT-PE.

Study 2

- The first study to investigate the predictive validity of enjoyment, BPNS and behavioural regulations towards motor proficiency and MVPA in children younger than seven years.
- The first study to investigate motor creativity and enjoyment, BPNS, and behavioural regulations.
- The presentation of motivational profiles for children under the age of seven years, expanding the motivational literature.

Study 3

- Empirical motivational climate data for NLP and LP where only theoretical work has been presented so far in the motivation and skill acquisition literature.
- Enjoyment was measured through emoticons, which has recently emerged as a viable data collection method, demonstrating sex differences per PE subject, thus adding to the limited enjoyment research in children under the age of seven.

Strengths

A strength of this work is the application of a novel mixed-method approach in the creation of the MAT-PE. The MAT-PE has demonstrated the capacity to produce motivational profiles that provide an overview of the motivational perceptions (inclusive of enjoyment, BPNS, and behavioural regulations) young children have within PE. It is sophisticated and intuitive and enables the researcher to capture insights into what, why and how children think about their PE experiences, which is vital in informing future PE-based interventions and applied pedagogic practice.

The comprehensive investigation of motivation across the thesis is considered another strength. This work investigated the contextual and situational motivation of young children as well as their BPNS, enjoyment and self-determined motivation. This thesis was comprehensive and methodical in the way it gathered data; through a mixed-method tool, quantitative measures and observations. It also investigated the motivational climates, in which this sample of children experienced, through less

subjective assessment, in comparison to self-reported assessment by PE teachers/coaches.

Limitations

Specific limitations have been highlighted in each chapter. However, some overarching issues will be discussed here. As the MAT-PE assessed enjoyment, BPNS, and behavioural regulation at the contextual level, a test-retest would have strengthened the reliability of the tool itself, assessing the stability of motivation over time and should be considered a priority for future work. Due to the use of the codebook to help combine the quantitative and qualitative strand, this thesis has presented the data in a highly quantitative manner. Although this is good for presenting motivational profiles of children, it does somewhat ignore the more qualitative description, which would help illustrate these profiles and push our understanding of children's motivational perceptions further. A truly mixed-method presentation of results would combine children's motivational profiles with qualitative quotes

Due to the number of coaches involved in the observed PE lesson ($n=9$) across the three groups, controlling for the role of the coach was not possible when the motivational climate data were summed across the three time points ($n=15$ per group) and analysed. Each time point would have to be investigated in turn to control for the effect of the coach. However, this would have resulted in only five data observations per time point, per group, meaning the statistical analysis would have low power and questionable results. It was decided to not run the analysis per time point for motivational climate because of this, and therefore, the coach may have

been a confounding variable. In future, more PE observations should be made per group per time point ($n > 8$) in order to conduct the analysis with coach inserted as a covariate.

Global items were used to assess BPNS in children in Chapter Six. The items were based on previous work (relatedness; Sebanc, 2003, autonomy; Barnett et al., 2015; competence; MAT-PE) however the justification for global questions in the MAT-PE was to reduce the load on children and concentrate on their qualitative responses, rather than on the number of questions per construct. However, in this study, the global items were purely quantitative and may have benefitted from including other items. Benefits would have included the ability to run construct validity.

Implications of findings

In the next section, I will set out the consequences for research, policy, and practice based on the findings of this thesis.

Research

The consequences of this thesis in regards to research include the ability for SDT researchers to explore a previously unknown demographic: children under the age of seven, which until now, has been highly under-researched. More specifically, the MAT-PE allows SDT researchers access to children's perceptions on enjoyment, BPNS, and behavioural regulations in regards to PE. In regards to analysis, researchers can analyse the MAT-PE data using mixed-method, quantitative and qualitative approaches, which makes the tool highly accessible to researchers and their individual needs. Therefore, the MAT-PE and its codebook can be used as a platform

to explore this under-researched demographic further, allowing researchers the capability to study the antecedents and consequences of enjoyment, BPNS, and behavioural regulations within this younger demographic, and help inform tailored interventions and teaching styles.

Policy and practice

Policy-makers should place more emphasis on children's motivation within the National Curriculum. Currently, within the National Curriculum, the emphasis is placed upon the development of FMS (Department of Education, 2013). This emphasis may be causing some questionable teaching practice within PE, i.e., PE teachers adopting teaching styles that do not address children's motivational perceptions (Haerens et al., 2011; Kirk, 2010).

This thesis revealed current PE practice and interventions groups to be highly empowering; however, there was significant variance in disempowering qualities across the groups, indicating that PE teachers should be mindful of their practice. PE teachers should consciously try to limit the amount of controlling and ego-involving characteristics within their teaching. Also, based on the findings of this thesis, pedagogies underpinned by Motor Learning Theory were significantly less disempowering than current PE practice. Thus, perhaps policy should change in regards to the national curriculum, recommending that all primary school PE teachers adopt a pedagogy that not only supports FMS development but also fosters young children's motivation within PE.

The MAT-PE has demonstrated that young children can reflect on their PE experiences and provide rational and coherent explanations for their perceptions. PE

teachers could ask their children about their perspectives on their PE lessons and create changes around that feedback. This approach could be particularly useful for identifying amotivated children and would help support researchers and teachers in enhancing their motivation. This thesis demonstrated the effectiveness and fast capture of feelings of enjoyment which PE teachers could adopt to obtain immediate feedback from the lesson they have just given. This feedback could help enhance PE teachers' practice within lessons.

Recommendations for future research

Based on the findings of this thesis and the reported strengths and limitations, there are several recommendations for future research. Firstly, additional acceptability of the MAT-PE should be conducted. A better examination of the MAT-PE's predictive validity should, therefore, be conducted with a larger sample to explore whether more significant relationships emerge. As the MAT-PE is a contextual assessment, other forms of reliability, such as test-retest should be conducted in future research. These recommendations would further strengthen the tool as guided by COSMIN (Mokkink et al., 2010). Future research could also evaluate the reliability of live coding against coding of transcript data to assess the viability of live coding. In regards to analysis, data from the MAT-PE was coded with a codebook to quantitatively describe the sample of children in this thesis (quantitative content analysis). This process included coding of the draw and write activity for PE enjoyment. However, other types of analysis could be conducted for these drawings, such as pen profiles. Qualitative analysis could be conducted across the tool and should be explored in future research to explore the why behind young children's motivational perceptions specifically. BPN support was assessed through video

coding within this thesis. Future research should investigate young children's perceptions of need support.

Future research should also collect more observation points so that motivational climate research can control for the effect of the coach. It would also be useful to assess the motivational climates of other pedagogies that do not specifically focus upon skill acquisition as some PE teachers may adopt fitness or PA as their primary outcomes, rather than FMS. The effect of pedagogy upon other PE-related variables should also be conducted, such as FMS development, PMC and engagement so that researchers have a better understanding of the role of pedagogy within children's development. This thesis measured children's need satisfaction, and it also measured need support through observation. Future research should investigate young children's perceptions of need support within PE to explore whether they recognise the support (or lack of) for which they are being provided.

Reflections

My time on the PhD has challenged and developed me, both academically and personally. It has shown me the reward of perseverance and determination, namely through the MAT-PE development process. That particular process took around 14 months to come to fruition and required multiple supervisory and advisory meetings, countless tool iterations, international communication and sheer will. The PhD has made me feel comfortable with feeling *uncomfortable*, frequently and consistently placing me outside of my comfort zone. I am not ashamed to admit that motivation was sometimes hard to come by and I am eternally grateful for the support structure

that I had within the supervisory team, the SAMPLE-PE team, and my friends and family.

The PhD process has developed my knowledge and skills. I have engaged in multiple professional development opportunities including stakeholder and public engagement, impact, data management, funding and statistical inference. My knowledge of self-determination, pedagogy and motor competence have increased over the three years; however, I am well aware that there is much more to learn. My interest in SDT has only increased with time and is hopefully something I can engage with in future. I have gained many opportunities through being a part of the SAMPLE-PE team, including working in a multi-disciplinary team, leading stakeholder meetings, training undergraduate students, leading data collection days, lecturing, and publishing papers. I feel that all of these experiences, and more, have prepared me well for a future in research.

This thesis is based in pragmatism, with the mixed-method approach to the tool and to the measurement choices within all studies, using ‘what works best’. My philosophical position as a researcher at the end of this project has not changed. I believe that being pragmatic when working with children allows both parties (participants and researchers) to benefit. What I mean by this is that this approach, from my experience during the PhD, allows researchers and participants to work together and be comfortable in the process as the researcher is mindful of their participants’ needs and outcomes that they themselves are striving for. In the limitations section above, I stated that the data was presented quantitatively and to be truly mixed-method, quotations illustrating this quantification would have been a

truer form of mixed-method dissemination. Therefore, upon reflection, although my approach was pragmatic, my dissemination was quantitative. This approach to dissemination may have hindered my deeper understanding of the data and what children were saying as they used their 'voice'. In future, when using a mixed-method approach, I would strive to disseminate the data in a mixed-method way, especially within an intervention context, as interventions primarily assess change. Gaining a deeper understanding of why change occurred would greatly benefit researchers and better inform future interventions and best practice. I only started to understand qualitative approaches to data collection and analysis during my PhD, as my undergraduate and master's degrees were primarily quantitatively-based, and it has given me an interest in pursuing this particular approach in future.

I have been highly fortunate to be able to attend multiple national and international conferences. These opportunities have led to informative discussions with a range of people, creation of connections and developed my presentation skills. I am a lot more confident and a lot happier presenting my work now than I was during my undergraduate and master's courses where the mere thought filled me with anxiety. This experience has been coupled with opportunities to lecture in skill acquisition and psychology modules where I admitted to myself and others that I actually enjoyed it, which would have been an impossible thought a few years ago. The opportunity to take part in the three-minute thesis was an anxiety-inducing process; however, it helped me place all other presenting types into perspective and has made me more confident. I have thoroughly enjoyed working with the children and within schools during data collection and is something I would be passionate about pursuing in future.

Conclusions

This thesis has provided a unique exploration of enjoyment, BPNS, and behavioural regulations in PE within a highly under-researched demographic: low SES young children. All children should be supported in regards to their motivation for PE as it is their motivation that dictates their level of engagement and therefore dictates the level of positive consequences they experience. All children deserve the best start in life and understanding what motivates young children and why can help support this endeavour. This thesis provides a newly developed assessment tool for enjoyment, BPNS, and behavioural regulations for this young age group and thus offers a viable platform for future research from which to start and continue. Current motivational research can identify older children's motivations and create effective interventions for them. This thesis helps support a downward extension so that young children can also benefit from tailored interventions and better teaching practice.

References

- Ackerman, P. L. (1988). Determinants of individual differences during skill acquisition: Cognitive abilities and information processing. *Journal of Experimental Psychology: General*, 117, 288.
- Adams, H., Cervantes, P., Jang, J., & Dixon, D., (2014). Standardized assessment. D, Granpeesheh, J, tarbox, A. C. Najdowski & J. Kornack (Eds.). *Evidence-based Treatment for Children with Autism: The CARD model*. (pp. 501-516). Elsevier.
- Adams, J. A. (1971). A closed-loop theory of motor learning. *Journal of Motor Behavior*, 3, 111-150.
- Adams, J. S. (1963). Towards an understanding of inequity. *The Journal of Abnormal and Social Psychology*, 67, 422.
- Adie, J. W., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction and the optimal functioning of adult male and female sport participants: A test of basic needs theory. *Motivation and Emotion*, 32, 189-199.
- Adolph, K. E. (2019). An ecological approach to learning in (not and) development. *Human Development*, 63, 180-201.
- Adolph, K. E., & Hoch, J. E. (2019). Motor development: Embodied, embedded, enculturated, and enabling. *Annual Review of Psychology*, 70, 141-164.
- Alderfer, C. P., & Guzzo, R. A. (1979). Life experiences and adults' enduring strength of desires in organizations. *Administrative Science Quarterly*, 347-361.
- Alderson, P. (2015). The ethics of research with young children. *Handbook of Research Methods in Early Childhood Education*, 2, 633-653.
- Ames, C. (1992). Achievement goals and the classroom motivational climate. *Student Perceptions in the Classroom*, 1, 327-348.
- Angell, C., Alexander, J., & Hunt, J. A. (2015). 'Draw, write and tell': A literature review and methodological development on the 'draw and write' research method. *Journal of Early Childhood Research*, 13, 17-28.
- Angyal, A. (1965). *Neurosis and treatment: A holistic theory*. Wiley.
- Appleton, P. R., & Duda, J. L. (2016). Examining the interactive effects of coach-created empowering and disempowering climate dimensions on athletes' health and functioning. *Psychology of Sport and Exercise*, 26, 61-70.
- Ash, T., Agaronov, A., Aftosmes-Tobio, A., & Davison, K. K. (2017). Family-based childhood obesity prevention interventions: a systematic review and quantitative content analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 113.
- Ayers, S. F., Housner, L. D., Gurvitch, R., Pritchard, T., Dell'Orso, M., Dietrich, S., ... & Pearson, M. (2005). An examination of skill learning using direct instruction. *The Physical Educator*, 62.

- Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health, 76*, 397-401.
- Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & Education, B. P. (2009). The educational benefits claimed for physical education and school sport: an academic review. *Research Papers in Education, 24*, 1-27.
- Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1). Prentice-hall.
- Bardid, F., Huyben, F., Lenoir, M., Seghers, J., De Martelaer, K., Goodway, J. D., & Deconinck, F. J. (2016). Assessing fundamental motor skills in Belgian children aged 3–8 years highlights differences to US reference sample. *Acta Paediatrica, 105*, e281-e290.
- Bardid, F., Rudd, J. R., Lenoir, M., Polman, R., & Barnett, L. M. (2015). Cross-cultural comparison of motor competence in children from Australia and Belgium. *Frontiers in Psychology, 6*, 964.
- Barnett, L. M., Lai, S. K., Veldman, S. L., Hardy, L. L., Cliff, D. P., Morgan, P. J., ... & Rush, E. (2016). Correlates of gross motor competence in children and adolescents: a systematic review and meta-analysis. *Sports Medicine, 46*, 1663-1688.
- Barnett, L. M., Ridgers, N. D., Zask, A., & Salmon, J. (2015). Face validity and reliability of a pictorial instrument for assessing fundamental movement skill perceived competence in young children. *Journal of Science and Medicine in Sport, 18*, 98-102.
- Baron, L. J., & Downey, P. J. (2007). Perceived success and enjoyment in elementary physical education. *Journal of Applied Research on Learning, 1*, 1-24.
- Barris, S., Farrow, D., & Davids, K. (2014). Increasing functional variability in the preparatory phase of the takeoff improves elite springboard diving performance. *Research Quarterly for Exercise and Sport, 85*, 97-106.
- Behzadnia, B., Mohammadzadeh, H., & Ahmadi, M. (2019). Autonomy-supportive behaviors promote autonomous motivation, knowledge structures, motor skills learning and performance in physical education. *Current Psychology, 38*, 1692-1705.
- Belcher, B. R., Berrigan, D., Dodd, K. W., Emken, B. A., Chou, C. P., & Spuijt-Metz, D. (2010). Physical activity in US youth: impact of race/ethnicity, age, gender, & weight status. *Medicine and Science in Sports and Exercise, 42*, 2211.
- Beni, S., Fletcher, T., & Ní Chróinín, D. (2017). Meaningful experiences in physical education and youth sport: A review of the literature. *Quest, 69*, 291-312.
- Bernstein, N. A. (1967). The problem of Interrelations between co-ordination and localization (English translation from Russian *Arch. Biol Sci, 38* 1935). The coordination and regulation of movement.
- Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development, 81*, 1641-1660.

- Best, K., Ball, K., Zarnowiecki, D., Stanley, R., & Dollman, J. (2017). In search of consistent predictors of children's physical activity. *International Journal of Environmental Research and Public Health*, 14, 1258.
- Biddle, S. J., & Asare, M. (2011). Physical activity and mental health in children and adolescents: a review of reviews. *British Journal of Sports Medicine*, 45, 886-895.
- Biddle, S. J., Ciaccioni, S., Thomas, G., & Vergeer, I. (2019). Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychology of Sport and Exercise*, 42, 146-155.
- Bolter, N. D., Kipp, L., & Johnson, T. (2018). Teaching sportsmanship in physical education and youth sport: Comparing perceptions of teachers with students and coaches with athletes. *Journal of Teaching in Physical Education*, 37, 209-217.
- Braithwaite, R., Spray, C. M., & Warburton, V. E. (2011). Motivational climate interventions in physical education: A meta-analysis. *Psychology of Sport and Exercise*, 12, 628-638.
- Bremer, E., & Cairney, J. (2018). Fundamental movement skills and health-related outcomes: A narrative review of longitudinal and intervention studies targeting typically developing children. *American Journal of Lifestyle Medicine*, 12, 148-159.
- Brian, A., Bardid, F., Barnett, L. M., Deconinck, F. J., Lenoir, M., & Goodway, J. D. (2018). Actual and perceived motor competence levels of Belgian and United States preschool children. *Journal of Motor Learning and Development*, 6, S320-S336.
- Brunet, J., Gunnell, K. E., Teixeira, P., Sabiston, C. M., & Bélanger, M. (2016). Should we be looking at the forest or the trees? Overall psychological need satisfaction and individual needs as predictors of physical activity. *Journal of Sport and Exercise Psychology*, 38, 317-330.
- Bryan, C. L., & Solmon, M. A. (2012). Student motivation in physical education and engagement in physical activity. *Journal of Sport Behaviour*, 35, 267.
- Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative Research*, 6, 97-113.
- Bryman, A. (2007). Barriers to integrating quantitative and qualitative research. *Journal of Mixed Methods Research*, 1, 8-22.
- Bungum, T., Dowda, M., Weston, A., Trost, S. G., & Pate, R. R. (2000). Correlates of physical activity in male and female youth. *Pediatric Exercise Science*, 12, 71-79.
- Bunker, D., & Thorpe, R. (1982). A model for the teaching of games in secondary schools. *Bulletin of Physical Education*, 18, 5-8.
- Burgess, R. G. (1989). Grey areas: Ethical dilemmas in educational ethnography. *The Ethics of Educational Research*, 60-76.

- Buszard, T., Reid, M., Masters, R., & Farrow, D. (2016). Scaling the equipment and play area in children's sport to improve motor skill acquisition: A systematic review. *Sports Medicine*, 46, 829-843.
- Butler, R. (2005). Competence assessment, competence, and motivation between early and middle childhood. *Handbook of Competence and Motivation*, 202-221.
- Cairney, J., Kwan, M. Y., Veldhuizen, S., Hay, J., Bray, S. R., & Faught, B. E. (2012). Gender, perceived competence and the enjoyment of physical education in children: a longitudinal examination. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 26.
- Carroll, B., & Loumidis, J. (2001). Children's perceived competence and enjoyment in physical education and physical activity outside school. *European Physical Education Review*, 7, 24-43.
- Caruth, G. D. (2013). Demystifying mixed methods research design: A review of the literature. *Online Submission*, 3, 112-122. <https://doi.org/10.13054/mije.13.35.3.2>
- Casey, A., & Goodyear, V. A. (2015). Can cooperative learning achieve the four learning outcomes of physical education? A review of literature. *Quest*, 67, 56-72.
- Cashin, W. E., & Downey, R. G. (1992). Using global student rating items for summative evaluation. *Journal of Educational Psychology*, 84, 563.
- Chanal, J., Cheval, B., Courvoisier, D. S., & Paumier, D. (2019). Developmental relations between motivation types and physical activity in elementary school children. *Psychology of Sport and Exercise*, 43, 233-242. doi: <https://doi.org/10.1016/j.psychsport.2019.03.006>
- Chandler, C. L., & Connell, J. P. (1987). Children's intrinsic, extrinsic and internalized motivation: A developmental study of children's reasons for liked and disliked behaviours. *British Journal of Developmental Psychology*, 5, 357-365. <https://doi.org/10.1111/j.2044-835x.1987.tb01072.x>
- Chen, A., Martin, R., Ennis, C. D., & Sun, H. (2008). Content specificity of expectancy beliefs and task values in elementary physical education. *Research Quarterly for Exercise and Sport*, 79, 195-208.
- Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., ... & Ryan, R. M. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, 39, 216-236.
- Chen, W. (2014). Psychological needs satisfaction, motivational regulations and physical activity intention among elementary school students. *Educational Psychology*, 34, 495-511.
- Chen, W., & Hypnar, A. J. (2015). Elementary school students' self-determination in physical education and attitudes toward physical activity. *Journal of Teaching in Physical Education*, 34, 189-209.

- Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology, 40*, 99-111.
- Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport and Exercise Psychology, 34*, 365-396.
- Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise, 35*, 74-88.
- Choi, S. M., Sum, K. W. R., Leung, F. L. E., Wallhead, T., Morgan, K., Milton, D., ... & Sit, H. P. C. (2020). Effect of sport education on students' perceived physical literacy, motivation, and physical activity levels in university required physical education: a cluster-randomized trial. *Higher Education, 1-19*.
- Chow, J. Y., Davids, K., Button, C., & Renshaw, I. (2015). *Nonlinear pedagogy in skill acquisition: An introduction*. Routledge.
- Chow, J. Y., Davids, K., Button, C., Rein, R., Hristovski, R., & Koh, M. (2009). Dynamics of multi-articular coordination in neurobiological systems. *Nonlinear Dynamics Psychology and Life Sciences, 13*, 27-52.
- Chowdhury, S. D., Wrotniak, B. H., & Ghosh, T. (2017). Association between body mass index and motor competence in santal children of Purulia District, India. *Journal of Motor Behavior, 49*, 349-354.
- Church, A. T., Katigbak, M. S., Locke, K. D., Zhang, H., Shen, J., de Jesús Vargas-Flores, J., ... & Mastor, K. A. (2013). Need satisfaction and well-being: Testing self-determination theory in eight cultures. *Journal of Cross-Cultural Psychology, 44*, 507-534.
- Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*, 284. doi: <https://doi.org/10.1037/1040-3590.6.4.284>
- Clark, M. E., McEwan, K., & Christie, C. J. (2019). The effectiveness of constraints-led training on skill development in interceptive sports: A systematic review. *International Journal of Sports Science & Coaching, 14*, 229-240.
- Cleland, F. E., & Gallahue, D. L. (1993). Young children's divergent movement ability. *Perceptual and Motor Skills, 77*, 535-544.
- Cole, T. J., & Lobstein, T. (2012). Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. *Pediatric Obesity, 7*, 284-294.
- Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology, 88*, 715.

- Corpus, J. H., McClintic-Gilbert, M. S., & Hayenga, A. O. (2009). Within-year changes in children's intrinsic and extrinsic motivational orientations: Contextual predictors and academic outcomes. *Contemporary Educational Psychology, 34*, 154-166.
- Coulter, M., & Woods, C. B. (2011). An exploration of children's perceptions and enjoyment of school-based physical activity and physical education. *Journal of Physical Activity and Health, 8*, 645-654.
- Creswell, J. W., & Plano Clark, V. L. (2011). Choosing a mixed methods design. *Designing and Conducting Mixed Methods Research, 2*, 53-106.
- Cronbach, L. J., & Meehl, P. E. (1955). Construct validity for psychological tests. *Psychological Bulletin, 52*, 281-302.
- Crotti, M., Foweather, L., Rudd, J. R., Hurter, L., Schwarz, S., & Boddy, L. M. (2020). Development of raw acceleration cut-points for wrist and hip accelerometers to assess sedentary behaviour and physical activity in 5-7-year-old children. *Journal of Sports Sciences, 38*, 1036-1045.
- Davids, K. W., Button, C., & Bennett, S. J. (2008a). *Dynamics of skill acquisition: A constraints-led approach*. Human Kinetics.
- Davids, K., Araújo, D., Hristovski, R., Passos, P., & Chow, J. Y. (2012). Ecological dynamics and motor learning design in sport. *Skill acquisition in sport: Research, Theory and Practice*, 112-130.
- Davids, K., Button, C., & Bennett, S. J. (2008b). *Coordination and control of movement in sport: An ecological approach*. Human Kinetics.
- Davids, K., Handford, C., & Williams, M. (1994). The natural physical alternative to cognitive theories of motor behaviour: An invitation for interdisciplinary research in sports science? *Journal of Sports Sciences, 12*, 495-528.
- Davis, B., Sumara, D. J., & Sumara, D. (2006). *Complexity and education: Inquiries into learning, teaching, and research*. Psychology Press.
- De Meester, A., Van Duyse, F., Aelterman, N., De Muynck, G. J., & Haerens, L. (2020). An experimental, video-based investigation into the motivating impact of choice and positive feedback among students with different motor competence levels. *Physical Education and Sport Pedagogy*, 1-18.
- De Meyer, J., Soenens, B., Aelterman, N., De Bourdeaudhuij, I., & Haerens, L. (2016). The different faces of controlling teaching: implications of a distinction between externally and internally controlling teaching for students' motivation in physical education. *Physical Education and Sport Pedagogy, 21*, 632-652.
- De Vet, H. C., Terwee, C. B., Mokkink, L. B., & Knol, D. L. (2011). *Measurement in medicine: a practical guide*. Cambridge University Press.
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*, 105-115.
- Deci, E. L. (1980). *The psychology of self-determination*. Lexington Books.

- Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*, 109-134.
- Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality.
- Deci, E. L., & Ryan, R. M. (1994). Promoting self-determined education. *Scandinavian Journal of Educational Research, 38*, 3-14.
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227-268.
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macro theory of human motivation, development, and health. *Canadian Psychology/ Psychologie Canadienne, 49*, 182.
- Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research, 71*, 1-27.
- Department of Education. (2013). *The national curriculum in England: Key stages 1 and 2 framework document*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425601/PRIMARY_national_curriculum.pdf
- Digelidis, N., & Papaioannou, A. (1999). Age-group differences in intrinsic motivation, goal orientations and perceptions of athletic competence, physical appearance and motivational climate in Greek physical education. *Scandinavian Journal of Medicine & Science in Sports, 9*, 375-380.
- Domville, M., Watson, P. M., Richardson, D., & Graves, L. E. F. (2019). Children's perceptions of factors that influence PE enjoyment: A qualitative investigation. *Physical Education and Sport Pedagogy, 24*, 207-219.
- Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., ... & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Medicine and Science in Sports and Exercise, 48*, 1197.
- Döring, N., Reif, A., & Poeschl, S. (2016). How gender-stereotypical are selfies? A content analysis and comparison with magazine adverts. *Computers in Human Behavior, 55*, 955-962.
- Duda, J. L. (2013). The conceptual and empirical foundations of Empowering Coaching™: Setting the stage for the PAPA project. *International Journal of Sport and Exercise Psychology, 11*, 311-318. doi: <https://doi.org/10.1080/1612197x.2013.839414>
- Duda, J. L., & Appleton, P. R. (2016). Empowering and disempowering coaching climates: Conceptualization, measurement considerations, and intervention implications. In *Sport and exercise psychology research* (pp. 373-388). Academic Press.

- Duda, J. L., Appleton, P. R., Stebbings, J., & Balaguer, I. (2018). Towards more empowering and less disempowering environments in youth sport. *Sport psychology for young athletes*, 81-93.
- Duda, J. L., & Nicholls, J. G. (1992). Dimensions of achievement motivation in schoolwork and sport. *Journal of Educational Psychology*, 84, 290. doi: <https://doi.org/10.1037/0022-0663.84.3.290>
- Duda, J. L., Chi, L., Newton, M. L., & Walling, M. D. (1995). Task and ego orientation and intrinsic motivation in sport. *International Journal of Sport Psychology*.
- Duda, J.L. (1992). *Motivation in sport settings: A goal perspective approach*. In Motivation in Sport and Exercise (edited by G.C. Roberts), pp. 57±91. Human Kinetics.
- Duncan, M. J., Roscoe, C. M., Noon, M., Clark, C. C., O'Brien, W., & Eyre, E. L. (2020). Run, jump, throw and catch: How proficient are children attending English schools at the fundamental motor skills identified as key within the school curriculum? *European Physical Education Review*, 26, 814-826.
- Dunn, J. G., Bouffard, M., & Rogers, W. T. (1999). Assessing item content-relevance in sport psychology scale-construction research: Issues and recommendations. *Measurement in Physical Education and Exercise Science*, 3, 15-36.
- Edwards, L. C., Bryant, A. S., Keegan, R. J., Morgan, K., & Jones, A. M. (2017). Definitions, foundations and associations of physical literacy: a systematic review. *Sports Medicine*, 47, 113-126.
- Engel, A. C., Broderick, C. R., van Doorn, N., Hardy, L. L., & Parmenter, B. J. (2018). Exploring the relationship between fundamental motor skill interventions and physical activity levels in children: A systematic review and meta-analysis. *Sports Medicine*, 48, 1845-1857.
- Epstein, J. L. (1983). Longitudinal effects of family-school-person interactions on student outcomes. *Research in Sociology of Education and Socialization*, 4, 101-128.
- Erickson, J. D. (2019). Primary Students' Emic Views of Reading Intervention: A Qualitative Case Study of Motivation. *Literacy Research: Theory, Method, and Practice*, 68, 86-107. <https://doi.org/10.1177/2381336919870282>
- Erwin, H. E., Stellino, M. B., Beets, M. W., Beighle, A., & Johnson, C. E. (2013). Physical education lesson content and teacher style and elementary students' motivation and physical activity levels. *Journal of Teaching in Physical Education*, 32, 321-334.
- Escartí, A., Gutiérrez, M., Pascual, C., & Llopis, R. (2010). Implementation of the personal and social responsibility model to improve self-efficacy during physical education classes for primary school children. *International Journal of Psychology and Psychological Therapy*, 10, 387-402.

- Escriva-Boulley, G., Tessier, D., Ntoumanis, N., & Sarrazin, P. (2018). Need-supportive professional development in elementary school physical education: Effects of a cluster-randomized control trial on teachers' motivating style and student physical activity. *Sport, Exercise, and Performance Psychology*, 7, 218.
- Estabrooks, P. A., Lee, R. E., & Gyurcsik, N. C. (2003). Resources for physical activity participation: does availability and accessibility differ by neighbourhood socioeconomic status? *Annals of Behavioral Medicine*, 25, 100-104.
- Evans, P. & Fuller, M. (1996). 'Hello. Who Am I Speaking To?' Communicating with Pre-school Children in Educational Research Settings. *Early Years*, 17, 17-20.
- Evans, P., & Fuller, M. (1998). Children's perceptions of their nursery education. *International Journal of Early Years Education*, 6, 59-74.
- Fairclough S, Stratton G, and Baldwin G (2002). The contribution of secondary school physical education to lifetime physical activity. *European Physical Education Review*, 8, 69–84.
- Fairclough, S. (2003). Physical activity, perceived competence and enjoyment during high school physical education. *European Journal of Physical Education*, 8, 5-18.
- Fajen, B. R., Riley, M. A., & Turvey, M. T. (2008). Information, affordances, and the control of action in sport. *International Journal of Sport Psychology*, 40, 79-107.
- Feilzer, Y. M. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, 4, 6-16.
- Fenton, S. A., Duda, J. L., Appleton, P. R., & Barrett, T. G. (2017). Empowering youth sport environments: Implications for daily moderate-to-vigorous physical activity and adiposity. *Journal of Sport and Health Science*, 6, 423-433.
- Fernald, D. H., & Duclos, C. W. (2005). Enhance your team-based qualitative research. *The Annals of Family Medicine*, 3, 360-364.
- Ferrer-Caja, E., & Weiss, M. R. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research quarterly for exercise and sport*, 71, 267-279.
- Firestone, P., & Douglas, V. I. (1977). The effects of verbal and material rewards and punishers on the performance of impulsive and reflective children. *Child Study Journal*, 7, 71-78.
- Fitts, P.M., and Posner, M.I. (1973). *Human performance*. Prentice Hall.
- Fonteyn, M. E., Vetteuse, M., Lancaster, D. R., & Bauer-Wu, S. (2008). Developing a codebook to guide content analysis of expressive writing transcripts. *Applied Nursing Research*, 21, 165-168.

- Foulkes, J. D., Knowles, Z., Fairclough, S. J., Stratton, G., O'dwyer, M., Ridgers, N. D., & Fowweather, L. (2015). Fundamental movement skills of preschool children in Northwest England. *Perceptual and Motor skills*, 121, 260-283.
- Fox, K. (2010). The physical self and physical literacy.
- Gao, Z. (2008). Perceived competence and enjoyment in predicting students' physical activity and cardiorespiratory fitness. *Perceptual and Motor Skills*, 107, 365-372.
- Gao, Z., Podlog, L., & Huang, C. (2013). Associations among children's situational motivation, physical activity participation, and enjoyment in an active dance video game. *Journal of Sport and Health Science*, 2, 122-128.
- Gauntlett, D. (2006). Creative and Visual Methodologies For Exploring Identities—A Conversation between David Gauntlett and Peter Holzwarth. Visual Studies 2006. Retrieved <http://www.tandf.co.uk/journals/titles/1472586X> Retrieved
- Gelman, R., & Baillargeon, R. (1983). *Review of some Piagetian concepts*. Handbook of child psychology: formerly Carmichael's Manual of child psychology/Paul H. Mussen, editor.
- Gentile, A. M. (2000). *Skill Acquisition: Action, Movement, and Neuromotor Processes* in Carr J. Shepherd R. Movement Science, Foundations for Physical Therapy in Rehabilitation.
- Gibson James, J. (1979). *The ecological approach to visual perception*.
- Giles-Corti, B., & Donovan, R. J. (2002). Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. *Preventive Medicine*, 35, 601-611.
- Gillison, F. B., Standage, M., & Skevington, S. M. (2006). Relationships among adolescents' weight perceptions, exercise goals, exercise motivation, quality of life and leisure-time exercise behaviour: a self-determination theory approach. *Health Education Research*, 21, 836-847.
- Goodway, J. D., & Rudisill, M. E. (1997). Perceived physical competence and actual motor skill competence of African American preschool children. *Adapted Physical Activity Quarterly*, 14, 314-326
- Gottfried, A. E. (1986). CAIMI: Children's academic intrinsic motivation inventory. *Psychological Assessment Resources*.
- Gottfried, A. E. (1990). Academic intrinsic motivation in young elementary school children. *Journal of Educational Psychology*, 82, 525-538. <https://doi.org/10.1037/0022-0663.82.3.525>
- Grammatikopoulos, V., Gregoriadis, A., & Zachopoulou, E. (2012). Acknowledging the role of motor domain in creativity in early childhood education. *Contemporary Perspectives on Research in Creativity in Early Childhood Education*, 159-176.
- Gråstén, A. (2016). Children's expectancy beliefs and subjective task values through two years of school-based program and associated links to physical education

- enjoyment and physical activity. *Journal of Sport and Health Science*, 5, 500-508.
- Gråstén, A., & Yli-Piipari, S. (2019). The Patterns of Moderate to Vigorous Physical Activity and Physical Education Enjoyment Through a 2-Year School-Based Program. *Journal of School Health*, 89, 88-98.
- Gråstén, A., Jaakkola, T., Liukkonen, J., Watt, A., & Yli-Piipari, S. (2012). Prediction of enjoyment in school physical education. *Journal of Sports Science & Medicine*, 11, 260.
- Greenwood, D., Davids, K., & Renshaw, I. (2016). The role of a vertical reference point in changing gait regulation in cricket run-ups. *European Journal of Sport Science*, 16, 794-800.
- Guadagnoli, M. A., & Lee, T. D. (2004). Challenge point: a framework for conceptualizing the effects of various practice conditions in motor learning. *Journal of Motor Behavior*, 36, 212-224.
- Guay, F., Chanal, J., Ratelle, C. F., Marsh, H. W., Larose, S., & Boivin, M. (2010). Intrinsic, identified, and controlled types of motivation for school subjects in young elementary school children. *British Journal of Educational Psychology*, 80, 711-735. <https://doi.org/10.1348/000709910x499084>
- Guay, F., Ratelle, C. F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role of self-determination in education. *Canadian Psychology/ Psychologie Canadienne*, 49, 233.
- Gunnell, K. E., Bélanger, M., & Brunet, J. (2016). A tale of two models: Changes in psychological need satisfaction and physical activity over 3 years. *Health Psychology*, 35, 167.
- Gusthart, J. L., & Sprigings, E. J. (1989). Student learning as a measure of teacher effectiveness in physical education. *Journal of Teaching in Physical Education*, 8, 298-311.
- Haerens, L., Aelterman, N., Van den Berghe, L., De Meyer, J., Soenens, B., & Vansteenkiste, M. (2013). Observing physical education teachers' need-supportive interactions in classroom settings. *Journal of Sport and Exercise Psychology*, 35, 3-17.
- Haerens, L., Kirk, D., Cardon, G., & De Bourdeaudhuij, I. (2011). Toward the development of a pedagogical model for health-based physical education. *Quest*, 63, 321-338.
- Haerens, L., Kirk, D., Cardon, G., De Bourdeaudhuij, I., & Vansteenkiste, M. (2010). Motivational profiles for secondary school physical education and its relationship to the adoption of a physically active lifestyle among university students. *European Physical Education Review*, 16, 117-139.
- Harcourt, D., & Einarsdóttir, J. (2011). Introducing children's perspectives and participation in research.
- Hardy, L. L., King, L., Farrell, L., Macniven, R., & Howlett, S. (2010). Fundamental movement skills among Australian preschool children. *Journal of Science and Medicine in Sport*, 13, 503-508.

- Harter, S. (1978). Effectance motivation reconsidered: toward a developmental model. *Human Development*, 21, 34-64.
- Harter, S. (1979). *Perceived competence scale for children: Manual, Form O*. University of Denver.
- Harter, S. (1988). Developmental processes in the construction of the self. *Integrative processes and socialization: Early to Middle Childhood*, 45-78.
- Harter, S. (1999). *The construction of the self: A developmental perspective*. Guilford.
- Harter, S., & Pike, R. (1984). The pictorial scale of perceived competence and social acceptance for young children. *Child Development*, 1969-1982. doi: <https://doi.org/10.2307/1129772>
- Harvey, S., Gil-Arias, A., Smith, M. L., & Smith, L. R. (2017). Middle and elementary school students' changes in self-determined motivation in a basketball unit taught using the Tactical Games model. *Journal of Human Kinetics*, 59, 39-53.
- Hays, R. D., Bjorner, J. B., Revicki, D. A., Spritzer, K. L., & Cella, D. (2009). Development of physical and mental health summary scores from the patient-reported outcomes measurement information system (PROMIS) global items. *Quality of Life Research*, 18, 873-880.
- Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing*, 18, 66-67.
- Herzberg, F., Mausner, B., & Snyderman B. (1959). *The motivation to work*. Wiley.
- Hill, M. (2006). Children's voices on ways of having a voice: children's and young people's perspectives on methods used in research and consultation. *Childhood*, 13, 69-89
- Hills, A. P., Dengel, D. R., & Lubans, D. R. (2015). Supporting public health priorities: recommendations for physical education and physical activity promotion in schools. *Progress in Cardiovascular Diseases*, 57, 368-374. <https://doi.org/10.1016/j.pcad.2014.09.010>
- Hjorth, M. F., Chaput, J. P., Ritz, C., Dalskov, S. M., Andersen, R., Astrup, A., ... & Sjödén, A. (2014). Fatness predicts decreased physical activity and increased sedentary time, but not vice versa: support from a longitudinal study in 8-to 11-year-old children. *International Journal of Obesity*, 38, 959-965
- Housner, L. D. (1990). Selecting master teachers: Evidence from process-product research. *Journal of Teaching in Physical Education*, 9, 201-226.
- Hulteen, R. M., Morgan, P. J., Barnett, L. M., Stodden, D. F., & Lubans, D. R. (2018). Development of foundational movement skills: A conceptual model for physical activity across the lifespan. *Sports Medicine*, 48, 1533-1540.
- Irwin, L. G., & Johnson, J. (2005). Interviewing young children: Explicating our practices and dilemmas. *Qualitative Health Research*, 15, 821-831.

- Jaakkola, T., Barkoukis, V., Huhtiniemi, M., Salin, K., Seppälä, S., Lahti, J., & Watt, A. (2019). Enjoyment and anxiety in Finnish physical education: achievement goals and self-determination perspectives. *Journal of Physical Education and Sport*, 19.
- Jaakkola, T., Wang, C. J., Soini, M., & Liukkonen, J. (2015). Students' perceptions of motivational climate and enjoyment in Finnish physical education: A latent profile analysis. *Journal of Sports Science & Medicine*, 14, 477.
- Jaakkola, T., Washington, T., & Yli-Piipari, S. (2013). The association between motivation in school physical education and self-reported physical activity during Finnish junior high school: A self-determination theory approach. *European Physical Education Review*, 19, 127-141. <https://doi.org/10.1177/1356336x12465514>
- Jaakkola, T., Yli-Piipari, S., Watt, A., & Liukkonen, J. (2016). Perceived physical competence towards physical activity, and autonomous motivation and enjoyment in physical education as longitudinal predictors of adolescents' self-reported physical activity. *Journal of Science and Medicine in Sport*, 19, 750-754. doi:10.1016/j.jsams.2015.11.003
- Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology*, 102, 588.
- Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7, 40.
- Kalaja, S. P., Jaakkola, T. T., Liukkonen, J. O., & Digelidis, N. (2012). Development of junior high school students' fundamental movement skills and physical activity in a naturalistic physical education setting. *Physical Education and Sport Pedagogy*, 17, 411-428.
- Kalaja, S., Jaakkola, T., Watt, A., Liukkonen, J., & Ommundsen, Y. (2009). The associations between seventh grade Finnish students' motivational climate, perceived competence, self-determined motivation, and fundamental movement skills. *European Physical Education Review*, 15, 315-335.
- Kendzierski, D., & DeCarlo, K. J. (1991). Physical activity enjoyment scale: Two validation studies. *Journal of Sport & Exercise Psychology*, 13.
- Khodaverdi, Z., Bahram, A., Stodden, D., & Kazemnejad, A. (2016). The relationship between actual motor competence and physical activity in children: mediating roles of perceived motor competence and health-related physical fitness. *Journal of Sports Sciences*, 34, 1523-1529.
- Kimiecik, J. C., & Harris, A. T. (1996). What is enjoyment? A conceptual/definitional analysis with implications for sport and exercise psychology. *Journal of Sport and Exercise Psychology*, 18, 247-263.
- Kimmel, A. (1988). *Ethics and values in applied social research* (Vol. 12). Sage.

- Kirk, D. (2005). Physical education, youth sport and lifelong participation: the importance of early learning experiences. *European Physical Education Review, 11*, 239-255.
- Kirk, D. (2009). *Physical education futures*. Routledge.
- Kirk, D. (2010) *Physical education futures*. Routledge
- Kirk, D. (2013). Educational value and models-based practice in physical education. *Educational Philosophy and Theory, 45*, 973-986.
- Knowles, Z. R., Parnell, D., Stratton, G., & Ridgers, N. D. (2013). Learning from the experts: exploring playground experience and activities using a write and draw technique. *Journal of Physical Activity and Health, 10*, 406-415.
- Koziol Jr, S. M., & Burns, P. (1986). Teachers' accuracy in self-reporting about instructional practices using a focused self-report inventory. *The Journal of Educational Research, 79*, 205-209.
- Kruk, M., Zarychta, K., Horodyska, K., Boberska, M., Scholz, U., Radtke, T., & Luszczynska, A. (2018). From enjoyment to physical activity or from physical activity to enjoyment? Longitudinal associations in parent-child dyads. *Psychology & Health, 33*, 1269-1283.
- Kulinna, P. H. (2008). Models for curriculum and pedagogy in elementary school physical education. *The Elementary School Journal, 108*, 219-227.
- Ladwig, M. A., Vazou, S., & Ekkekakis, P. (2018). "My best memory is when I was done with it": PE memories are associated with adult sedentary behavior. *Translational Journal of the American College of Sports Medicine, 3*, 119-129.
- Lange R.T. (2011) *Inter-rater Reliability*. In: Kreutzer J.S., DeLuca J., Caplan B. (eds) Encyclopedia of Clinical Neuropsychology. Springer.
- Lee, J., Hoornbeek, J., & Oh, N. (2020). Social Cognitive Orientations, Social Support, and Physical Activity among at-Risk Urban Children: Insights from a Structural Equation Model. *International Journal of Environmental Research and Public Health, 17*, 6745.
- Lee, M. C. Y., Chow, J. Y., Button, C., & Tan, C. W. K. (2017). Nonlinear Pedagogy and its role in encouraging twenty-first century competencies through physical education: a Singapore experience. *Asia Pacific Journal of Education, 37*, 483-499.
- Lemos, A. G., Avigo, E. L., & Barela, J. A. (2012). Physical education in kindergarten promotes fundamental motor skill development. *Advances in Physical Education, 2*, 17.
- Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology, 97*, 184.
- Leptokaridou, E. T., Vlachopoulos, S. P., & Papaioannou, A. G. (2016). Experimental longitudinal test of the influence of autonomy-supportive teaching on

- motivation for participation in elementary school physical education. *Educational Psychology*, 36, 1138-1159. <https://doi.org/10.1080/01443410.2014.950195>
- Lewis, B. A., Williams, D. M., Frayeh, A., & Marcus, B. H. (2016). Self-efficacy versus perceived enjoyment as predictors of physical activity behaviour. *Psychology & Health*, 31, 456-469.
- Lewthwaite, R., Chiviacowsky, S., Drews, R., & Wulf, G. (2015). Choose to move: The motivational impact of autonomy support on motor learning. *Psychonomic Bulletin & Review*, 22, 1383-1388.
- Lin WL., Yao G. (2014) Concurrent Validity. In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht.
- Liu, J., Xiang, P., Lee, J., & Li, W. (2017). Developing physically literacy in K-12 physical education through achievement goal theory. *Journal of Teaching in Physical Education*, 36, 292-302.
- Lock, I., & Seele, P. (2016). The credibility of CSR (corporate social responsibility) reports in Europe. Evidence from a quantitative content analysis in 11 countries. *Journal of Cleaner Production*, 122, 186-200.
- Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Prentice Hall.
- Loprinzi, P. D., Davis, R. E., & Fu, Y. C. (2015). Early motor skill competence as a mediator of child and adult physical activity. *Preventive Medicine Reports*, 2, 833-838.
- Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents. *Sports Medicine*, 40, 1019-1035.
- MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cam Journal*, 10, 31-36.
- Maeng, H. J., Webster, E. K., & Ulrich, D. A. (2016). Reliability for the test of gross motor development-(TGMD-3). *Research Quarterly for Exercise and Sport*, 87, A38.
- Magill, R. A. (1990). Motor learning is meaningful for physical educators. *Quest*, 42, 126-133.
- Mandigo, J., Holt, N., Anderson, A., & Sheppard, J. (2008). Children's motivational experiences following autonomy-supportive games lessons. *European Physical Education Review*, 14, 407-425.
- Manly, C. A., & Wells, R. S. (2015). Reporting the use of multiple imputation for missing data in higher education research. *Research in Higher Education*, 56, 397-409.
- Marques, A., Corrales, F. R. G., Martins, J., Catunda, R., & Sarmento, H. (2017). Association between physical education, school-based physical activity, and

academic performance: a systematic review. *Retos: nuevas tendencias en educación física, deporte y recreación*, 31, 316-320.

- Marques, A., Santos, D. A., Hillman, C. H., & Sardinha, L. B. (2018). How does academic achievement relate to cardiorespiratory fitness, self-reported physical activity and objectively reported physical activity: a systematic review in children and adolescents aged 6–18 years. *British Journal of Sports Medicine*, 52, 1039-1039.
- Martin, E. H., Rudisill, M. E., & Hastie, P. A. (2009). Motivational climate and fundamental motor skill performance in a naturalistic physical education setting. *Physical Education and Sport Pedagogy*, 14, 227-240.
- Maslow, A. H. (1943). A Theory of Human Motivation. Originally published in psychological review, 50, 370-396. *Classics in the History of Psychology*. York University, Toronto. [Online]. [Accessed 4th March 2014]. Available from World Wide Web:< <http://psychclassics.yorku.ca/Maslow/motivation.htm>.
- Matsumoto, D. (2003). *Cross-cultural research*. In S. F. Davis (Ed.), *Handbook of research methods in experimental psychology*. Blackwell.
- Matvienko, O., & Ahrabi-Fard, I. (2010). The effects of a 4-week after-school program on motor skills and fitness of kindergarten and first-grade students. *American Journal of Health Promotion*, 24, 299-303.
- Maxwell, J. A., & Loomis, D. M. (2003). Mixed methods design: An alternative approach. *Handbook of Mixed Methods in Social and Behavioral Research*, 1, 241-272.
- McClelland, D. C., & Atkinson, J. W. (1958). Motives in fantasy, action, and society. *The importance of early learning in the formation of motives*, 437-452.
- Mellor, D., & Moore, K. A. (2014). The use of Likert scales with children. *Journal of Pediatric Psychology*, 39, 369-379.
- Metzler, M. (2017). *Instructional models in physical education*. Taylor & Francis.
- Migueles, J. H., Rowlands, A. V., Huber, F., Sabia, S., & van Hees, V. T. (2019). GGIR: A research community-driven open source R package for generating physical activity and sleep outcomes from multi-day raw accelerometer data. *Journal for the Measurement of Physical Behaviour*, 2, 188-196.
- Milić, N. S. (2014). The influence of motor experience on motor creativity (fluency) of preschool children. *Kinesiology*, 46.
- Milyavskaya, M., & Koestner, R. (2011). Psychological needs, motivation, and well-being: A test of self-determination theory across multiple domains. *Personality and Individual Differences*, 50, 387-391.
- Ministry of Housing, Communities & Local Government. (2019). *English indices of deprivation 2019*. Retrieved from <http://imd-by-postcode.opendatacommunities.org/imd/2019>

- Mitchell, S., Mitchell, S. A., Oslin, J., & Griffin, L. (2020). *Teaching sport concepts and skills: A tactical games approach*. Human Kinetics Publishers.
- Mokkink, L. B., Terwee, C. B., Patrick, D. L., Alonso, J., Stratford, P. W., Knol, D. L., ... & De Vet, H. C. (2010). The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. *Quality of life research*, 19(4), 539-549.
- Moore, J. B., Yin, Z., Hanes, J., Duda, J., Gutin, B., & Barbeau, P. (2009). Measuring enjoyment of physical activity in children: validation of the Physical Activity Enjoyment Scale. *Journal of Applied Sport Psychology*, 21, S116-S129.
- Morano, M., Bortoli, L., Ruiz, M. C., Vitali, F., & Robazza, C. (2019). Self-efficacy and enjoyment of physical activity in children: factorial validity of two pictorial scales. *PeerJ*, 7, e7402.
- Morley, D., Till, K., Ogilvie, P., & Turner, G. (2015). Influences of gender and socioeconomic status on the motor proficiency of children in the UK. *Human Movement Science*, 44, 150-156.
- Mosston, M., & Ashworth, S. (1990). *The Spectrum of Teaching Styles. From Command to Discovery*. Longman, Inc., 95 Church St., White Plains, NY 10601-1505.
- Mouratidis, A. A., Vansteenkiste, M., Sideridis, G., & Lens, W. (2011). Vitality and interest–enjoyment as a function of class-to-class variation in need-supportive teaching and pupils' autonomous motivation. *Journal of Educational Psychology*, 103, 353.
- Moy, B., Renshaw, I., & Davids, K. (2016). The impact of nonlinear pedagogy on physical education teacher education students' intrinsic motivation. *Physical Education and Sport Pedagogy*, 21(5), 517-538.
- Newell, K. (1986). Constraints on the development of coordination. Motor development in children: Aspects of coordination and control. doi: https://doi.org/10.1007/978-94-009-4460-2_19
- NHS Digital. (2019). Statistics on obesity, physical activity and diet, England, 2019. Retrieved from <https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-obesity-physical-activity-and-diet/statistics-on-obesity-physical-activity-and-diet-england-2019/part-5-adult-physical-activity>
- Nicholls, J. G. (1978). The development of the concepts of effort and ability, perception of academic attainment, and the understanding that difficult tasks require more ability. *Child Development*, 800-814.
- Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91, 328.
- Nicholls, J. G. (1989). *The competitive ethos and democratic education*. Harvard University Press. doi: <https://doi.org/10.5860/choice.27-1049>

- Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence-Based Nursing, 18*, 34-35.
- Noonan, R. J., Boddy, L. M., Fairclough, S. J., & Knowles, Z. R. (2016). Write, draw, show, and tell: a child-centred dual methodology to explore perceptions of out-of-school physical activity. *BMC Public Health, 16*, 326. <https://doi.org/10.1186/s12889-016-3005-1>
- Noordstar, J. J., van der Net, J., Jak, S., Helders, P. J., & Jongmans, M. J. (2016). The change in perceived motor competence and motor task values during elementary school: A longitudinal cohort study. *British Journal of Developmental Psychology, 34*, 427-446.
- Ntoumanis, N. (2001). Empirical links between achievement goal theory and self-determination theory in sport. *Journal of Sports Sciences, 19*, 397-409.
- Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology, 97*, 444.
- Ntoumanis, N., & Standage, M. (2009). Motivation in physical education classes: A self-determination theory perspective. *Theory and Research in Education, 7*, 194-202.
- Ntoumanis, N., Barkoukis, V., & Thøgersen-Ntoumani, C. (2009). Developmental trajectories of motivation in physical education: Course, demographic differences, and antecedents. *Journal of Educational Psychology, 101*, 717.
- Ntoumanis, N., Pensgaard, A. M., Martin, C., & Pipe, K. (2004). An idiographic analysis of amotivation in compulsory school physical education. *Journal of Sport and Exercise Psychology, 26*, 197-214.
- Owen, K. B., Astell-Burt, T., & Lonsdale, C. (2013). The relationship between self-determined motivation and physical activity in adolescent boys. *Journal of Adolescent Health, 53*, 420-422.
- Owen, K. B., Smith, J., Lubans, D. R., Ng, J. Y., & Lonsdale, C. (2014). Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis. *Preventive Medicine, 67*, 270-279.
- Parish, L. E., & Treasure, D. C. (2003). Physical activity and situational motivation in physical education: Influence of the motivational climate and perceived ability. *Research Quarterly for Exercise and Sport, 74*, 173-182.
- Patall, E. A., Cooper, H., & Robinson, J. C. (2008). The effects of choice on intrinsic motivation and related outcomes: a meta-analysis of research findings. *Psychological Bulletin, 134*, 270.
- Poitras, V. J., Gray, C. E., Borghese, M. M., Carson, V., Chaput, J. P., Janssen, I., ... & Sampson, M. (2016). Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism, 41*, S197-S239.

- Ponce, O. A., & Pagán-Maldonado, N. (2015). Mixed methods research in education: Capturing the complexity of the profession. *International Journal of Educational Excellence*, 1, 111-135. <https://doi.org/10.18562/ijee.2015.0005>
- Porcellato, L., Dugdill, L., & Springett, J. (2005). A longitudinal study exploring Liverpool primary schoolchildren's perspectives on smoking. *Childhood*, 12, 425-443. <https://doi.org/10.1177/0907568205058601>
- Portman, P. A. (1995). Who is having fun in physical education classes? Experiences of sixth-grade students in elementary and middle schools. *Journal of Teaching in Physical Education*, 14, 445-53.
- Portney, L. G., & Watkins, M. P. (2009). *Foundations of clinical research: applications to practice* (Vol. 892). Pearson/Prentice Hall.
- Práxedes, A., Del Villar Álvarez, F., Moreno, A., Gil-Arias, A., & Davids, K. (2019). Effects of a nonlinear pedagogy intervention programme on the emergent tactical behaviours of youth footballers. *Physical Education and Sport Pedagogy*, 24, 332-343
- Prinsen, C. A., Mokkink, L. B., Bouter, L. M., Alonso, J., Patrick, D. L., De Vet, H. C., & Terwee, C. B. (2018). COSMIN guideline for systematic reviews of patient-reported outcome measures. *Quality of Life Research*, 27, 1147-1157.
- Prochaska, J. J., Sallis, J. F., Slymen, D. J., & McKenzie, T. L. (2003). A longitudinal study of children's enjoyment of physical education. *Pediatric Exercise Science*, 15, 170-178.
- Quested, E., Ntoumanis, N., Viladrich, C., Haug, E., Ommundsen, Y., Van Hove, A., ... & Duda, J. L. (2013). Intentions to drop-out of youth soccer: A test of the basic needs theory among European youth from five countries. *International Journal of Sport and Exercise Psychology*, 11, 395-407.
- Rafferty, R., Breslin, G., Brennan, D., & Hassan, D. (2016). A systematic review of school-based physical activity interventions on children's wellbeing. *International Review of Sport and Exercise Psychology*, 9, 215-230.
- Rahman, R. J., Thøgersen-Ntoumani, C., Thatcher, J., & Doust, J. (2011). Changes in need satisfaction and motivation orientation as predictors of psychological and behavioural outcomes in exercise referral. *Psychology & Health*, 26, 1521-1539.
- Rasberry, C. N., Lee, S. M., Robin, L., Laris, B. A., Russell, L. A., Coyle, K. K., & Nihiser, A. J. (2011). The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. *Preventive Medicine*, 52, S10-S20.
- Reeve, J., & Lee, W. (2019). A neuroscientific perspective on basic psychological needs. *Journal of Personality*, 87, 102-114.
- Reilly, J. J. (2016). When does it all go wrong? Longitudinal studies of changes in moderate-to-vigorous-intensity physical activity across childhood and

- adolescence. *Journal of Exercise Science & Fitness*, 14, 1-6.
<https://doi.org/10.1016/j.jesf.2016.05.002>
- Reinboth, M., Duda, J. L., & Ntoumanis, N. (2004). Dimensions of coaching behavior, need satisfaction, and the psychological and physical welfare of young athletes. *Motivation and Emotion*, 28, 297-313.
- Revicki D. (2014) *Internal Consistency Reliability*. In: Michalos A.C. (eds) *Encyclopaedia of Quality of Life and Well-Being Research*. Springer.
- Richard, V., Lebeau, J. C., Becker, F., Boiangin, N., & Tenenbaum, G. (2018). Developing cognitive and motor creativity in children through an exercise program using nonlinear pedagogy principles. *Creativity Research Journal*, 30, 391-401.
- Roberts, S. J., Rudd, J. R., & Reeves, M. J. (2020). Efficacy of using non-linear pedagogy to support attacking players' individual learning objectives in elite-youth football: A randomised cross-over trial. *Journal of Sports Sciences*, 38, 1454-1464.
- Robinson, L. E. (2011). The relationship between perceived physical competence and fundamental motor skills in preschool children. *Child: Care, Health and Development*, 37, 589-596.
- Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor competence and its effect on positive developmental trajectories of health. *Sports Medicine*, 45, 1273-1284.
- Rothbart, M. K., Posner, M. I., & Kieras, J. (2006). Temperament, attention, and the development of self-regulation.
- Rourke, L., & Anderson, T. (2004). Validity in quantitative content analysis. *Educational Technology Research and Development*, 52, 5.
- Royston, P. (2004). Multiple imputation of missing values. *Stata Journal*, 4, 227-241.
- Rubin, D. B. (1976). Inference and missing data. *Biometrika*, 63, 581-592.
- Rudd, J. R., Barnett, L. M., Butson, M. L., Farrow, D., Berry, J., & Polman, R. C. (2015). Fundamental movement skills are more than run, throw and catch: The role of stability skills. *PloS One*, 10, e0140224.
- Rudd, J. R., Crotti, M., Fitton-Davies, K., O'Callaghan, L., Bardid, F., Utesch, T., ... & Foulkes, J. (2020a). Skill Acquisition Methods Fostering Physical Literacy in Early-Physical Education (SAMPLE-PE): Rationale and study protocol for a cluster randomized controlled trial in 5-6-year-old children from deprived areas of North West England. *Frontiers in Psychology*, 11, 1228.
- Rudd, J. R., Pesce, C., Strafford, B. W., & Davids, K. (2020b). Physical Literacy-A Journey of Individual Enrichment: An Ecological Dynamics Rationale for Enhancing Performance and Physical Activity in All. *Frontiers in Psychology*, 11, 1904.

- Rutten, C., Boen, F., & Seghers, J. (2012). How school social and physical environments relate to autonomous motivation in physical education: The mediating role of need satisfaction. *Journal of Teaching in Physical Education*, 31, 216-230.
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, 57, 749.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54-67.
- Deci, E. L., & Ryan, R. M. (2002). Overview of self-determination theory: An organismic dialectical perspective. *Handbook of Self-Determination Research*, 3-33.
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications. doi: <https://doi.org/10.7202/1041847ar>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 101860.
- Ryan, R. M., Mims, V., & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. *Journal of personality and Social Psychology*, 45, 736.
- Ryan, R. M., Ryan, W. S., Di Domenico, S. I., & Deci, E. L. (2019). *The Nature and the Conditions of Human Autonomy and Flourishing*. In *The Oxford Handbook of Human Motivation*.
- Sahito, Z., & Vaisanen, P. (2017). The Diagonal Model of Job Satisfaction and Motivation: Extracted from the Logical Comparison of Content and Process Theories. *International Journal of Higher Education*, 6, 209-230.
- Sallis, J. F., & McKenzie, T. L. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport*, 62, 124-137
- Sallis, J. F., Carlson, J. A., & Mignano, A. M. (2012). Promoting youth physical activity through physical education and after-school programs. *Adolescent Medicine: State of the Art Reviews*, 23, 493.
- Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32, 963-975.
- Sánchez-Miguel, P. A., Leo, F. M., Sánchez-Oliva, D., Amado, D., & García-Calvo, T. (2013). The importance of parents' behavior in their children's enjoyment and amotivation in sports. *Journal of Human Kinetics*, 36, 169-177.

- Sanchez-Oliva, D., Sanchez-Miguel, F., Leo, F. M., Kinnafick, F. E., & García-Calvo, T. (2014). Physical education lessons and physical activity intentions within spanish secondary schools: A self-determination perspective. *Journal of Teaching in Physical Education*, 33, 232-249.
- Savelsbergh, G. J., & Wormhoudt, R. (2018). Creating adaptive athletes: the athletic skills model for enhancing physical literacy as a foundation for expertise. *Movement & Sport Sciences-Science & Motricité*, 102, 31-38.
- Scanlan, T. K., & Lewthwaite, R. (1986). Social psychological aspects of competition for male youth sport participants: IV. Predictors of enjoyment. *Journal of Sport Psychology*, 8.
- Scanlan, T. K., & Simons, J. P. (1992). The construct of sport enjoyment. *Motivation in sport and exercise*, 199-215.
- Schmidt, R. A. (1975). A schema theory of discrete motor skill learning. *Psychological Review*, 82, 225.
- Sebanc, A. M. (2003). The friendship features of preschool children: Links with prosocial behavior and aggression. *Social Development*, 12, 249-268. doi: <https://doi.org/10.1111/1467-9507.00232>
- Sebire, S. J., Jago, R., Fox, K. R., Edwards, M. J., & Thompson, J. L. (2013). Testing a self-determination theory model of children's physical activity motivation: a cross-sectional study. *International Journal of Behavioural Nutrition and Physical Activity*, 10, 111. <https://doi.org/10.1186/1479-5868-10-111>
- Sebire, S. J., Standage, M., & Vansteenkiste, M. (2009). Examining intrinsic versus extrinsic exercise goals: Cognitive, affective, and behavioral outcomes. *Journal of Sport and Exercise Psychology*, 31, 189-210.
- Seifriz, J., Duda, J. L., & Chi, L. (1992). The relationship of perceived motivational climate to achievement-related affect and cognitions in basketball. *Journal of Sport & Exercise Psychology*, 14, 375-391.
- Shaw, C., Brady, L. M., & Davey, C. (2011). Guidelines for research with children and young people. London: National Children's Bureau.
- Sheldon, K. M., & Bettencourt, B. A. (2002). Psychological need-satisfaction and subjective well-being within social groups. *British Journal of Social Psychology*, 41, 25-38.
- Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need satisfaction, and longitudinal well-being: the self-concordance model. *Journal of Personality and Social Psychology*, 76, 482.
- Sherar, L. B., Esliger, D. W., Baxter-Jones, A. D., & Tremblay, M. S. (2007). Age and gender differences in youth physical activity: does physical maturity matter? *Medicine & Science in Sports & Exercise*, 39, 830-835.

- Shields, B. J., Palermo, T. M., Powers, J. D., Grewe, S. D., & Smith, G. A. (2003). Predictors of a child's ability to use a visual analogue scale. *Child: Care, Health and Development*, 29, 281-290.
- Shropshire, J., & Loumidis, K. (1996). Development of the pre-adolescent attitude toward physical education questionnaire. *Quality and Quantity Research Methods in Sport and Exercise Psychology*, 44-53
- Simpson, P., Howie, E., Williams, S., Neil, A., Morris, S., & Ng, L. (2017). The relationship between competence and enjoyment with physical activity in children: It depends on the dependent variable. *Journal of Science and Medicine in Sport*, 20, e77.
- Skinner, B. F. (1948). 'Superstition' in the pigeon. *Journal of experimental psychology*, 38, 168.
- Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology*, 11, 101-121.
- Smith, N., Quested, E., Appleton, P. R., & Duda, J. L. (2017). Observing the coach-created motivational environment across training and competition in youth sport. *Journal of Sports Sciences*, 35, 149-158.
- Smith, N., Tessier, D., Tzioumakis, Y., Quested, E., Appleton, P., Sarrazin, P., ... & Duda, J. L. (2015). Development and validation of the multidimensional motivational climate observation system. *Journal of Sport and Exercise Psychology*, 37, 4-22. doi: <https://doi.org/10.1037/t45326-000>
- Solmon, M. A., & Carter, J. A. (1995). Kindergarten and first-grade students' perceptions of physical education in one teacher's classes. *The Elementary School Journal*, 95, 355-365.
- Spessato, B. C., Gabbard, C., Robinson, L., & Valentini, N. C. (2013a). Body mass index, perceived and actual physical competence: the relationship among young children. *Child: Care, Health and Development*, 39, 845-850.
- Spessato, B. C., Gabbard, C., Valentini, N., & Rudisill, M. (2013b). Gender differences in Brazilian children's fundamental movement skill performance. *Early Child Development and Care*, 183, 916-923.
- Sport England. (2019). Physical activity – GOV.UK Ethnicity facts and figures. Retrieved from <https://www.ethnicity-facts-figures.service.gov.uk/health/diet-and-exercise/physical-activity/lates>
- Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, 95, 97.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, 75, 411-433.

- Standage, M., Gillison, F. B., Ntoumanis, N., & Treasure, D. C. (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. *Journal of Sport and Exercise Psychology*, 34, 37-60.
- Statistics, L. Determining the correlation coefficient. 2013.
- Stefanou, C. R., Perencevich, K. C., DiCintio, M., & Turner, J. C. (2004). Supporting autonomy in the classroom: Ways teachers encourage student decision making and ownership. *Educational psychologist*, 39, 97-110.
- Stein, M., Carnine, D., & Dixon, R. (1998). Direct instruction: Integrating curriculum design and effective teaching practice. *Intervention in School and Clinic*, 33, 227-233.
- Steward, M. S., Bussey, K., Goodman, G. S., & Saywitz, K. J. (1993). Implications of developmental research for interviewing children. *Child Abuse & Neglect*, 17, 25-37.
- Stodden, D. F., Gao, Z., Goodway, J. D., & Langendorfer, S. J. (2014). Dynamic relationships between motor skill competence and health-related fitness in youth. *Pediatric Exercise Science*, 26, 231-241.
- Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Robertson, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest*, 60, 290-306.
- Stone, W. L., & Lemanek, K. L. (1990). Developmental issues in children's self-reports. *Journal of Autism and Developmental Disorders*, 20, 513-522. <https://doi.org/10.1007/bf02216056>
- Tabachnick, B. G. & Fidell, L. S. (1983). *Using multivariate statistics*. Harper & Row.
- Tandon, P. S., Zhou, C., Sallis, J. F., Cain, K. L., Frank, L. D., & Saelens, B. E. (2012). Home environment relationships with children's physical activity, sedentary time, and screen time by socioeconomic status. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 88.
- Taylor, I. M., & Lonsdale, C. (2010). Cultural differences in the relationships among autonomy support, psychological need satisfaction, subjective vitality, and effort in British and Chinese physical education. *Journal of Sport and Exercise Psychology*, 32, 655-673.
- Taylor, I. M., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology*, 99, 747-760.
- Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 78.
- Teraoka, E., Ferreira, H. J., Kirk, D., & Bardid, F. (2020). Affective learning in physical education: a systematic review. *Journal of Teaching in Physical Education*.

- Terwee, C. B., Prinsen, C. A., Chiarotto, A., Westerman, M. J., Patrick, D. L., Alonso, J., ... & Mokkink, L. B. (2018). COSMIN methodology for evaluating the content validity of patient-reported outcome measures: a Delphi study. *Quality of Life Research*, 27, 1159-1170.
- Theeboom, M., De Knop, P., & Weiss, M. R. (1995). Motivational climate, psychological responses, and motor skill development in children's sport: A field-based intervention study. *Journal of Sport and Exercise Psychology*, 17, 294-311.
- Thelen, E., & Fisher, D. M. (1982). Newborn stepping: An explanation for a "disappearing" reflex. *Developmental Psychology*, 18, 760.
- Times Educational Supplement. (2018). What is pedagogy? Retrieved <https://www.tes.com/news/what-is-pedagogy-definition>
- Tompsett, C., Sanders, R., Taylor, C., & Cobley, S. (2017). Pedagogical approaches to and effects of fundamental movement skill interventions on health outcomes: A systematic review. *Sports Medicine*, 47, 1795-1819.
- Trost, S. G., Pate, R. R., Sallis, J. F., Freedson, P. S., Taylor, W. C., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise*, 34, 350-355.
- Trost, S. G., Pate, R. R., Saunders, R., Ward, D. S., Dowda, M., & Felton, G. (1997). A prospective study of the determinants of physical activity in rural fifth-grade children. *Preventive Medicine*, 26, 257-263.
- Tsangaridou, N., & Lefteratos, C. (2013). Elementary students' views and experiences on Sport Education in Cyprus. *Advances in Physical Education*, 3, 28.
- Turvey, M. T. (1977). Preliminaries to a theory of action with reference to vision. *Perceiving, Acting and Knowing*, 2.
- UK Chief Medical Officers' Physical Activity Guidelines. (2019). Retrieved https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/832868/uk-chief-medical-officers-physical-activity-guidelines.pdf
- Ulrich, D. A. (2013). The test of gross motor development-3 (TGMD-3): Administration, scoring, and international norms. *Spor Bilimleri Dergisi*, 24, 27-33.
- United Nations (1989). *Convention on the rights of the child*. Retrieved <https://www.ohchr.org/en/professionalinterest/pages/crc.aspx>
- United Nations Educational Scientific and Cultural Organisation. (2013). *World-wide survey of school physical education*. Retrieved <https://bit.ly/35QveBq>
- Utesch, T., Bardid, F., Büsch, D., & Strauss, B. (2019). The relationship between motor competence and physical fitness from early childhood to early adulthood: a meta-analysis. *Sports Medicine*, 49, 541-551.

- Valentini, N. C., & Rudisill, M. E. (2004). An inclusive mastery climate intervention and the motor skill development of children with and without disabilities. *Adapted Physical Activity Quarterly*, 21, 330-347.
- Valentini, N. C., Nobre, G. C., de Souza, M. S., & Duncan, M. J. (2020). Are BMI, Self-Perceptions, Motor Competence, Engagement, and Fitness Related to Physical Activity in Physical Education Lessons? *Journal of Physical Activity and Health*, 17, 493-500.
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In *Advances in experimental social psychology* (Vol. 29, pp. 271-360). Academic Press.
- Vallerand, R. J. (2007). Intrinsic and extrinsic motivation in sport and physical activity: A review and a look at the future.
- Vallerand, R. J., Blais, M. R., Brière, N. M., & Pelletier, L. G. (1989). Construction et validation de l'Échelle de motivation en éducation (EME) [On the construction and validation of the French form of the Academic Motivation Scale]. *Canadian Journal of Behavioral Science*, 21, 323-349.
- van Aart, I., Hartman, E., Elferink-Gemser, M., Mombarg, R., & Visscher, C. (2017). Relations among basic psychological needs, PE-motivation and fundamental movement skills in 9-12-year-old boys and girls in Physical Education. *Physical Education and Sport Pedagogy*, 22, 15-34.
- van Bruggen, S. G., Lameijer, C. M., & Terwee, C. B. (2020). Structural validity and construct validity of the Dutch-Flemish PROMIS® physical function-upper extremity version 2.0 item bank in Dutch patients with upper extremity injuries. *Disability and Rehabilitation*, 1-9.
- Van de Mortel, T. F. (2008). Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing*, 25, 40.
- Van Hees, V. T. (2020). *Accelerometer data processing with GGIR*. Retrieved <https://cran.r-project.org/web/packages/GGIR/vignettes/GGIR.html#citing-ggir>
- Van Hees, V. T., Gorzelniak, L., Leon, E. C. D., Eder, M., Pias, M., Taherian, S., ... & Brage, S. (2013). Separating movement and gravity components in an acceleration signal and implications for the assessment of human daily physical activity. *PloS One*, 8, e61691.
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23, 263. doi: <https://doi.org/10.1037/a0032359>
- Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., ... & Lonsdale, C. (2019). Self-determination theory applied to physical education: A systematic review and meta-analysis. *Journal of Educational Psychology*. doi: <https://doi.org/10.1037/edu0000420>

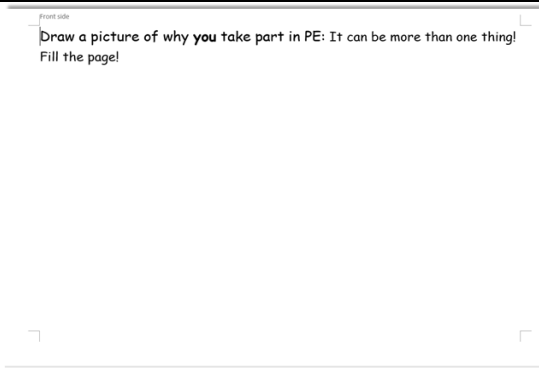
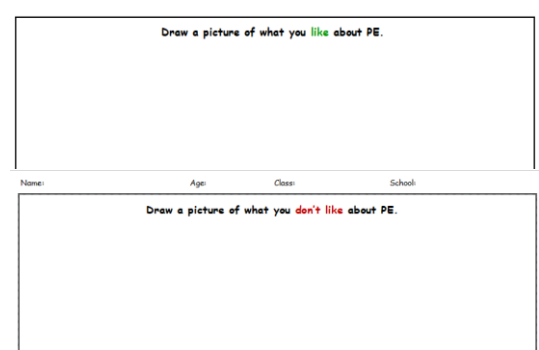
- Vecchione, M., Alessandri, G., & Marsicano, G. (2014). Academic motivation predicts educational attainment: Does gender make a difference? *Learning and Individual Differences, 32*, 124-131.
- Verloigne, M., Altenburg, T. M., Chinapaw, M. J. M., Chastin, S., Cardon, G., & De Bourdeaudhuij, I. (2017). Using a co-creational approach to develop, implement and evaluate an intervention to promote physical activity in adolescent girls from vocational and technical schools: a case control study. *International Journal of Environmental Research and Public Health, 14*, 862.
- Véronneau, M. H., Koestner, R. F., & Abela, J. R. (2005). Intrinsic need satisfaction and well-being in children and adolescents: An application of the self-determination theory. *Journal of Social and Clinical Psychology, 24*, 280-292.
- Vilagut G. (2014) *Test-Retest Reliability*. In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer.
- Voegtle, T. M. (2008). *A systematic review of community-based participatory research interventions in pediatric and adolescent populations* (Doctoral dissertation, The University of Texas School of Public Health).
- Vroom, V. (1964). Motivation and work.
- Wampold, B. E., Davis, B., & Good, R. H. III. (1990). Hypothesis validity of clinical research. *Journal of Consulting and Clinical Psychology, 58*, 360-367.
- Wang, J. J., Baranowski, T., Lau, P. W., Chen, T. A., & Zhang, S. G. (2016). Psychological correlates of self-reported and objectively measured physical activity among chinese children—Psychological correlates of pa. *International Journal of Environmental Research and Public Health, 13*, 1006.
- Wankel, L. M. (1993). The importance of enjoyment to adherence and psychological benefits from physical activity. *International Journal of Sport Psychology.*
- Warren, W. H. (2006). The dynamics of perception and action. *Psychological Review, 113*, 358.
- Washburn, R., & Kolen, A. (2018). Children's Self-Perceived and Actual Motor Competence in Relation to Their Peers. *Children, 5*, 72.
- White, M. D., & Marsh, E. E. (2006). Content analysis: A flexible methodology. *Library Trends, 55*, 22-45.
- Whitehead, M. (Ed.). (2010). *Physical literacy: Throughout the lifecourse*. Routledge.
- Whitehead, M. (Ed.). (2019). *Physical Literacy Across the World*. Routledge. <https://doi.org/10.4324/9780203702697>
- Wiering, B., de Boer, D., & Delnoij, D. (2017). Patient involvement in the development of patient-reported outcome measures: a scoping review. *Health Expectations, 20*, 11-23.

- Wolters, C. A. (2004). Advancing Achievement Goal Theory: Using Goal Structures and Goal Orientations to Predict Students' Motivation, Cognition, and Achievement. *Journal of Educational Psychology, 96*, 236.
- Woods, S. E., Springett, J., Porcellato, L., & Dugdill, L. (2005). 'Stop it, it's bad for you and me': experiences of and views on passive smoking among primary-school children in Liverpool. *Health Education Research, 20*, 645-655.
- World Health Organisation. (n.d.). *Early child development*. Retrieved <https://www.who.int/topics/early-child-development/en/>
- World Medical Association. (2001). World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Bulletin of the World Health Organization, 79*, 373.
- Wu, X. Y., Han, L. H., Zhang, J. H., Luo, S., Hu, J. W., & Sun, K. (2017). The influence of physical activity, sedentary behavior on health-related quality of life among the general population of children and adolescents: A systematic review. *PloS One, 12*, e0187668.
- Xiang, P., Ağbuğa, B., Liu, J., & McBride, R. E. (2017). Relatedness need satisfaction, intrinsic motivation, and engagement in secondary school physical education. *Journal of Teaching in Physical Education, 36*, 340-352.
- Xiang, P., McBride, R. E., & Solmon, M. A. (2003). Motivational climates in ten teachers' elementary physical education classes: An achievement goal theory approach. *The Elementary School Journal, 104*, 71-91.
- Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J., & Nurmi, J. E. (2009). Relationships between physical education students' motivational profiles, enjoyment, state anxiety, and self-reported physical activity. *Journal of Sports Science & Medicine, 8*, 327.
- Youth Sport Trust (2018). TOP PE [Online]. Loughborough: Youth Sport Trust

Appendices

Appendix A: Full iteration matrices for each aspect of the MAT-PE

Enjoyment of PE

Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
1	An A4 piece of paper with the following instruction at the top of the page: Draw a picture of why you take part in PE: It can be more than one thing! Fill the page!	All children within the sample took part. Pictures varied highly in quality and relevance.		The class teacher highlighted the abstract nature of the task request. Discussions with the expert panel resulted in the task instruction and set-up be changed to a double-sided A4 piece of paper with the instructions: Draw a picture of what you like about PE [one side] Draw a picture of what you don't like about PE [other side]
2	An A4 double-sided piece of paper asked the children to draw a picture of what they like and don't like about PE.	All children within the sample took part. Pictures were of better quality and more relevant to the task instruction.		The research group determined that the instruction was clearer for the children. It was also decided that enjoyment could be determined more directly through this task than through interpretation of pictures through the "why" question in the last version.

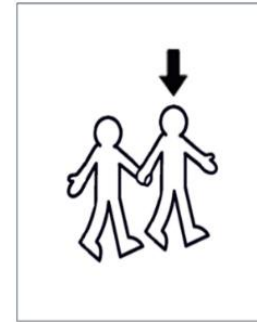
Relatedness Need Satisfaction

Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
1	<p>A Harter/Barnett type pictorial questionnaire was used with the stems:</p> <p>“When you were in this PE lesson, did your teacher talk to you not talk to you?”</p> <p>“When you were in this PE lesson, did you talk to or work with your friends?”</p>	<i>Not tried with children.</i>	N/A	The research group deemed the statements may be too broad and not harness the essence of relatedness.
2	<p>My teacher always helps me in PE- My teacher never helps me in PE</p> <p>My teacher likes me- My teacher doesn't like me</p> <p>My teacher shouts at me in PE- My teacher is nice to me in PE</p> <p>My teacher always helps me to do my best in PE-My teacher tells me off a lot</p> <p>My teacher listens to me in PE- My teacher doesn't listen to me in PE.</p> <p>My teacher cares about me in PE- My teacher doesn't care about me in PE</p>	<i>Not tried with children</i>	N/A	It was suggested that these stems mix between need support and need satisfaction. Further development of these stems was suggested for conceptual understanding and refining of items. It was also suggested that development start upon a peer related item.

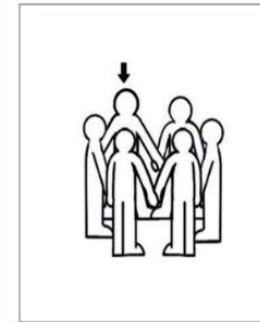
3

My teacher lets me play with my friends in PE-My teacher doesn't let me play with my friends
 "This child has many friends to play with in PE/This child doesn't have many friends to play with in PE."
 "This child's PE teacher likes them/This child's PE teacher doesn't like them."
 These stems had pictures to go with them so the children would have something to focus on and with which to engage.

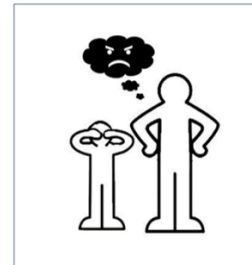
Not tried with children



This child doesn't have many friends in PE



This child has many friends in PE



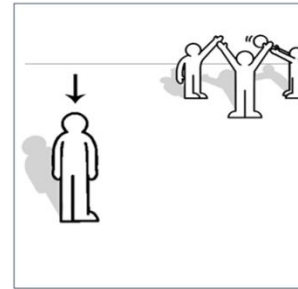
This child's teacher doesn't like them



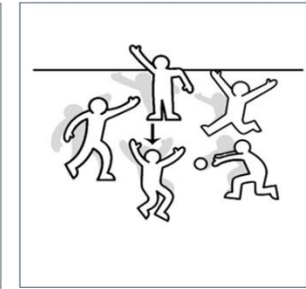
This child's teacher does like them

Pictures were created for peer relatedness and it was suggested that the pictures be PE specific.

- 4 The peer relatedness pictures were altered to be more PE specific. *Not tried with children*



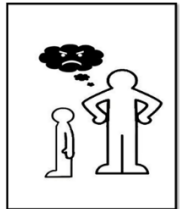

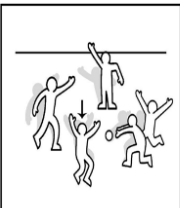
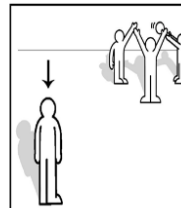
This child doesn't have many friends in PE



This child has many friends in PE

It was suggested to have two separate types of resources (male/female). To avoid extreme language, it was suggested that on the PE teacher relatedness stems it should be changed to "this girl/boy's teacher doesn't like them very much." It was also suggested to contrast the expression clouds on the teacher relatedness pictures.

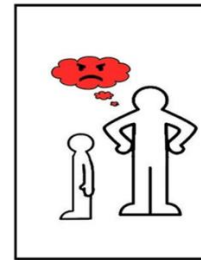
During Phase 1

Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
5	Pictures were developed for both teacher and peer relatedness items alongside stem development. Teacher expression clouds were coloured black for angry, white for happy.	Through trialling this aspect in three schools, it was necessary to explain the pictures to the children to ensure clarity.	 <p>This girl's teacher doesn't like her very much</p>  <p>This girl's teacher likes her a lot</p>  <p>This girl has lots of friends to play with in PE</p>  <p>This girl doesn't have lots of friends to play with in PE</p>	It was suggested that perhaps colour could be used in the teacher relatedness pictures to aid understanding.

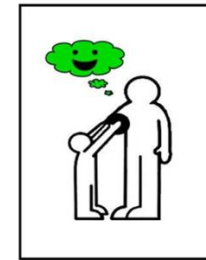
6

On the teacher relatedness pictures, the clouds were either red (angry) or green (happy).

Trialling this iteration didn't lead to any marked improvement in understanding on the child's part.

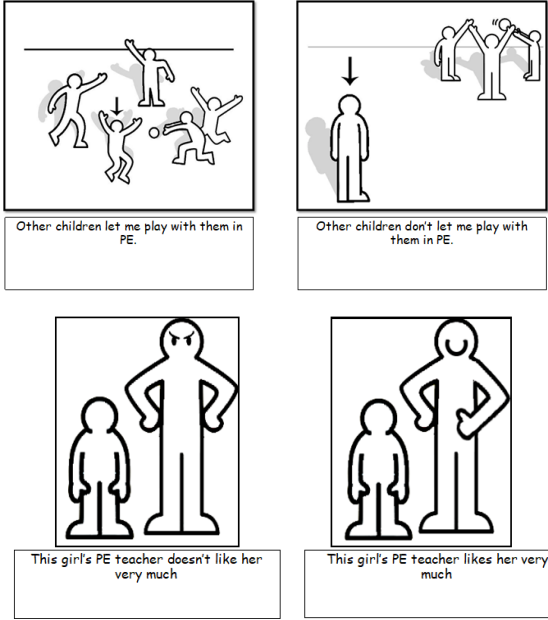


This boy's teacher doesn't like him very much

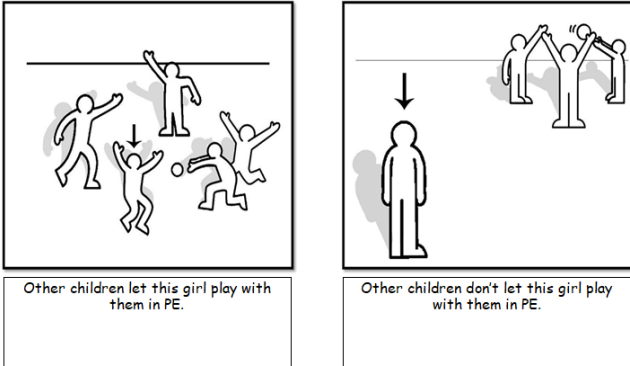


This boy's teacher likes him a lot

It was suggested that using colour would cause problems for colour-blind children. It was recommended that colour be taken out with the expression to be placed on the teacher's face rather than in the clouds. Conceptual understanding of peer relatedness was developed and it was suggested that the stem be changed but the pictures to stay the same.


7	<p>Within the peer relatedness pictures, the stem was changed to:</p> <p>“Other children let me play with them in PE.”</p> <p>“Other children don’t let me play with them in PE.”</p> <p>The teacher relatedness pictures were altered and made PE teacher specific within the stem.</p>	Not tried with children	 <p>Other children let me play with them in PE.</p> <p>Other children don't let me play with them in PE.</p> <p>This girl's PE teacher doesn't like her very much</p> <p>This girl's PE teacher likes her very much</p>	<p>The stems had changed structurally to initially support the new stem formation so it was suggested to revert back to the old structure to maintain consistency.</p> <p>The PE teacher resource was deemed the final one.</p>
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During Phase 2

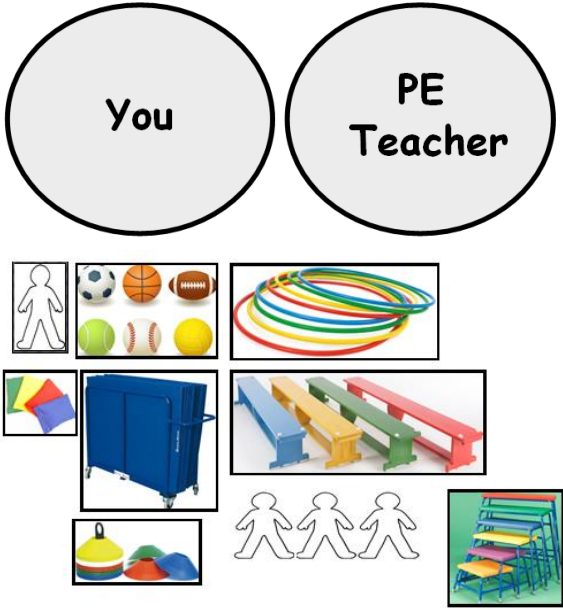
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
8	<p>The peer relatedness pictures' stems were changed to:</p> <p>“Other children don’t let this girl play with them in PE.”</p> <p>“Other children let this girl play with them in PE.”</p>	<p>The child was first asked what they thought was happening in the pictures. The majority of the children understood what scenario the pictures represented. Confusion was minimised and clarity was gained from their answers.</p>	 <p>Other children let this girl play with them in PE.</p> <p>Other children don't let this girl play with them in PE.</p>	<p>This iteration was deemed the final one.</p>

Autonomy Need Satisfaction

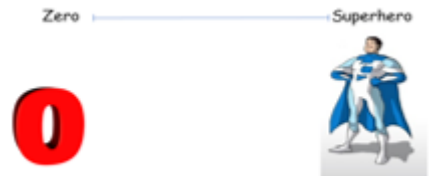
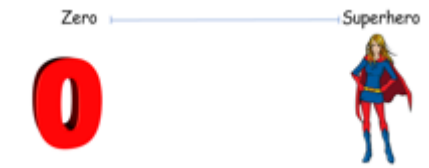
Before Phase 1				
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
1	Contained questions such as: “How are you feeling in this picture?” (their PE picture) “What is making you feel X?” Why are you doing X?” “Did you feel like you could choose what you wanted to do?” “Did you enjoy being able to choose?”	<i>Not tried with children.</i>	N/A	It was put forward to emulate the Harter/Barnett type of two layers of questioning i.e. Option 1 or 2, a lot or not a lot, looking exclusively at need satisfaction.
2	“My teacher lets me choose what to do in PE” or “My teacher tells me what to do in PE.” “My teacher lets me choose what we can play in PE” or “My teacher tells us what to play in PE” “I like PE” or I don’t like PE.”	<i>Not tried with children.</i>		It was suggested that this stage needed an activity rather than a list of statements to keep the children engaged and to be consistent with the previous activity.

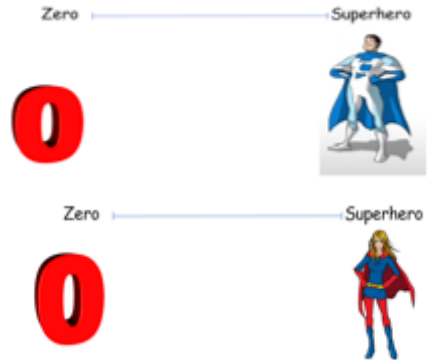
During Phase 1				
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
3	Activity changed to be pictorial-based where a picture of a child was placed in front of the child and two thought bubbles were given as choices: one contained different equipment and the other the choice of whether they could choose which friends they worked with during PE.	<p>It was explained that the child silhouette was them in PE. In one thought bubble there were different types of PE equipment. The children were then asked whether they could choose equipment in PE and if so, to move the bubble over the child silhouette. The other bubble was explained that there are children in PE that we might be able to choose to work with in pairs and/or groups and they were asked whether they could choose who they worked with. If so, they were to move that bubble over to the child silhouette. They were then asked if they could give an example of when they could choose equipment and/or children</p>		<p>It was deemed that although the activity had the children engaged, it may not be giving much detail about the choices they make in PE. Separating the selection of choices further was developed.</p>

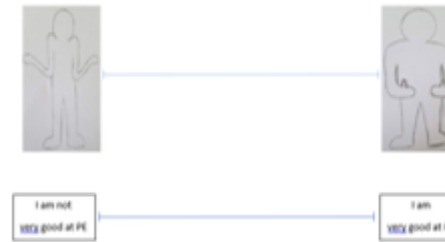
During Phase 2

Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
4	<p>A plate with “PE teacher” and a plate with “You” was created. A choice of equipment was put together as individual choices so the children could pick which equipment they might choose. Child silhouettes depicting working in pairs and working in groups were also created. After the pictures had been sorted, each child was asked:</p> <p>Do you ever get to choose the activities that you do in PE or does the PE teacher choose for you?</p> <p>Do you ever get to choose how you do the movements or actions in PE or does the PE teacher show you and tell you how to do them?</p> <p>Does your PE teacher listen to you?</p> <p>Does your PE teacher answer your questions?</p>	<p>Children were shown both plates and it was explained that the “you” plate was theirs and the PE teacher plate was for their PE teacher. They were then shown a series of pictures depicting peer working, small equipment and large equipment. They were then asked which things could they choose in their PE lessons and which things they couldn’t. Once they’d placed the different pictures in both plates, they were asked if they could recall a time where they got to choose these things and not choose these things. Children were able to answer the follow-up questions.</p>		<p>The activity was broken down so that more detail could be explored around the choices they make within PE and captured organisational and procedural autonomy. Adding these follow-up questions added extra depth to the autonomy construct by adding more cognitive autonomy aspects This was deemed the final iteration.</p>

Competence Need Satisfaction

Before Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
1	A sheet of one-sided paper including a 10cm visual analogue scale, anchored by “zero” (accompanied with a picture of a zero) at one end, and “superhero” (accompanied by a picture of a superhero) at the other. There is a male and female version. “How good are you at PE?” Zero means “not very good” and superhero means “amazing.” Child is also told that they may be somewhere in the middle. The child is told to point along the line as to where they think they lie on the continuum. They are then asked “How do you know that you’re there on the line?” and “Do you think PE easy or hard, why?”	<i>Not tried with children.</i>	 <p>The resource shows a horizontal line with a blue arrow pointing from left to right. At the left end is the word "Zero" and at the right end is the word "Superhero". Below the line, on the left, is a large red number "0". On the right is a picture of a male superhero in a blue and white suit with a cape.</p>  <p>The resource shows a horizontal line with a blue arrow pointing from left to right. At the left end is the word "Zero" and at the right end is the word "Superhero". Below the line, on the left, is a large red number "0". On the right is a picture of a female superhero in a blue and red suit with a cape.</p>	“How do you know that you’re there on the line?” changed to “Tell me why you have put your mark here.”

During Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
2	The question “How do you know that you’re there on the line?” was changed to “Tell me why you have put your mark here.”	Children seemed to be drawn to the superhero pictures, regardless of gender, presenting bias towards more positive pictures rather than an attempt at considering competence within PE.	N/A	It was suggested “not too good” and “really good” be used instead of “not very good” and “amazing” to be more in-line with the pictorial scales used in other aspects. <i>Suggestion was seen too late before administering to children.</i> The research group suggested that other forms of pictures should be used to anchor the visual analogue scale and perhaps a text only version to account for any pictorial bias.
3	Three representations of competence scale were presented to each child (superhero scales determined by gender). The child was given the same procedure but for each one. First being the zero to superhero, second being the unsure picture to thumbs up picture, third being “I am not very good at PE” to “I am very good at PE” in text form only.	Children seemed to give more thought into their responses on the unsure and thumbs up picture line and the text line.		Although the children seemed to think more about their answers before marking the line, they did not understand the concept of the visual analogue scale. It was suggested to try a star rating scale instead.



4

The sheet of paper included pictures of stars from 1 to 5, horizontally along the page. Above 1 star was a picture of an unsure gender/ethnically neutral picture. 2, 3 and 4 stars were shown but without pictures above them. Over 5 stars, a picture of three different children demonstrating different skills was shown. 1 star meant "Some children can't do many things in PE" and 5 stars meant "Some children can do many things very well in PE." The stars in the middle were explained to the child that some children are neither not very good nor very good at things in PE but somewhere in the middle. They were then asked, "How good do you think you are in PE? How

Children understood the star system and gave varying answers (indicating sensitivity) with relevant justifications.



It was suggested that the middle stars may need to be represented pictorially with a progression of skills but without biasing the children's answers by giving them examples. All pictures were to be gender and ethnically neutral.


many stars would you give yourself? Why?"

- 5 Gender and ethnically neutral humanoid pictures were created for each star rating. The 2, 3 and 4 stars were represented by figures juggling progressively more objects to demonstrate that they could do more things in PE. The 5-star representation was changed to a smiling figure with thumbs up.

Not tried with children.



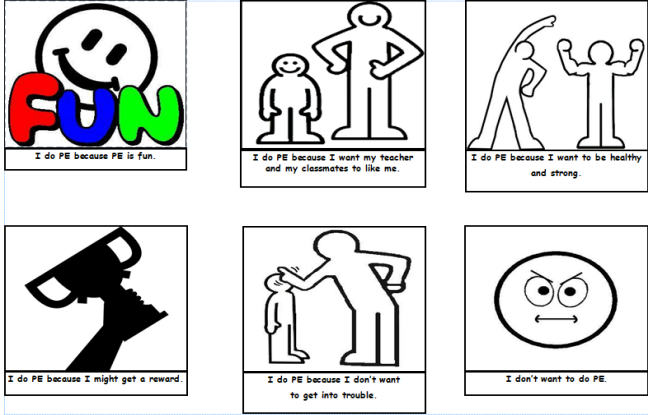
It was suggested that the older version of pictures was clearer. To make sure that the gaps between the ratings were clear so that children could pick in between them. After more discussion it was decided to try out displaying different fundamental movement skills according to the national curriculum along the top of the page with the star rating along the bottom. Children can look at all the skills involved within Key Stage 1 PE and judge whether they think they are good at them or not and then to give themselves a star rating. This would then be discussed between researcher and child.

During Phase 2				
Iteration	Description of version	With children	Resource	Recommended changes
6	Gender-neutral figures depicting fundamental movement skills included within the national curriculum for Key Stage 1 along the top. A five-star rating running along the bottom.	Children were asked what each skill was and the vast majority answered correctly. It was explained that a child who could do all of these skills really well all the time would get five stars. A child who could do most things most of the time would get four stars. A child who could do some things some of the time would get three stars. A child who could maybe do a couple of things would get two stars. A child who could maybe do 1 thing would get one star. How many stars would they give themselves for doing things in PE? Why would you rate yourself as (5, 4, 3, 2, 1) stars? Some children wanted to give isolated scores for each skill so this was incorporated into the method.		This iteration was deemed most appropriate with full use of follow-up questions to clarify children's and researcher's understanding of what was being said.

Behavioural Regulation

During Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
1	Seven pictures were taken from a Google images search. These pictures were to be used as pictorial representations for each type of regulation on the self-determination continuum. Stems were written based upon selections within self-determination-based questionnaires within PE. Language was simplified to be appropriate for five years old to understand but not necessarily to read.	Each picture and stem were explained to the child one at a time. Introjection contained the word guilt which is a complex emotion therefore when introducing the introjection picture, each child was asked whether they knew what guilty meant. Only one child approached the correct answer therefore it was deemed that in general, five-year olds do not understand the word guilt especially when attributed to not doing an activity. Children were told that each picture represented all the reasons why we might do PE. They were asked to pick their favourite, placing no lower or upper threshold in the amount they chose. From these choices, they were then asked to place them in order of importance.	N/A	Debate was held over whether to keep both positive and negative aspects of external regulation within the method as theoretically they originate from the same psychological principle. However, it was felt to be important to give the children the option of both as they may relate to one but not the other, or both. It was decided that more thought was needed and reading required to theoretically support and inform the stems used.

2	An attempt was made at developing the stems, concentrating on the wording of each.	<i>Not used with children</i>	It was advised that more reading was required to fully understand how each stem could fully represent the aspect of regulation in question yet maintaining a simplicity so that children could understand.
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During Phase 2				
Iteration	Description of version	With children	Resource	Recommended changes
3	Extensive reading led to developed stems alongside a rationale for their inclusion. Pictures were created for the method to maintain consistency across all stages. Amotivation was included through three formats as three exist according to SDT literature.	The method was trialled on two children that included the new pictures, the developed stems, three levels of amotivation and follow up questions based from the SDT literature depending on which reasons they picked. Full method took ~20 minutes per child.	 <p>The resource consists of six illustrations arranged in a 2x3 grid, each with a caption below it:</p> <ul style="list-style-type: none"> Top-left: A smiley face with the word "FUN" in large, colorful letters below it. Caption: "I do PE because PE is fun." Top-middle: A small stick figure standing next to a larger stick figure. Caption: "I do PE because I want my teacher and my classmates to like me." Top-right: A stick figure performing a yoga-like stretch. Caption: "I do PE because I want to be healthy and strong." Bottom-left: A hand holding a megaphone. Caption: "I do PE because I might get a reward." Bottom-middle: A stick figure being pulled back by another stick figure. Caption: "I do PE because I don't want to get into trouble." Bottom-right: A stick figure with a sad, angry facial expression. Caption: "I don't want to do PE." 	<p>It was deemed that this iteration would provide the most depth in regards to their motivation in PE.</p> <p>It was also decided that only one choice for amotivation should be used and "I don't want to do PE" was retained.</p>

Appendix B: MAT-PE codebook

MAT-PE

Codebook Instructions

Instrument purpose: To explore and quantify young children's (ages 5-7) enjoyment, basic psychological needs satisfaction and self-determined motivation within Physical Education lessons.

Note: The DWST tool was created exclusively to explore children's motivation within Physical Education classes and in its current form, cannot be used to explore self-determined motivation in other areas.

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Purpose

The Motivational Assessment Tool for Physical Education (MAT-PE) is a mixed-method tool designed to explore self-determined motivation in children aged between five and seven years within a Physical Education context. It also explores children's likes and dislikes around PE (enjoyment), their perceived relatedness, perceived autonomy and perceived competence. Knowledge of Self-determination Theory (Ryan & Deci, 2017) is necessary to use this codebook effectively and efficiently.

Rationale

When children enjoy a subject and feel that they are good at it, their participation in the subject will outlast children who do not enjoy it and do not feel competent in it. This continued participation leads to the development of many outcomes such as social, cognitive and physical. Young children start to become more self-aware and begin to compare themselves to others when they reach around eight years of age which can either set themselves upon a spiral of engagement or disengagement (Stodden, Goodway, Langendorfer, Robertson, Rudisill, Garcia & Garcia, 2008). If a child perceives to have autonomy, competence and relatedness (basic psychological needs) within their PE environment then they are hypothesised to be more autonomously motivated than a child who does not (Ryan & Deci, 2017). A child who is more autonomously motivated within an environment are more likely to remain engaged and therefore all learning environment should seek to support the satisfaction of these needs.

Summary

The DWST tool can be used to explore children's perceptions of their PE environments and the basic psychological needs it provides as well as the type of self-determined motivation they experience. This tool could be used to assess how well PE environments encourage children's basic psychological need satisfaction as well as determining how different motivational climates and teaching styles impact children's self-determined motivation. Scores from this tool can provide practitioners with a motivational profile and corresponding advice is given for each profile type at the end of the tool.

Validity & Reliability

TBC

Glossary

Action: Whole or part body movements and actions performed by pupils during Physical Education (PE). Actions within the context of this codebook are skill-based and relate to different movements, for example, running, balancing and throwing.

Activity/ies: Games or activities incorporated within a PE lesson that are designed to help pupils meet the learning outcomes. Games or activities can be performed by pupils on an individual basis or in pairs/groups, with or without equipment, and with or without rules.

Articulate: The child verbally responds to the question/prompt from the researcher in a coherent manner where the content of their response corresponds with the question being asked.

Deep level: The child provides detailed information and/or gives coherent examples in their verbal response to posed by questions and/or probes.

Irrelevant response: The child has articulated an answer that is not relevant to the question posed. For example, the researcher may ask, "Why do you like PE?" An irrelevant answer to this question may be, "Because I like playing with Grandpa." As Grandpa does not take part in PE, this is counted as an irrelevant response. If a child provides an irrelevant answer, it is to be coded under surface level response (see surface level).

Movement: The act of moving in a certain way either directed by the teacher (verbally and/or through demonstration) or by the child.

PE Teacher: Within the context of this codebook, the PE teacher is the person delivers the PE lesson to the child's class. This person could be their class teacher, specialist PE teacher or an external coach.

Surface level: The child provides limited or no new information in their verbal response to posed primary questions and/or probes. Responses are generally short, either stating they do not know, or stating that something is the way it is because it is.

Abbreviations

C: Child participant.

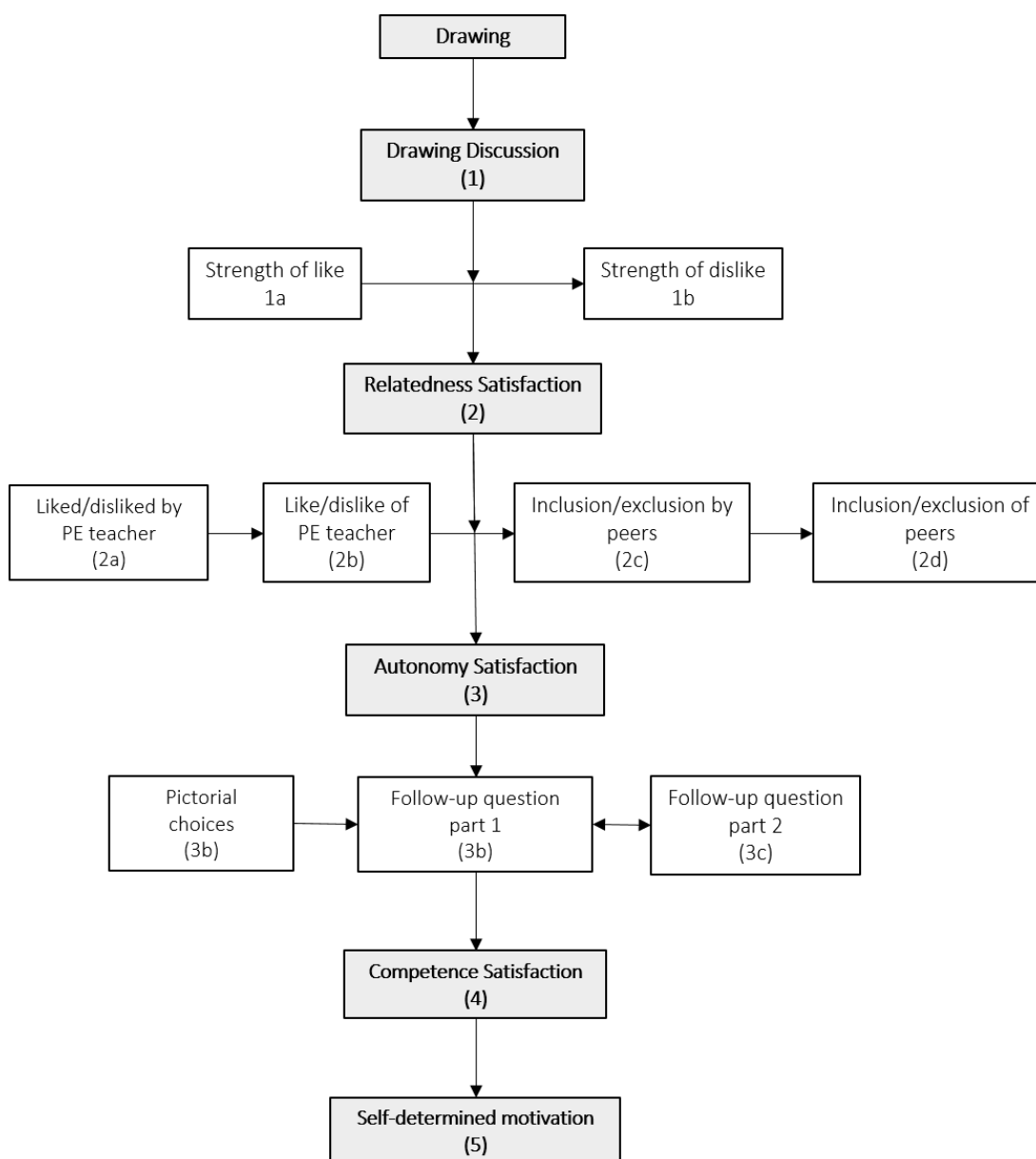
N/A: Not applicable. An option which comes under some of the sections within the method. This is chosen when the child has failed to make a choice, whether by pointing to or by verbalising, or because they do not know, even with help from the researcher.

PE: Physical Education.

R: Researcher conducting the method.

General codebook instructions

- a) You will require a copy of the codebook and a transcript of a child who completed the DWST tool.
- b) The codebook is separated into five themes and their respective topics, outlined below:



- c) In the codebook, each theme is titled at the top of the page along with the question(s) for each topic.
- d) The questions for each topic are embedded within the transcripts and act as a guide as to where each topic starts.
- e) Each transcript runs as follows:
 - Icebreaker (*does not need to be coded*)
 - Drawing discussion (Strength of like/dislike PE)
 - Relatedness (Liked by teacher, Like of teacher, Inclusion by peers and Inclusion of peers)
 - Autonomy (Pictorial choices and follow-up questions part 1 and 2)
 - Competence
 - Self-determined motivation
- f) Coding is based on the child's choices and their level of articulation (deep or surface/irrelevant; see glossary for definitions) throughout the codebook.
 - a. The same coding format is applied for the drawing discussion, relatedness/autonomy/competence satisfaction themes.
 - b. A different coding format is applied for the self-determined motivation theme and is explained in more detail on page 23 of the instruction manual.
- g) Coding for each topic within its theme is explained in the following pages preceded by the theoretical underpinning for each topic and an overview of the tool activity.

Tool Overview

Construct: Enjoyment

Drawing activity

Drawings are created within the classroom setting however, children are instructed to work independently. The children are instructed to “Draw a picture of what you like about PE” on one side of A4 paper. The children are also instructed to “Draw a picture of what you don’t like about PE” on the other side of the same A4 piece of paper. They are told that drawing on either side is optional, for example, they do not have to draw on the disliked side if they cannot think of anything they do not like about PE. Colouring and labelling of the drawing is encouraged although it is not mandatory. The children have 30 minutes to complete the task.

Icebreaker: Pair matching game

Once the child is settled before the one-to-one activities, introduce the pair-matching icebreaker task. Explain to the child that the aim is to remember where all the cards are while face up. Once the cards are face down, the child is to flip two cards they think are matching. If they are wrong, the cards are flipped face down again. The child is encouraged to try and flip two matching cards until all cards remain face up. The task can be made more challenging by adding more cards to remember. This is posed as an option to the child who can decline if they don’t wish to make it more challenging. Continue until the child has started talking and seems comfortable but should not exceed 10 minutes in duration.

Drawing activity: Enjoyment part 2 - discussion

The child is reminded of the drawing task and is asked, “what have you drawn here?” The child is encouraged to describe their drawings as fully as they can through prompts given by the researcher (e.g. Who is this? What are they doing here? What is that?) A follow-up question is posed to determine why they like or dislike the things they have drawn (depending on which side of paper they are discussing). The child is encouraged to fully explain why they like or dislike each drawing they have produced.

Construct: Relatedness Satisfaction

Topic: Liked/disliked by PE teacher

The child is shown two pictures with contrasting themes. In this topic, the first picture is stemmed with “This girl’s/boy’s teacher likes them very much” and the second stemmed with “This girl’s/boy’s teacher doesn’t like them very much.” The child is asked to pick which boy/girl they feel is most like them. After the child picks, the researcher asks one of two follow-up questions: “how do you know your teacher likes you?” or “how do you know your PE teacher doesn’t like you?” The child is encouraged to explain to the best of their ability why they have picked that particular picture.

Topic: Like/dislike of PE teacher

The researcher asks, “Do you like your PE teacher?” follow-up by why they think this. The child is encouraged to fully explain why they like or dislike their teacher. No resources are used for this topic.

Topic: Inclusion/Exclusion by peers

The child is shown two pictures with contrasting themes. In this topic, the first picture is stemmed with “Other children let this girl/boy play with them in PE” and the second is

stemmed with “Other children don’t let this girl/boy play with them in PE.” The child is asked to pick which boy/girl they feel is most like them. After the child picks, the researcher asks one of two follow-up questions: “can you tell me about a time when other children let you play in PE?” or “can you tell me about a time when other children didn’t let you play in PE?” The child is encouraged to explain to the best of their ability why they have picked that particular picture.

Topic: Inclusion/Exclusion of peers

The researcher asks, “Do you let other children play with you in PE?” The follow-up question is determined by their answer. If the child says that they do let other children play with them, the researcher asks, “Do you let them play all the time or most of the time?” If they said no to the first question, the researcher asks, “Do you not let them play all the time or most of the time?” If the child says they let other children play they are next asked, “Is it important to let other children play in PE?” and then “why is it important to let other children play in PE?” If the child says they do not let children play, the researcher asks, “Why don’t you let other children play in PE?” The child is encouraged to fully explain why they include or exclude their peers. No resources are used for this topic.

Construct: Autonomy satisfaction

Topic: Pictorial choices

The resources for this topic include 9 pictures depicting partner work, group work, small equipment and large equipment typically found in PE lessons. They are also given two “plates” which are two laminated discs with either “You” or “PE teacher” printed in the centre. The researcher states that sometimes in PE, the child might get to choose certain things in PE like the partner they work with, what they do and how they do it and sometimes the PE teacher might get to choose these things. The child’s task is to sort the pictures that they choose and place on their plate and the pictures the PE teacher chooses onto the “PE teacher” plate. The researcher will ask for examples for pictures that the child chooses in PE and if they get to choose them all the time or sometimes.

Topic: Follow-up question part 1

The researcher asks the child two questions: “Do you ever get to choose the activities that you do in PE?” and “Do you ever get to choose how you do certain movements or does the PE teacher show you and tell you how to do those movements?” The child answers either yes, no or sometimes. There are no resources for this topic.

Topic: Follow-up question part 2

The researcher asks the child two questions: “If you have something to say to your PE teacher, do they listen to you?” and “If you have a question for your PE teacher, do they answer it?” The child answers either yes, no or sometimes. There are no resources for this topic.

Construct: Competence satisfaction

The child is shown a laminated A4 piece of paper that is divided into two sections. The top section depicts common skills performed in PE such as running, jumping, catching and throwing. The bottom section shows a five-star rating scale (1=not very good at things in PE to 5=very good at things in PE). The researcher asks, “How good are you at doing things in PE?” The child indicates which star they feel they most align with. The researcher asks, “How do you know you’re ... stars?” The child is encouraged to explain why they think they are the star rating they have chosen.

Construct: Self-determined motivation

The child is introduced to each type of motivation regulation as reasons for taking part in PE. Each reason is shown to the child in their turn and their stems read aloud. Once all reasons are in front of the child, the researcher asks, "Out of all these reasons, what would be your most favourite reasons for doing PE?" The child picks any reasons they like which can range from none to all of them. The researcher then goes through each reason, one by one, asking the designated follow-up question for each. Once this has been done, the child is asked to place the reasons in order of importance with the first being the most important reason for doing PE to the last and least important reason for doing PE. The child can assign more than one reason to an ordinal position.

Overview of MAT-PE Interview Questions

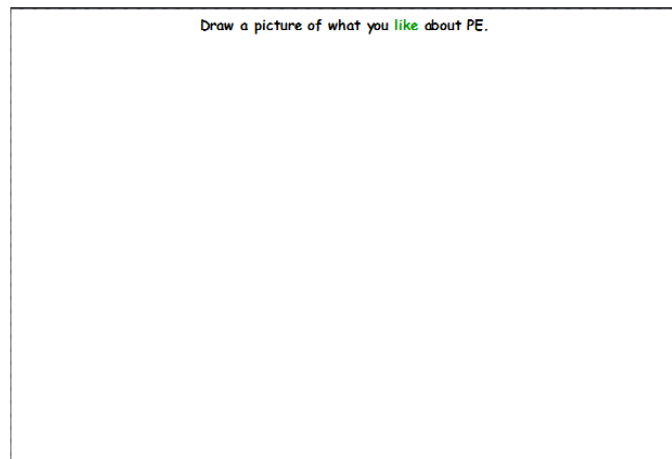
Theme	Topic	Question(s)	Probes
Likes/Dislikes about PE	Likes about PE	<i>I asked you to draw a picture of what you like about PE, what have you drawn here?</i>	Why do you like...?
		<i>OR</i>	
		<i>You haven't drawn anything, why is that?</i>	
	Dislikes about PE	<i>I asked you to draw a picture of what you don't like about PE, what you have drawn here?</i>	Why don't you like...?
		<i>OR</i>	
		<i>You haven't drawn anything, why is that?</i>	
Relatedness	Liked by PE teacher	<i>This girl's/boy's PE teacher likes her very much, this girl's/boy's PE teacher doesn't like her very much, which girl/boy are you most like?</i>	<i>How do you know your PE teacher likes/doesn't like you?</i>
	Like of PE teacher	<i>Do you like your PE teacher?</i>	Why?
	Inclusion by peers	<i>Other children let this girl/boy play with them in PE, other children don't let this girl/boy play with them in PE, which girl/boy are you most like?</i>	<i>Can you tell me about a time when other children let you play with them in PE?</i>
	Inclusion of peers	<i>Do you let other children play with you in PE?</i>	<i>Can you tell me about a time when other children didn't let you play with them in PE?</i> Why?
Autonomy	Pictorial choices	<i>I've got some pictures here and I want to know which things you get to choose and which things your teacher gets to choose.</i>	<i>Can you tell me about a time you got to choose...?</i>
			<i>Do you get to choose this all the time or sometimes?</i>

	Autonomy supportive PE teacher part 1	<p><i>Do you ever get to choose the activities you do in PE or does the PE teacher?</i></p> <p><i>Do you ever get to choose the movements you do in PE or does the PE teacher show you and tell you what to do?</i></p>	<p><i>Do you/they get to choose all the time or sometimes?</i></p> <p><i>Do you/they get to choose these all the time or sometimes?</i></p>
	Autonomy supportive PE teacher part 2	<p><i>Does your PE teacher listen to you if you have something to say to them?</i></p> <p><i>Does your PE teacher answer any questions you might have?</i></p>	<p><i>Do they listen all the time or sometimes?</i></p> <p><i>Do they answer your questions all the time or sometimes?</i></p>
Competence	Overall competence	<i>How many stars would you give yourself for doing things in PE?</i>	<i>Why would you give yourself...star(s)?</i>
Self-determined motivation	Regulation type	<i>Out of all these reasons, which are your favourite reasons for doing PE?</i>	Intrinsic: Why is PE fun?
			Identified: Why is being healthy and strong important to you?
		<i>Now that you have chosen your reasons for taking part in PE, can you put them in order of importance for you? With first being most important and the last being the least important. More than one reason can be placed in the same position, for example, I do PE because PE is fun and I do PE because I want to be healthy and strong can be number one.</i>	Introjected: Why is it important that your teacher and classmates like you?
			Do you ever feel like you need to do PE to show other children and teacher how good you are at PE?
			External (reward): Do you get rewards in PE? What rewards do you get in PE?
			External (punishment): If you knew you wouldn't get into trouble, would you still want to do PE? Why?
			Amotivation: Why don't you want to do PE?

Likes PE | Strength of Liking PE | Activity 1a (Drawing)

Tool activity:

The child is reminded of the drawing task and is asked, “What have you drawn here?” The child is encouraged to describe their drawings as fully as they can through prompts given by the researcher (e.g. Who is this? What are they doing here? What is that?) A follow-up question is posed to determine why they like the things they have drawn. The child is encouraged to fully explain why they like each drawing they have produced.

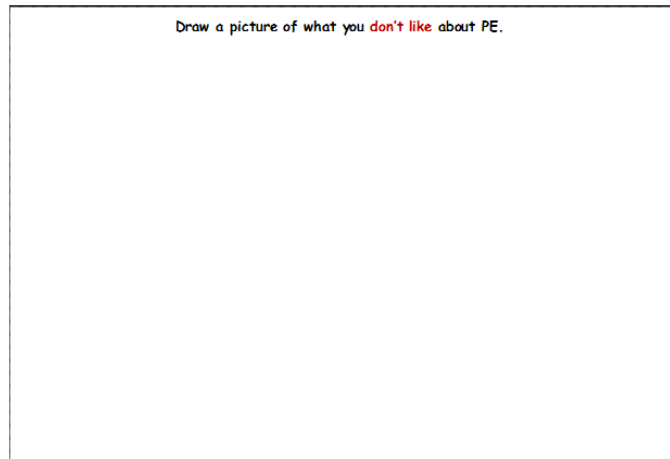


1. Find the section of the transcript that starts with the researcher asking, “I asked you to draw a picture of what you like about PE, what have you drawn here?”
2. The child will either describe their picture and/or the researcher will ask prompts for more detail.
3. The researcher will next ask the follow-up question, “Why do you like...?”
4. The response to this follow-up question (Why do you like...?) and the drawing is used to determine the code given (1-4).
5. Use the descriptions and examples on page 3 and 4 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding “code.”
7. Write in the “coder’s comments” box if the child says anything noteworthy.

Dislikes PE | Strength of Disliking PE | Activity 1b (Drawing)

Tool activity:

The child is reminded of the drawing task and is asked, "What have you drawn here?" The child is encouraged to describe their drawings as fully as they can through prompts given by the researcher (e.g. Who is this? What are they doing here? What is that?) A follow-up question is posed to determine why they don't like the things they have drawn. The child is encouraged to fully explain why they don't like each drawing they have produced.

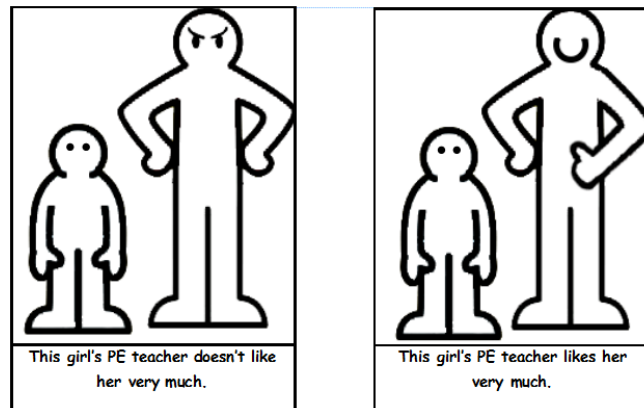


1. Section starts with: *On the other side, I asked you to draw a picture of what you don't like about PE, what have you drawn here?*
2. Child will either fully describe their picture or researcher will ask prompts for more detail.
3. Researcher will next ask: *Why don't you like...?*
4. The response to this follow-up question (Why don't you like...?) and the drawing is used to determine the code given (1-4).
5. Use the descriptions and examples on page 3 and 4 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding "code."
7. Write in the "coder's comments" box if the child says anything noteworthy.

Relatedness Satisfaction | Liked/Disliked by PE Teacher | Activity 2a

Tool activity:

The child is shown two pictures with contrasting themes. In this topic, the first picture is stemmed with “This girl’s/boy’s teacher likes them very much” and the second stemmed with “This girl’s/boy’s teacher doesn’t like them very much.” The child is asked to pick which boy/girl they feel is most like them. After the child picks, the researcher asks one of two follow-up questions: “how do you know your teacher likes you?” or “how do you know your PE teacher doesn’t like you?” The child is encouraged to explain to the best of their ability why they have picked that particular picture.



1. Find the section of the transcript that starts with the researcher asking, “*This girl’s/boy’s PE teacher likes them very much, this girl’s/boy’s PE teacher doesn’t like them very much, which girl/boy are you most like?*”
2. The child will either pick liked by teacher (code 4 or 3) or disliked by teacher (code 2 or 1) either verbally or the researcher will verbalise their choice (when the child has pointed rather than verbalised). This may only become clear with the phrasing of the next question:
3. The researcher will then ask the follow-up question, “*How do you know your teacher likes/doesn’t like you?*”
4. The response to this follow-up question (*How do you know your teacher likes/doesn’t like you?*) and the child’s choice (liked or disliked by teacher) is used to determine the code given (1-4).
5. Use the descriptions and examples on page 7 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding “code.”
7. Write in the “coder’s comments” box if the child says anything noteworthy.

Relatedness Satisfaction | Like/Dislike of PE Teacher | Activity 2b

Tool activity:

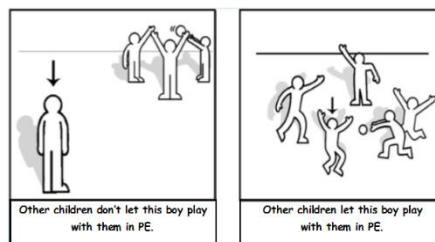
The researcher asks, “Do you like your PE teacher?” follow-up by why they think this. The child is encouraged to fully explain why they like or dislike their teacher. No resources are used for this topic.

1. Find the section of the transcript that starts with the researcher asking, “*Do you like your PE teacher?*”
2. The child will respond either yes (code 4 or 3) or no (code 2 or 1).
3. The researcher will then ask the follow-up question, “*Why do you like your PE teacher? / Why don’t you not like your PE teacher?*”
4. The response to this follow-up question (*Why do you like your PE teacher? / Why don’t you not like your PE teacher?*) and the child’s choice (child likes or dislikes teacher) is used to determine the code given (1-4).
5. Use the descriptions and examples on page 8 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding “code.”
7. A child will only receive an N/A if they fail to participate in the activity.
8. Write in the “coder’s comments” box if the child says anything noteworthy.

Relatedness Satisfaction | Inclusion/Exclusion by Peers | Activity 2c

Tool activity:

The child is shown two pictures with contrasting themes. In this topic, the first picture is stemmed with “Other children let this girl/boy play with them in PE” and the second is stemmed with “Other children don’t let this girl/boy play with them in PE.” The child is asked to pick which boy/girl they feel is most like them. After the child picks, the researcher asks one of two follow-up questions: “can you tell me about a time when other children let you play in PE?” or “can you tell me about a time when other children didn’t let you play in PE?” The child is encouraged to explain to the best of their ability why they have picked that particular picture.



1. Find the section of the transcript that starts with the researcher asking, *“Other children let this girl/boy play with them in PE, other children don’t let this girl/boy play with them in PE, which girl/boy are you most like?”*
2. The child will either pick included by peers (code 4 or 3) or not included by peers (code 2 or 1) either verbally or the researcher will verbalise the choice. This may only become clear with the phrasing of the next question.
3. The researcher will then ask, *“Can you tell me about a time when other children let you play with them in PE? / Can you tell me about a time when other children didn’t let you play with them in PE?”*
4. The response to this follow-up question (*“Can you tell me about a time when other children let you play with them in PE? / Can you tell me about a time when other children didn’t let you play with them in PE?”*) and the child’s choice (included or excluded by peers) is used to determine the code given (1-4).
5. Use the descriptions and examples on page 9 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding “code.”
7. A child will only receive an N/A if they fail to participate in the activity.
8. Write in the “coder’s comments” box if the child says anything noteworthy.

Relatedness Satisfaction | Inclusion/Exclusion of Peers | Activity 2d

Tool activity:

The researcher asks, “Do you let other children play with you in PE?” The follow-up question is determined by their answer. If the child says that they do let other children play with them, the researcher asks, “Do you let them play all the time or most of the time?” If they said no to the first question, the researcher asks, “Do you not let them play all the time or most of the time?” If the child says they let other children play they are next asked, “Is it important to let other children play in PE?” and then “why is it important to let other children play in PE?” If the child says they do not let children play, the researcher asks, “Why don’t you let other children play in PE?” The child is encouraged to fully explain why they include or exclude their peers. No resources are used for this topic.

1. Find the section of the transcript that starts with the researcher asking, “*Do you let other children play with you in PE?*”
2. The child will either say yes (code 4 or 3) or no (code 2 or 1).
3. The researcher will then ask, “*Why? / Why not?*”
4. The response to this follow-up question (“*Why? / Why not?*”) and the child’s choice (included or excludes other children) is used to determine the code given (1-4).
5. Use the descriptions and examples on page 10 of the codebook to make a judgement around which code to assign.
6. Circle the corresponding “code.”
7. A child will only receive an N/A if they fail to participate in the activity.
8. Write in the “coder’s comments” box if the child says anything noteworthy.

Autonomy Satisfaction | Pictorial Choices in PE | Activity 3a

Tool activity:

The resources for this topic include 9 pictures depicting partner work, group work, small equipment and large equipment typically found in PE lessons. They are also given two “plates” which are two laminated discs with either “You” or “PE teacher” printed in the centre. The researcher states that sometimes in PE, the child might get to choose certain things in PE like the partner they work with, what they do and how they do it and sometimes the PE teacher might get to choose these things. The child’s task is to sort the pictures that they choose and place on their plate and the pictures the PE teacher chooses onto the “PE teacher” plate. The researcher will ask for examples for pictures that the child chooses in PE and if they get to choose them all the time or sometimes.



1. Find the section of the transcript that starts with the researcher asking, *“I’ve got some pictures and I want to know which things you get to choose in PE and which things your teacher gets to choose?”*
2. They will either verbally indicate which pictures they choose or the researcher will verbalise the placement of each choice the child makes.
3. Read through the section in the transcript and count how many things the child gets to choose in PE.
4. The researcher will ask the following question, *“Can you tell me about a time you chose...?”* either after each choice placement or right at the end of the activity.
5. The response to this follow-up question (*“Can you tell me about a time you chose...?”*) and the child’s choices (pictures) is used to determine the code given (1-6).
6. Use the descriptions and examples on page 11 and 12 of the codebook to make a judgement around which code to assign.
7. Circle the corresponding “code.”
8. A child will only receive an N/A if they fail to participate in the activity.
9. Write in the “coder’s comments” box if the child says anything noteworthy.

Autonomy Satisfaction | Follow-up Question 1 | Activity 3b

Tool activity: Follow-up question 1

The researcher asks the child two questions: “Do you ever get to choose the activities that you do in PE?” and “Do you ever get to choose how you do certain movements or does the PE teacher show you and tell you how to do those movements?” The child answers either yes, no or sometimes. There are no resources for this topic.

1. Find the section of the transcript that starts with the researcher asking, “*Do you ever get to choose the activities you do in PE or does the teacher?*” OR “*Do you get to choose the movements you do in PE or does the PE teacher show you and tell you what to do?*”
2. Both questions are coded together on page 17 of the codebook.
3. The child will either say they do or the PE teacher does to both questions.
4. What they articulate for both questions will determine which code they receive (1-3).
9. Use the descriptions and examples on page 13 of the codebook to make a judgement around which code to assign.
10. Circle the corresponding “code.”
11. A child will only receive an N/A if they fail to participate in the activity.
10. Write in the “coder’s comments” box if the child says anything noteworthy.

Autonomy Satisfaction | Follow-up Question Part 2 | Activity 3c

Tool activity: Follow-up question 2

The researcher asks the child two questions: “If you have something to say to your PE teacher, do they listen to you?” and “If you have a question for your PE teacher, do they answer it?” The child answers either yes, no or sometimes. There are no resources for this topic.

1. Find the section of the transcript that starts with the researcher asking, *“Does your teacher listen to you if you have something to say to them?”* OR *“Does your teacher answer any questions you might have?”*
2. Both questions are coded separately on page 18 of the codebook.
3. The child will either say yes (code of 3), sometimes (code of 2) or no (code of 1) for each question.
4. Use the descriptions and examples on page 14 of the codebook to make a judgement around which code to assign.
5. Circle the corresponding “code.”
6. A child will only receive an N/A if they fail to participate in the activity.
7. Write in the “coder’s comments” box if the child says anything noteworthy.

Competence Satisfaction | Overall Competence | Activity 4

Tool activity:

The child is shown a laminated A4 piece of paper that is divided into two sections. The top section depicts common skills performed in PE such as running, jumping, catching and throwing. The bottom section shows a five star rating scale (1=not very good at things in PE to 5=very good at things in PE). The researcher asks, "How good are you at doing things in PE?" The child indicates which star they feel they most align with. The researcher asks, "How do you know you're ... stars?" The child is encouraged to explain why they think they are the star rating they have chosen.



1. Find the section of the transcript that starts with the researcher asking, "How many stars would you give yourself for doing things in PE?"
2. The child will either verbalise the star rating or the researcher will verbalise on the child's behalf.
3. The researcher will then ask: "Why would you give yourself...stars?"
4. The response to this follow-up question ("Why would you give yourself...stars?") and the child's choice (star rating) is used to determine the code given (1-9).
5. Use the descriptions and examples on page 15 of the codebook to make a judgement around which code to assign.
6. Circle the "code" that aligns most with what was provided by the child.
7. If the child says anything of note (use best judgement) that has not been accounted for by the codebook, please write in the "coder's comments" box.

Self-Determined Motivation | Summary Table | Activity 5

Tool activity:

The child is introduced to each type of motivation regulation as reasons for taking part in PE. Each reason is shown to the child in their turn and their stems read aloud. Once all reasons are in front of the child, the researcher asks, "Out of all these reasons, what would be your most favourite reasons for doing PE?" The child picks any reasons they like which can range from none to all of them. The researcher then goes through each reason, one by one, asking the designated follow-up question for each. Once this has been done, the child is asked to place the reasons in order of importance with the first being the most important reason for doing PE to the last and least important reason for doing PE. The child can assign more than one reason to an ordinal position.

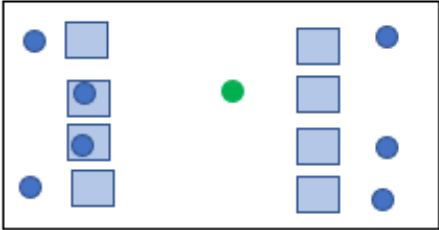
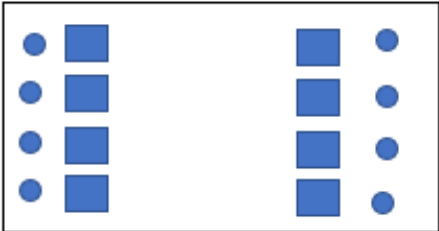


Note. The format of coding changes here.

1. Find the section of the transcript that starts with the researcher asking, *“Out of all these reasons, which are your favourite reasons for doing PE?”*
2. Read through the whole section until the end to familiarise yourself with the section.
3. Note in the table on page 16 of the codebook which reasons for taking part in PE the child chose as their *first choice*, *other choices* (any choice after first choice) and any choices *not picked*.
4. Locate each chosen reason for PE participation within the transcript. Using the pages listed below, judge if the response to the follow-up questions are deep or surface/irrelevant, and note this in the table on page 16. For example, a child has picked *“I do PE because it is fun”* as a reason, locate this within the transcript and turn to page 17 of the codebook to help guide your judgement over whether the child’s response is deep or surface/irrelevant. Note the level of articulation in the table in the codebook.
 - a. *I do PE because it’s fun*: page 17
 - b. *I do PE because I want to be healthy and strong*: page 18
 - c. *I do PE because I want my teacher and classmates to like*: page 19
 - d. *I do PE because I might get a reward*: page 20
 - e. *I do PE because I don’t want to get into trouble*: page 21
 - f. *I don’t want to do PE*: page 22
5. Use the descriptions and examples on these pages listed above of the codebook to base your judgement around which code to assign.
6. Please note, they will receive a code of 1 for any reason that is not picked.
7. It is very important for the coder to only code **first choices** as a 4 or 5 as this is their most important reason.
8. The child has the freedom to choose more than one reason as their first reason and so all first choice reasons can be coded as a 5 or 4 (depending on the articulation of the child).
9. Circle the “code” that aligns most with what was provided by the child.

10. If the child says anything of note (use best judgement) that has not been accounted for by the codebook, please write in the “coder’s comments” box.

Appendix C: Linear lesson plan

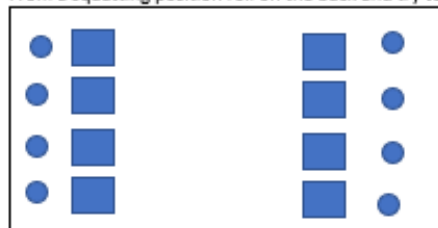
	Gymnastics
B3: Lesson No	Lesson 3
Lesson Outcome	Demonstrate mastery in balance and rolling
Desired outcome	To be able to maintain the balance on different surfaces and on different parts of the body a roll and a static
Progression based on Gentile's taxonomy	<p>Foster children motor skills learning by increasing the difficulty of the task over the lessons using Gentile's taxonomy:</p> <p>Body: from no-body transport → to body transport</p> <p>Object: from no object → to manipulation of object</p> <p>Motion: from environment still → to environment moving</p> <p>Intertrial Variability: from no intertrial variability → to intertrial variability</p>
B3: Whole Class Task Activity	<p>Warm up</p> <p><u>The thieves</u></p> <p>Foxes and spiders. Spiders have to move from a nest to another but the fox will try to stop them. If a spider gets tagged by a fox it remains stuck and only the other spiders can help him.</p> <p>● fox</p>  <p>Drill 1</p> <p>Children occupy all the space in the hall.</p> <p>Roll like a log in the forest, rolling 2 times on the left and then two times on the right.</p> <ul style="list-style-type: none"> Arms on the waist Arms extended over the head Arms crossed on the chest <p>■ Mats</p> 

Drill 2

Progression to get to a frontal roll

A little egg in the chest start moving.

From a squatting position roll on the back and try to get back to the starting position.

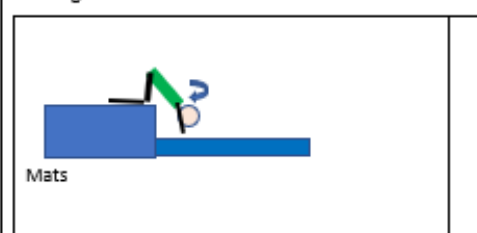


Drill 3 (ONLY do this in one group at a time if you think they are able. The rest to carry on with previous drill).

From a big mat and with the help of the teacher the child rolls to another mat

IN black the limbs

And in green the torso



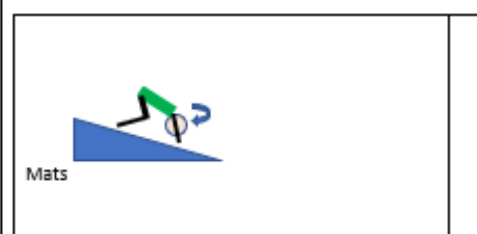
The head cannot touch the lower mat. Arms flexed.

Hip higher than the shoulders

The teacher might help children who cannot perform the roll by putting **an** hand behind their neck and one on their leg

Drill 3

From a smaller mat that was used in the previous drill and with the help of the teacher the child rolls to another mat



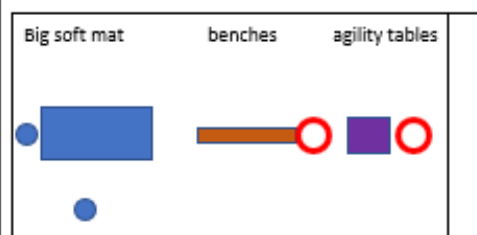
The head cannot touch the lower mat.

Drill 4

From a smaller mat that was used in the previous drill and with the help of the teacher the child rolls to another mat



The head cannot touch the lower mat.

Performance

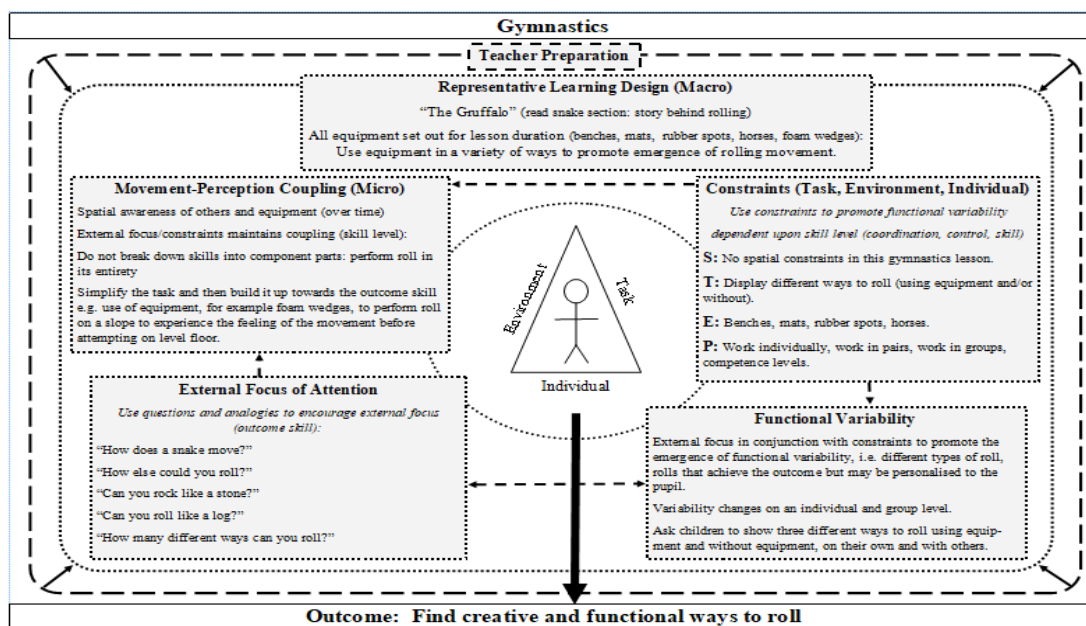
Roll on the mat, move as a spider to get to the bench, walk like an owl with hands open, jump and land with knee bent and arms pointing in the front, move like a rabbit and then jump as a frog on the agility table, from there jump down with legs bent and hands pointing forward.

Cool down

Walking around the space, quietly. Take a seat.

The teacher asks questions about the lesson.

Appendix D: Nonlinear lesson plan



Appendix E: Pedagogical fidelity checklist

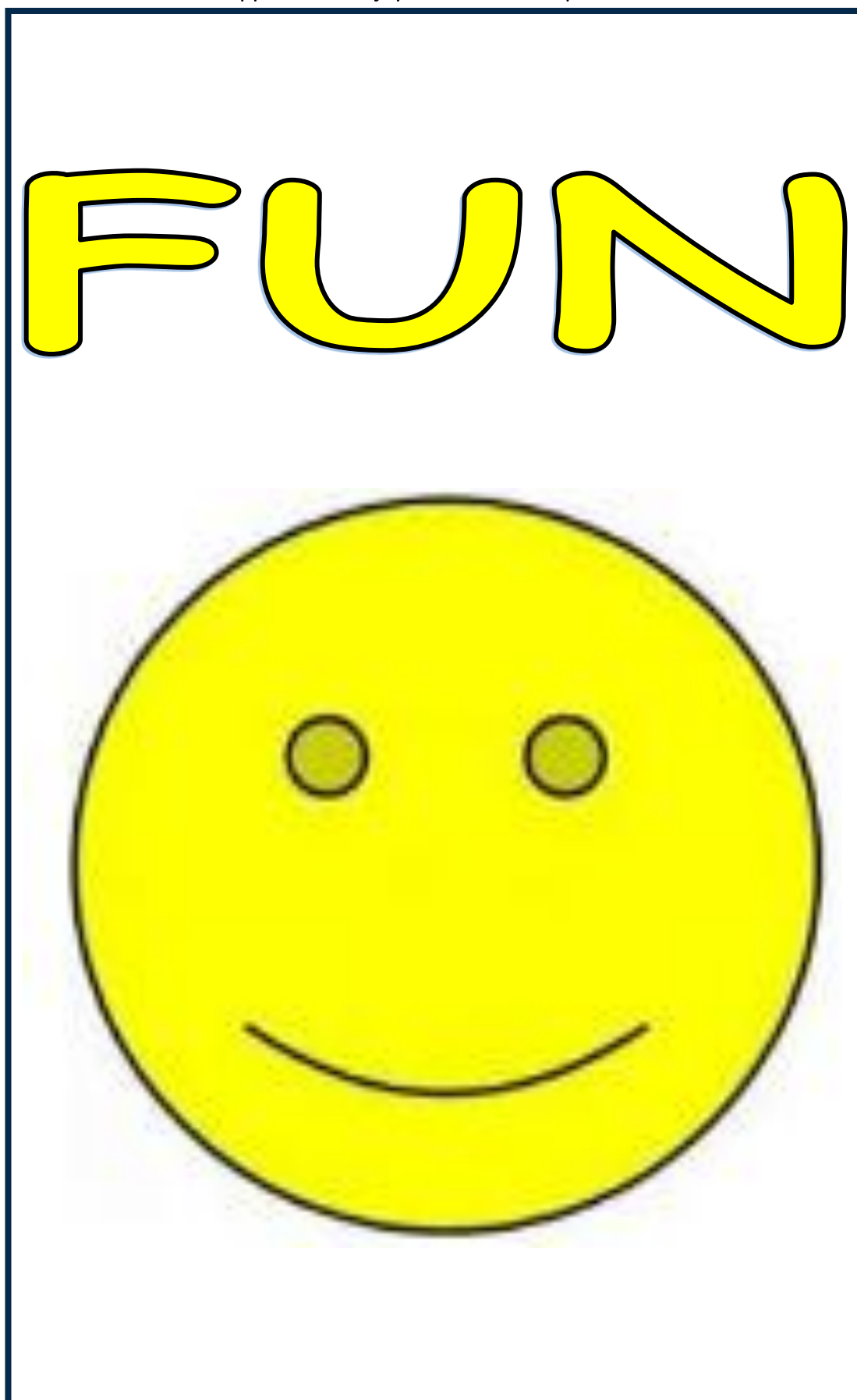
School	Lesson Type		Lesson Duration (Divide by 4 to work out quartiles)	Quartiles			
	Pedagogy A	Sliding Scale	Pedagogy B	Q1	Q2	Q3	Q4
1	To support learning of fundamental movement skills, PE teacher/coach will manipulate the child's movements through breaking the skill into component parts.	1 2 3 4 5	To support the emergence of functional movement solutions, the PE teacher/coach will manipulate the task or environment but not the child.				
2	Children learn the skill(s) first in closed decontextualized environments then apply new skills in a performance environment.	1 2 3 4 5	Movements are always learnt in context (music, storytelling, scenarios or games).				
3	All children transition between activities and task at roughly the same time.	1 2 3 4 5	Transitions may be whole class, group of children or individual child and involve manipulations of tasks and activities but could on the surface be quite minor.				
4	PE teacher/coach controls what equipment is used and when it is introduced to the children.	1 2 3 4 5	PE teacher/coach allows children to choose which equipment to use and when they want to use it to help with finding solution to the task.				
Teaching Behaviours							
1	Demonstrations of fundamental movement skill by adult or a competent child is the preferred option in a closed environment.	1 2 3 4 5	Demonstration are done in context to encourage children to explore unique performance solutions.				
2	The use of verbal instruction is prescriptive and focused on correct technical movement pattern.	1 2 3 4 5	Verbal instruction is short and not prescriptive, focused on the environment or task.				
3	Feedback is skill focused and prescriptive to learn ideal template.	1 2 3 4 5	Feedback is used to support alternative functional movement solutions.				

Lesson Objectives		Sliding Scale 1 2 3 4 5	
A Global	<p>PE teacher/coach prescribes children to perform fundamental movement skill or set of fundamental movement skills.</p> <p>Children learn an optimal movement template or technique of a particular skill or series of skills</p>	<p>1 2 3 4 5</p>	<p>PE teacher/coach creates an environment for children to perform functional movement solutions through interaction with the environment and task.</p> <p>Children learn to explore and interact with their environment to find functional solutions</p>
B Global	<p>Lesson progression is through clear and linear structure, warm up, drills, game/performance and cool down.</p>	<p>1 2 3 4 5</p>	<p>Lesson evolves through storytelling, scenarios or games.</p>

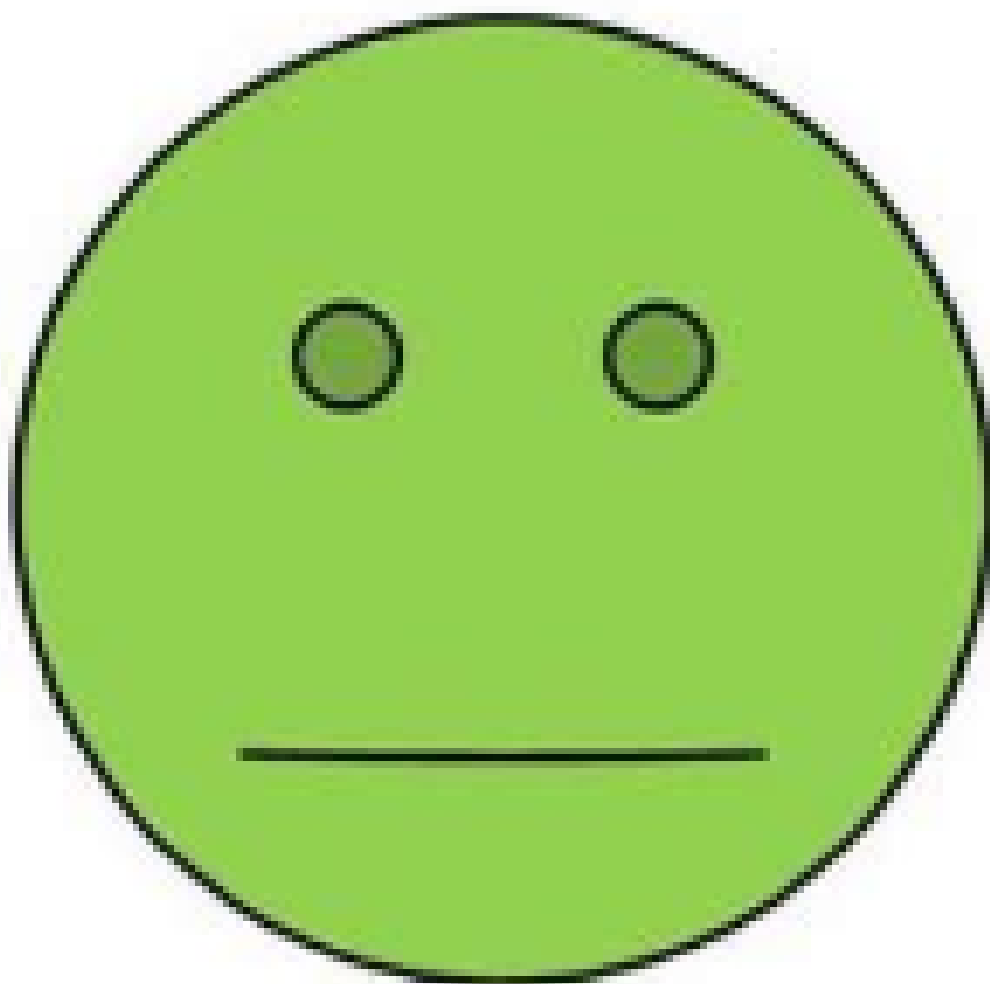
Appendix F: Fidelity coder training information

Coder training consisted of three steps. The first step was the review of NLP and LP pedagogical papers, alongside consultation with a pedagogy expert. The second step consisted of clarifying pedagogical terminology and the fidelity checklist before coding began. The third step had both coders collaboratively code one school (6 lessons) before independently coding another school (6 lessons) and comparing scores. Their training ended once both coders were confident in their coding. The coders then independently coded a further three schools each. This independent coding was followed by an interrater check to avoid drift (one school) before finishing coding with a final school each.

Appendix E: Enjoyment emoticon posters



OK



BORING

