Physical Education Teaching Pedagogy and Resources for Fundamental Skill Development in Primary School Children with Autism in Malta

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Abstract

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Proficiency in fundamental movement skills (FMS) is an important milestone in childhood development leading to a positive spiral of engagement in physical activity. Several studies have demonstrated the benefits of FMS interventions for children on the autism spectrum. Such interventions had a positive effect on their FMS development, leading to improvements in their social and communication skills and resulting in enhanced participation in class. This study evaluates the essential teaching pedagogy and resources identified by Physical Education (PE) Teachers and Learning Support Educators (LSEs) in Malta necessary to improve the development of FMS of primary school children on the autism spectrum. A mixed research method approach was adopted. Professionals in the field were interviewed. A questionnaire was also distributed to PE teachers and LSEs in Malta and Gozo. The factors affecting FMS development in primary students on the autism spectrum in Malta were investigated, as well as how local PE Teachers and LSEs assess the FMS of these students. The established and leading-edge pedagogy methods and teaching resources, indicated as essential by local PE teachers and LSEs, to improve FMS development of these students was also determined. Eighty two percent (82%) of questionnaire respondents as well as all interviewees support the hypothesis that an early intervention focusing on FMS development of students on the autism spectrum will improve the overall development of the students in later years. Yet only 33% of questionnaire respondents feel prepared to teach FMS to such students. This study then makes several recommendations to address this problem, with an objective to make the belief of the American Association for Health, Physical Education and Recreation (*This is Physical Education. (1965)* p. 24) that '*today's physical education is the subject which children learn to move as they move to learn*" a reality for primary students on the autism spectrum in local PE classes.

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KEY WORDS: AUTISM SPECTRUM, FUNDAMENTAL MOVEMENT SKILLS, PEDAGOGY, TEACHING RESOURCES, PRIMARY

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List of Abbreviations

AAHPER	American Association for Health, Physical Education and Recreation
ABA	Applied Behaviour Analysis
ADOS	Autistic Diagnostic Observation Schedule
ASD	Autism Spectrum Disorder
BOT-3	Bruininks-Oseretsky Test of Motor Proficiency 3rd edition
CDAU	Child Development and Assessment Unit
CoPE	Continuous Professional Education
CPRT	Classroom Pivotal Response Teaching
DCDQ	Development Coordination Disorder Questionnaire
DSM-V	Diagnostic and Statistical Manual of Mental Disorders 5th Edition
EIBI	Early Intensive Behavioural Intervention
FMS	Fundamental Movement Skills
UREC	University Research Ethics Committee
IBI	Intensive Behavioural Intervention
LO	Learning Outcomes
LSE	Learning Support Educator
MABC-2	Movement Assessment Battery for Children 2nd edition
MEDE	Ministry for Education and Employment
MOT 4-6	Psychomotor Motor proficiency test
MSEL	Mullen Scales of Early Learning
NSO	National Statistics Office
PA	Physical Activity
PDD-NOS	Persuasive developmental disorder not otherwise specified
PDMS-3	Peabody Developmental Motor Scales 3rd edition
PE	Physical Education
TEACCH	University of North Carolina Treatment and Education of Autistic and related Communications Handicapped children
TGMD-2/3	Test of Gross Motor Development 2nd or 3rd edition

Chapter 1

Introduction

1.1 Fundamental Movement Skill Education for Students with ASD in Malta

In 2021, the Autism Advisory Council published "*Malta's 2021-2030 National Autism Strategy, Respecting Diversity - Safeguarding Equality"* (Autism Advisory Council, 2021). This strategy proposed a plan for improving public awareness about the autism spectrum and enhancing the inclusion of children on the autism spectrum within the educational system. The strategy also included recommendations to support early identification and improved health care services (Autism Advisory Council, 2021).

Inclusive education is also safeguarded in the Education Act (Cap. 327) of the Laws of Malta, and the Ministry for Education and Employment (MEDE) has published several policy documents to guide inclusion in Maltese schools, namely the "*Respect for All Framework*" (MEDE, 2014), the "*National Inclusive Education Framework*" (MEDE, 2019) and "*A Policy on Inclusive Education in Schools: Route to Quality Inclusion*" (MEDE, 2019b).

It has been estimated that in Malta, 1 in 52 births will be diagnosed to be on the Autism Spectrum (Times of Malta, 2015). Using the latest published student population statistics, in 2022 the primary student population in Malta was 27,039 (NSO, 2022). An estimate of approximately 513 children on the autism spectrum, therefore, potentially attend primary school, several of whom will be in a mainstream setting.

Children with an Autism Spectrum Disorder (ASD) demonstrate a difficulty with eye-tracking of people and objects. They typically don't share enjoyment during play and have difficulties in making social connects leading to difficulties during cooperative play. Research on motor development in persons on the autism spectrum indicates that autistic individuals exhibit impairment in gross motor skills (Wang et al., 2022), including difficulties

with object control (Ament et al., 2015), coordination (Hilton et al., 2012) and balance and postural stability (Lim et al., 2017). Further research is required to improve the understanding of gross motor impairments in the ASD population, to determine whether gross motor impairments should be considered an important characteristic for ASD diagnosis (Wang et al., 2022).

These behaviours and gross motor impairments pose a challenge when teaching Physical Education (PE) to children with ASD. A recent study on the self-reported preparedness of PE teachers in Malta to teach inclusive PE classes that contain students on the autism spectrum has identified that local PE teachers feel unprepared to address their PE class students' diverse needs (Attard, 2022).

The study's findings, led to several recommendations that may be grouped in three areas, (a) PE teacher training in a real-life hands-on inclusive setting, (b) Specialised resources to support PE teachers during their PE lesson, and (c) Policy, Strategy and PE curriculum adaptations to better support inclusion. Attard (2022) also found that a successful outcome of students on the autism spectrum becoming participating members of the PE class was strongly correlated with the availability of specialized teaching resources to support the PE teacher/LSE team to deliver the actual PE lesson. In the same study most PE teachers indicated a lack of availability of any specialized teaching resources.

An important endorsement by local PE teachers was the recommendation to focus on maximizing the development of fundamental movement skills in primary students with ASD as this could potentially improve their chances of eventual successful integration in subsequent years (Attard, 2022).

Proficiency in Fundamental Movement Skills (FMS) is an important milestone in childhood development. Appropriately developed FMS lead to a positive spiral of engagement in physical activity which in turn improves the child's perception of physical competence, further stimulating their physical activity participation (Stodden et al., 2008). FMS capabilities help children lead a healthy lifestyle and has been shown to have a positive relationship with adolescent physical activity (Barnett et al., 2009). Desired outcomes in an environment where various studies are showing a worrying trend towards lower prevalence of FMS proficiency is preschool and primary school children, a trend attributed to the increasing opportunities for sedentary activities competing with time spent in physical activity and movement (Cools et al., 2009; Hardy et al., 2010).

The PE syllabus for primary schools in Malta recognises the importance of proficiency in FMS and defines *"Fundamentals"* as a key primary school learning area,

allocated 40% of the marks, twice the marks allocated to the other three learning outcomes Individual Activity (20%), Team Game (20%), and Outdoor/Recreational (20%). The syllabus organises the "Fundamentals" in the following topic areas, Differentiation, Equilibrium, Combination of Movements, Orientation of Space and Time, Reaction, Rhythm, Agility, Speed, Throwing and Catching.

Several studies have demonstrated the importance and benefits of fundamental movement skill interventions for children with ASD (Bremer et al., 2016; Colombo-Dougovito, 2019; Li et al., 2023). Such interventions had a positive effect on student participation in class and motor skill improvements, as well as improvements in their social and communication skills. When carried out, FMS interventions could also enhance the overall learning and well-being of the students.

1.2 Research Area and Research Design

The main contribution of this dissertation is therefore to determine the essential teaching pedagogy and resources identified by PE Teachers and Learning Support Educators (LSE) in Malta to assist the PE Teacher - LSE team to improve the development of FMS (The Fundamentals) of primary school children with ASD.

As shown in Figure 1.1 the research is focused at the intersection of three traditionally separate fields of study namely: Movement education and FMS Assessment; Adapted PE Pedagogy to teach FMS to Primary students with an ASD and the Teaching Resources required.

A mixed research method approach will be adopted in this study. Both, one-to-one interviews with five professionals working in the autism spectrum inclusion/movement education field, and an online questionnaire distributed to PE teachers and Learning Support Educators in Malta and Gozo, will be used.

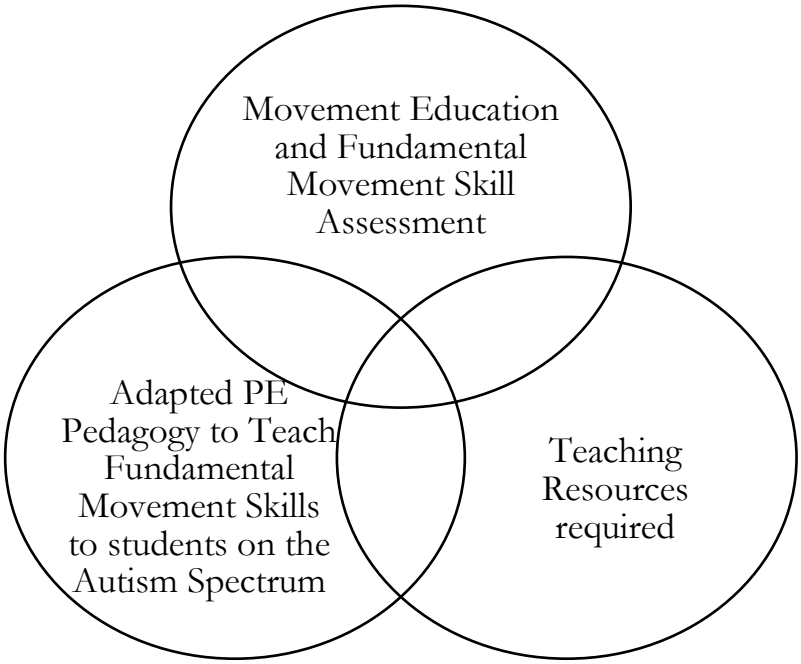

Figure 1.1 Dissertation research area

1.3 Objective and Benefits of this Study

The objective of this research is therefore to identify the essential teaching pedagogy and resources needed by PE Teachers and LSEs to assist the PE Teacher – LSE team to improve the development of FMS of Primary students with ASD.

The key research questions for this study are:

a) What are the factors affecting fundamental movement skill development in primary students with ASD?

b) How do local PE Teachers and Learning Support Educators assess the fundamental movement skills of primary students with ASD?

c) What are the tried and tested, as well as leading edge pedagogy methods and teaching resources used or indicated as essential by local PE teachers and Learning Support Educators, to improve fundamental movement skill development in primary students with ASD?

d) Do local PE Teachers and Learning Support Educators support the hypothesis that an early intervention focusing on fundamental movement skills development in primary students with ASD will improve the overall development of the student in later years?

e) What is the self-reported level of preparedness of local PE Teachers and Learning Support Educators to teach Fundamental Movement Skills to primary students with ASD?

The main benefit of the results of this research will be to guide stakeholders and policy makers on the requirements to improve the teaching of fundamental movement skills to primary students with ASD.

1.4 Dissertation Organisation

A literature review is presented in Chapter 2. A summary of the key milestones in the evolution of movement education since the introduction of physical exercise teaching in schools is presented. The interplay of movement education with applied aesthetics, new gymnastics, natural methods and Laban movement analysis, as well as the learning to move – moving to learn debate that led to movement and fundamental movement skill education forming part of primary school PE curricula is also outlined. The fundamental movement skill learning outcomes in the Maltese year 1 and 2 curriculum are then analysed.

A summary of the research on the challenges of teaching FMS to children on the autism spectrum and the benefits of early interventions for children with ASD is also presented. This is followed by a review of the adapted PE techniques to teach primary children on the autism spectrum, as well as the difficulties introduced by the autism spectrum variability in behaviours.

Chapter 3 describes the methodology followed to carry out this research – a mixed research method consisting of interviews and questionnaire data collection. The ontology and epistemology of the research are described, as well as the qualitative and quantitative research methods adopted. The sampling and participant selection methodology together with the data processing and analysis techniques used are also described. Ethical considerations are then outlined.

Chapter 4 presents the results obtained from the qualitative analysis (interviews) and the quantitative analysis (questionnaire). A critical analysis of all the results obtained is then also presented.

Chapter 5 summarises the main findings and contributions of this research. The strengths and limitations are outlined. Recommendations arising from this study are identified, as well as a number of recommendations for future research, followed by a final conclusion.

Chapter 2
Literature Review

2.1 Introduction

In this chapter a literature review of the evolution of movement skills education leading to the definition of fundamental movement skills and their inclusion in the Maltese primary school PE syllabus is presented. The benefits, challenges and techniques used for early intervention when teaching FMS to students on the autism spectrum in the primary school PE class are appraised. An overview of the resources and FMS proficiency assessment methods used during such early interventions is also presented.

2.2 The Evolution of Movement Education

The evolution to curricular FMS education from early Movement Education was not without its challenges. This section presents the main milestones and events of this evolution.

2.2.1 Gymnastics for Youth (1750-1850)

Movement education finds its origins in the seminal work carried out by Johann Bernhard Basedow and Johann Christoph Friedrich GutsMuths in the latter half of the 18th century (Diñoso, 1990). Basedow was the first to introduce the teaching of physical exercise (gymnastics) in schools in the newly setup *Philanthropinum* in 1774 (Shuman, 2013). GutsMuths studied pedagogy at the University of Halle between 1778 and 1782. In 1793 he published "*Gymnastic fur die Jugend*" translated as "*Gymnastics for Youth : A practical guide to delightful and amusing exercises for the use of schools*" (GutsMuths, 1793). He designed his

curriculum on the Greek pentathlon and his own work. The book describes two forms of gymnastics, *utilitarian* and *non-utilitarian* (Solly, 2021). The former prioritised physical health while the latter placed a higher value on the skills' aesthetic. His work included climbing, dancing, jumping, military exercises, running, swimming, throwing, and walking. The second edition of his work contained additional exercises related to balancing, lifting, leaping, carrying, pulling and wrestling. GutsMuths described gymnastics as culture for the body and his first principle for gymnastics education was to "*fully develop the aptitudes of the physical individual and attain the body's potential beauty and perfect usefulness*" (Naul, 2008, p.41). English versions of GutsMuths' book were published in London in 1800 by J. Johston and in America in 1802 by William Duane. GutsMuths is also credited with the creation of the seesaw, the horizontal ladder, the oblique wooden ladder, the climbing rope, the balancing beam, the vault-apparatus and the rope leader resource for teaching gymnastics (Diñoso, 1990)

Friedrich Ludwig Jahn opened the first gymnasium in Berlin in 1811 leading the Turnverein Movement (clubs to practice gymnastics). Early '*turnvereins*' included the use of gymnastic equipment such as the horizontal bar, parallel bars, side horse and vaulting buck. Friedrich Ludwig Jahn and Ernst Eiselen published several joint, and solo works, further evolving the work done by GutsMuths (Jahn et al., 1816).

GutsMuths' work influenced Pehr Henrik Ling, the first principal of the Royal Central Gymnastics Institute, founded in 1813 by the Swedish government for the training of gymnastics instructors. Ling developed a system of gymnastics and exercises in four areas (Ottosson, 2010),

(i) Pedagogical gymnastics (Physical Education)
(ii) Military gymnastics (mostly Fencing)
(iii) Medical gymnastics (Massage, Physical therapy, and Physiotherapy)
(iv) Aesthetic gymnastics (Dance and Performing arts).

Ling is also credited with developing the box horse, wall bars and beams for use in physical education. Following Ling's death in 1839, his work was continued by Lars Gabriel Branting (1799-1881), Carl August Georgi (1808-1881) who is credited with the creation of the word "Kinesiology" in 1854, Hjalmar Ling (1820-1886) and Thure Brandt (1819-1895) (Pfister, 2003).

Adolf Spiess worked as a schoolteacher of gymnastics in Burgdorf, Switzerland. Experience with all grades of pupils made him aware that the methods of Jahn's "*Deutsche Turnkunst*" were not sufficient for classroom needs. He developed a "System of

Gymnastics" which he published in four parts between 1840 and 1846. A description of the different parts is summarised in Table 2.1.

Volume	Published Year	Description
Volume 1 (Spiess, 1840)	1840	Described his 'free exercises', exercises that require no apparatus or only apparatus that could be easily carried. The exercises were envisaged to be used when the student was standing or walking and differed from the forms practiced in the Turnplatz.
Volume 2 (Spiess, 1842)	1842	Described hanging exercises
Volume 3 (Spiess, 1843)	1843	Described supporting exercises including balancing and vaulting
Volume 4 (Spiess, 1846)	1846	Described exercises for large groups and provided instructions for the orderly coordination of large numbers of pupils, by means of which the class moved as one individual, improving discipline and order

Table 2.1: Summary of Adolf Spiess' System of Gymnastics

These publications were accompanied with an instruction book for teachers in two volumes. Volume 1 published in 1847 for teaching pupils aged 6 to 10 with an improved 2nd edition published in 1880 (Spiess, 1880), and Volume 2 for teaching pupils aged 10 to 16 published in 1851 with an improved second edition in 1889 (Spiess, 1889). Adolf Spiess's key contribution was his work to make physical and movement training a part of school life (Leonard et al., 1927).

2.2.2 Applied Aesthetics, Harmonic & New Gymnastics (1851 – 1900)

The early 19th century was further influenced by the Romanticism Movement. Romanticism emphasised an intense appreciation of the beauty of nature, the expression of thought and emotion over reason, and of the senses over intellect, and viewed the creative spirt of an artist as more important than strict adherence to formal rules and traditional procedures.

It was in this macro environment that Francois Delsarte, a singing and oratory teacher in Paris developed what he termed "*applied aesthetics*", by studying how humans

moved, behaved and responded to various emotional and real-life situations (Ruyter, 1996). Delsarte's applied aesthetics was rooted in the performing arts and encompassed all the expressive elements of the human body including movement, which he saw as a union of time, space, and motion, where expressive movement should relate to the emotion that inspired the movement (Ruyter, 1996).

Delsarte defined nine motions of expression, altitude, force, sequence, direction, form, reaction, velocity and extension. He also introduced parallelism in movement involving the simultaneous movement of two body parts in the same direction and in sequence. His theories were brought to America by his disciple Steele MacKaye through lectures Mackaye delivered in New York and Boston in 1871. In 1885, Genvieve Stebbins a student of MacKaye published a book titled "*The Delsarte System of Expression*" which was an immediate success (Stebbins, 1885). Stebbins combined Delsarte ideas and Ling's aesthetic gymnastics as well as her own creative work to create a system of "*Harmonic gymnastics*". She founded the New York School of Expression in the Carnegie Music Hall and established her methods by publishing "*Society Gymnastics and Voice Culture*" (Stebbins, 1888), "*Dynamic Breathing and Harmonic gymnastics*" (Stebbins, 1893), and "*Genevieve Stebbins' System of Physical Training*" (Stebbins, 1899). Her work also facilitated the establishment of "Modern Dance" in 20th century America and Europe, as well as contributing to the "yoga as an exercise" culture. These ideas would bring the performing arts and physical education closer eventually giving rise to the field of movement education.

In 1862 Dio Lewis published "*The New Gymnastics for Men, Women and Children*" (Lewis, 1862). Lewis observed that the German gymnastics model that was common throughout the United States was not adapted to the classes that most needed physical training. Athletic young men were already provided for, but old, feeble or unfit men, young children and females were not drawn to the gymnasium. Lewis developed a set of new exercises "New Gymnastics" and devoted himself to introduce them to the public. This led to the formation of the Normal Institute for Physical Education in Boston in 1861 to train teachers in the "*New Gymnastics*" system (Leonard et al., 1927).

According to Leonard et al., (1927 pg 260-261) the enhancements brought about by the "New Gymnastics" system are in part the following:

(i) The range of movements used the full play of every muscle in the body, resulting in a holistic development.

(ii) Exercises are rotated from one set of muscles to another, thereby avoiding muscle strain.

(iii) Exercises are tailored to specific individual needs, unlike older systems in which the individual's main target is the performance of difficult feats.

(iv) The physiological purpose of targeting all the muscles in training, is to improve nerve -muscle coordination.

(v) Apparatus which does not strain and stiffen the muscles, not even in the feeble, is preferred over the old school methods that prioritised weights which result in slow, inelastic muscles.

(vi) The New Gymnasium was open to all ages and sexes. Both sexes participated in the exercises leading to a more welcome atmosphere. The old system has failed to attract the old, or the very young, or women.

(vii) Music was used to set the rhythm for the various exercises, improving their appeal. Under the old system each individual works by himself, deprived of the energy evoked by music and the associated group dynamics.

2.2.3 Natural Methods and Laban Movement Analysis (1901 – 1950)

Georges Hébert, an officer in the French Navy published the principles of his "*Natural Method*" in 1936 (Hébert, 1936). After completing the Naval School in 1896, Hébert travelled widely with the Navy. During his travels, Hébert observed that the indigenous people in Africa demonstrated impressive physical development and movement skills, writing, "*Their bodies were splendid, flexible, nimble, skilful, enduring, resistant and yet they had no other tutor in gymnastics but their lives in nature*" (McDougall, 2016, p.228). Hébert also observed that French farmworkers could "*outrun and outlive athletes*" during the First World War (Ostrum, 2011, p.42).

Hébert published his methods in the book "*L'éducation physique virile et morale par la méthode naturelle*" in 1936 in five Volumes (Hébert, 1936). The principles behind the "*Natural Method*" may be found in the first volume and may be summarized as the 3-10-15 approach illustrated in Table 2.2. The "*Natural Method*" had a key influence on the emergence of Parkour.

3 Main Training Components			
1	**Physical Training** for the heart, lungs and muscles, as well as for speed, dexterity, endurance, resistance and balance		
2	**Mental Training** for energy, willpower, courage, coolness and firmness		
3	**Ethical Training** for friendship, teamwork, and altruism		
10 Fundamental Movements			
1	Walking	6	Balance (Equilibrium)
2	Running	7	Lifting and carrying
3	Crawling (on all fours)	8	Throwing
4	Climbing	9	Swimming
5	Jumping	10	Defense
15 Principles for Training			
1	Continuity of work and exercises	9	Cultivation of speed and skill
2	Alternating opposite efforts	10	Correction of individual weaknesses
3	Progression of intensity	11	Taking advantage of air and sun and the hardening benefits of nature
4	Initial warm up and final cool down	12	Express joy and happiness
5	Personalised efforts	13	Cultivation of the qualities of action – courage, willpower, cool headedness and firmness
6	Relaxing inactive muscles and the mind	14	Cultivation of altruistic behaviour
7	Proper posture and sufficient breathing	15	Cultivation of self-improvement
8	Freedom of action even in groups		

Table 2.2: 3-10-15 Components of the Natural Method (Hébert, 1936)

In 1928 Rudolf Laban published "*Schrifttanz*" a method for recording all forms of human motion, nowadays known as *Labanotation* (Hodgson, 2016). Labanotation is a system for analysing and recording movement, providing a framework to describe

someone's movement in qualitative terms. Laban also described Laban Movement Analysis (LMA) a theoretical and experimental system for observation, description, prescription, performance, and interpretation of human movement. This analysis describes movement using four major categories, Body, Effort, Shape and Space.

The German dancer and choreographer Albrecht Knust who had established the first Dance Notation Bureau with Laban's daughter by 1930 published "*Das Hanbuch der Kinetographie Laban*" in eight volumes between 1946 and 1950. Labanotation and "*Kinetographie Laban*" evolved separately until 1959, when the International Council of Kinetorgraphy Laban was created to standardize and eliminate differences between the two systems.

Irmgard Bartenieff who had studied with Rudolf Laban created a set of movement exercises known as the "*Bartenieff Fundamentals*". Bartenieff initially developed these exercises as part of her physiotherapy programme for polio patients. Bartenieff Fundamentals incorporate Laban's spatial concepts in physical therapy, through a set of principles for corrective body movement. These are preparation, breath support, dynamic alignment, core support, rotary factor, initiation, and sequencing. Her work was published in 1980 (Bartenieff et al., 1980).

Figure 2.1 illustrates the key milestones of the evolution of movement education between 1750 and 1950.

2.2.4 Learning to Move – Moving to Learn Debate (1951 – 1980)

In 1957 Professor Luise Charlotte (Liselott) Diem published "*Who can: Illustrating education for movement in the primary grades*" (Diem, 1957). Professor Liselott Diem and her husband Carl had founded the Deutsche Sporthochschule Koln in the 1947 to train teachers in sport and physical activity education. Diem's approach to movement education is based on Laban's principles.

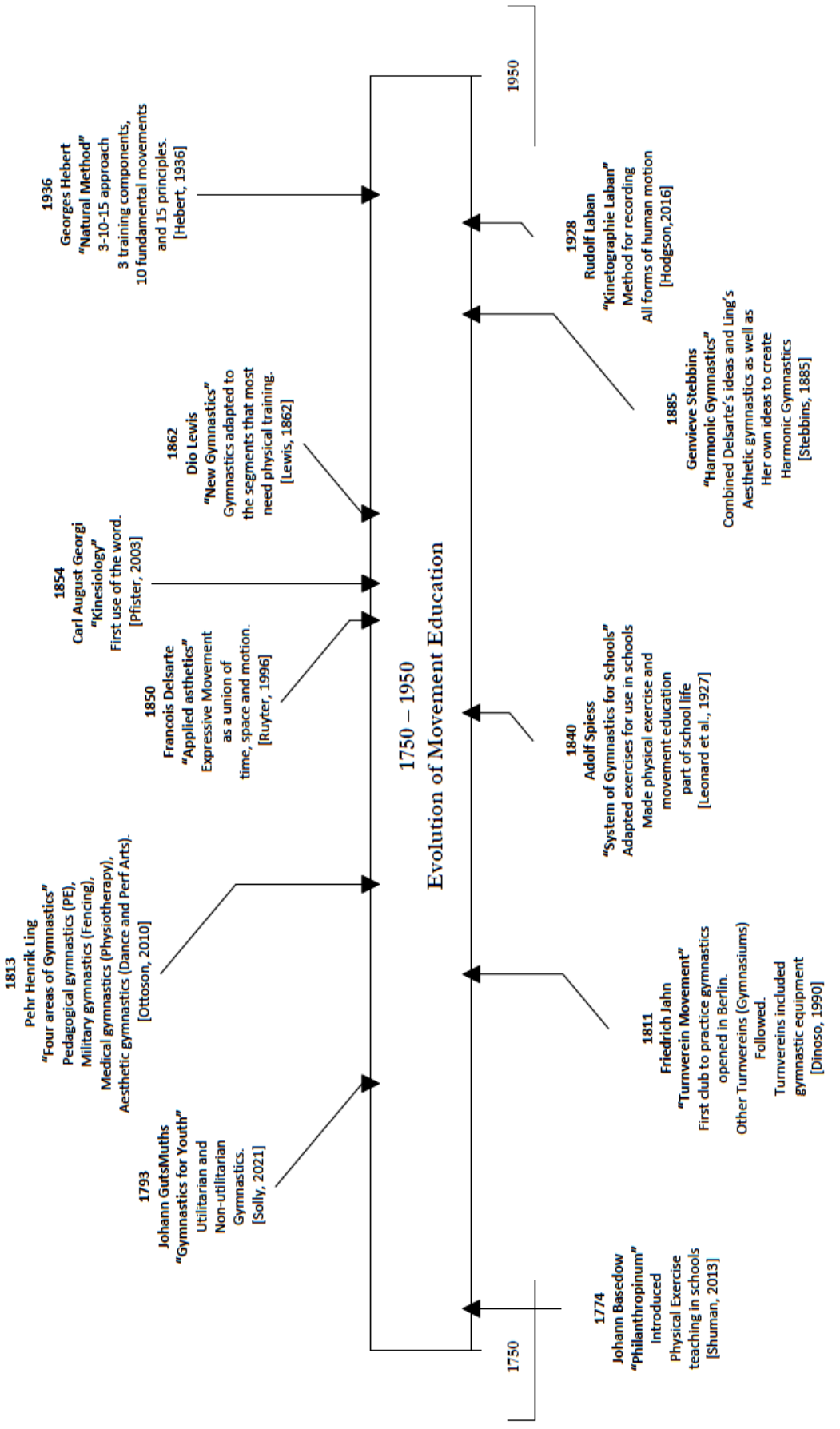

Figure 2.1: Evolution of Movement Education (1750-1950)

Diem developed a '*Natural Technique*' by which children were encouraged to explore movement freely in their own way and according to their development stage. Diem's approach aims to set the environment such as to challenge the child, rather than directing the child to play, to encourage learning by doing and developing self-confidence and self-esteem through diverse movement experiences (Diem, 1991). The teachers were trained to provide an environment that supported this, by asking students "*Who can do this?*" or "*How can this be done differently?*" and guiding the students after. Diem's approach centred on building movement skills and balance (Diem, 1957). Professor Diem work in movement education emphasised the integrated nature of physical, emotional and cognitive development, and she believed that movement education should form part of children's education and that it could enhance their overall learning and well-being. It was not until the late 1950's that theories concerning the relationship between motor skills and perpetual functions started to develop (Barret, 1973).

During the 1960s and 1970s PE programs for young children underwent a shift towards the thinking that a child's physical education is in essence his movement education, in and through movement. It also led to emergence of the term "*Movement Education*" and its positioning at the forefront of primary physical education.

In 1965 the American Association for Health, Physical Education and Recreation (AAHPER) brought about the debate on the interchangeability of learning to move and moving to learn to the forefront, whereby they stated that "*today's physical education is the subject which children learn to move as they move to learn*" (AAHPER, 1965, p.24). This period was also interwoven with a period during which a much larger understanding of the role of early learning was developing (Omwake, 1971). This evolution also triggered the development of various models describing the nature of movement. These typically considered the components of movement, the content of PE programs for children and the means for program development (Barret, 1973).

The Frostig and Maslow model describes the attributes of movement and creative movement (Frostig et al., 1970). The attributes of movement focus on the development of coordination, rhythm, speed, agility, flexibility, strength, endurance, and balance. Creative movement focuses on increasing the child's self-awareness using space, time, flow, weight, gravity, shape and level. Another model, The Hanson model, described movement as having four major divisions, elements of movement, basic movement, fundamental skills and specialised skills. The Hanson model aims to achieve efficient movement as the major aim of physical education (Hanson, 1969). While the Stanley Model adapted Laban's system

to create an effective movement education curriculum for children in a physical education setting. The Stanley model simplifies Laban system concepts for practical utilisation during the teaching of physical education (Stanley, 1977).

In 1982, Professor Diem published the results of an important study in early childhood development which showed that early motor stimulation affected the entire development of the child aged four to six years (Diem, 1982). Motor training in early childhood improves interaction between parents and child, allowing the parents to give the child more autonomy, and to reinforce development through direct motor action, social contacts with peers and coping with anxiety. Simultaneously the child begins to attribute his/her growing autonomy to personal efforts and efficiency in mastering new tasks, inducing a positive learning reinforcement cycle (Diem, 1982). Professor Diem also provided important and lasting initiatives in sports for the disabled and seniors (Thomann, 2023).

2.2.5 The Workout, Aerobics and Fitness Revolution (1981 – 2000)

The interest in bodybuilding, workout techniques, aerobics and fitness in general exploded in the 1980s. The reputation and popularity of body building was negatively impacted in the 1990s by the increased use of performance enhancing drugs. Parallel with these developments Jane Fonda and others developed a set of choreographed movements packaged as a workout. Her first book sold 17 million copies and she became an important part of the mushrooming international fitness industry. Fonda released altogether twenty-three videos and five workout books during the 1980s and 1990s (Fonda, 2010).

The physical fitness revolution quickly became an international phenomenon mainly driven by aesthetic and health considerations. Fitness centres encompassed a wide range of facilities from the traditional fitness gym to luxurious recreational centres (Andreasson, 2014). Such trends increased the significance of movement education into everyday life activities for the purpose of health improvement.

2.2.6 Modern Perspectives of Movement Education (2001 – 2023)

In 2004, John Evans a British educational sociologist published a review of how "*ability*" is defined and perceived in physical education within schools (Evans, 2004). The overall conclusion of the research was that *ability* in physical education within schools was defined by narrow, decontextualised perspectives of movement education. The dominating paradigm favoured able bodied, upper or middle class, western boys, with a framework that lacked the prerequisites to handle diversity.

Movement education became central to support a more diverse student population in the PE class as inclusive teaching strategies become more mainstream. This has brought phenomenological perspectives where movement education is studied from the standpoint of a lived experience within a socio-cultural environment, to the forefront. Such perspectives also explore how individuals perceive and experience movement, challenging the mechanical view of movement education as a sequence of calculated actions.

This period was also characterised with a rapid increase in technology, internet and the use of connected personal devices and it led to a proliferation of mobile apps, online resources and specialised equipment enabling schools, students and individuals to participate, learn and improve their movement education in a more personalised way.

2.3 Fundamental Movement Skills

FMS are basic learnt movement patterns that do not occur naturally, and which involve various body parts, providing the basis for physical literacy. They are the foundational movements that lead to more specialised and complex movements used in day-to-day life, play and sports (Gallahue et al., 2012). FMS are widely regarded as an essential prerequisite for participation in physical activity (Lubans, 2010) and for learning more advanced movement patterns (Kalaja et al., 2012).

Early childhood is a sensitive period for the development of FMS and their mastery is a critical fundamental milestone in the development of the child. Gallahue et al., (2012) categorise FMS into three groups:

(i) Body and Stability management skills;

(ii) Locomotor skills;

(iii) Object control skills.

The development of FMS is directly interrelated with physical activity (PA) and its indirect health, self-esteem and social benefits. If students have been unable to acquire FMS in early schooling it makes little sense to try to teach them advanced movement skills later (Bradford et al., 2016).

Movement learning is achieved primarily through practice and feedback (Saemi et al., 2012). Learners need to acquire sufficient practice time and feedback to be able to carry out the movement on their own, ideally in a complex setting such as a competitive game environment. Learning does not happen in a preset pathway, rather it manifests itself in a set of dynamic, spontaneous, and unpredictable ways. The teacher's role is to construct learning situations that will guide the student along (Chow, 2013).

2.3.1 Body and Stability Management Skills

Body management skills involve balancing the body in stillness and in motion. Movements in which the body maintains a static or dynamic balance or axial stability. Examples of such movements are landing after a jump, bending and stretching, twisting and turning, dodging, stopping after a run, and climbing.

Static balance skills can be taught through practicing standing, walking on balancing beams, obstacle courses, balancing objects on different parts of the body or imitating different body poses such as a flamingo pose. Dynamic balance skills can be taught using tumbling and rolling techniques, safe landings, dancing and climbing. Axial stability skills can be developed using twisting movements, somersaults, dance and pretend play such as imitating twirling leaves in the wind or spinning tops. Without competence in body management, the safe implementation and development of the other fundamental movement skills becomes difficult.

2.3.2 Locomotor Skills

Locomotor skills involve transporting the body in any direction from one point to another. Examples are crawling, walking, running, hopping, leaping, jumping, galloping, skipping, sliding and swimming. Locomotor skills are essential for physical literacy.

These skills may be taught by crawling, walking and marching, obstacle courses, tag games, or imaginative play such as duck walking, frog jumps, bear walk, penguin waddles, or horse galloping. Locomotor skills also contribute to spatial awareness and social interaction.

2.3.3 Object Control Skills

Object control skills require controlling objects such as balls, hoops, bats and ribbons by hand, by foot or with any other part of the body. Examples are picking, throwing, catching, kicking, striking, bouncing and dribbling. These skills help in the development of hand-eye or foot-eye coordination, and overall motor control. Ball games, target games, and bouncing practice could be used to improve object control skills.

2.3.4 FMS in the Maltese Year 1 and 2 Curricula

The Maltese Physical Education curricula for Year 1 and 2 define a set of Learning Outcomes for a comprehensive list of topics (movements) (MEDE, 2023). The topics, grouped in the five areas shown below are described in Tables 2.3., 2.4, 2.5, 2.6 and 2.7:

a. Fundamentals
b. Gymnastics
c. Athletes
d. Educational Dance
e. Outdoor/Recreational.

Area Fundamentals	Topic	Year 1 and Year 2 Learning Outcomes
F2.1	Differentiation	I can self-toss and catch a ballon and a scarf.
F2.2		I can go over and under an implement such as a swimming noodle placed at different heights by the teacher.
F2.3	Equilibrium	I can travel while balancing an implement such as a bean bag on my head without dropping it.
F2.4		I can balance on one foot while balancing an implement such as a bean bag on different body parts such as knee, shoulders, and foot.
F2.5	Combination of Movements	I can self-toss / bounce an implement such as a scarf, ballon, or a ball, perform a body action such as a jumping jack and catch the implement again.
F2.6		I can lift my foot over a low obstacle, and I can crawl under low obstacles to move in the intended direction.
F2.7	Orientation of Space and Time	I can travel faster in a big space and slower in a small space.
F2.8		I can travel as required to go from one spot to another and arrive at a destination.
F2.9	Reaction	I can react instantly to given instruction
F2.10		I can roll a ball through my feet, turn, and go and catch it fast.
F2.11	Rhythm	I can throw and catch a ball upon rebound for at least three consecutive times at the same rate.
F2.12		I can travel as slow as possible such as an inch worm and fast such as a cheetah.
F2.13	Agility	I can travel along different pathways to create letters such as 'V', 'M', 'L' and/or numbers such as '0', '4' and '7'.
F2.14		I can create and copy different footwork movements using different implements such as 'square' or 'hexagon'.
F2.15	Speed	I can differentiate between running in a straight line and running in between obstacles.
F2.16	Throwing	I can throw a ball/implement towards a target.
F2.17		I can differentiate between underhand and overhand throws.
F2.18	Catching	I can catch a self-tossed ball / implement.
F2.19		I can catch a large ball thrown at me.

Table 2.3: Maltese PE curriculum Topics in the Fundamentals Area (MEDE, 2023, p.1)

Area Gymnastics	Topic	Year 1 and Year 2 Learning Outcomes
GY2.1	Animal Travels	I can perform some animal walks such as duck and seal.
GY2.2	Location	I can perform a skill in self-space such as a jump and I can perform another skill in general space such as a roll.
GY2.3	Directions	I can travel in different ways such as forward/ backward, right/ left.
GY2.4	Pathways	I can travel from one side to another side of the mat in different ways, using hands, feet, and rolls.
GY2.5	Weight Transference	I can transfer weight from my feet to different parts of the body.
GY2.6	Levels	I can travel at low, medium, and high levels.
GY2.7	Balance	I can hold balance for 3 seconds.

Table 2.4: Maltese PE curriculum Topics in the Gymnastics Area (MEDE, 2023, p.1)

Area Athletics	Topic	Year 1 and Year 2 Learning Outcomes
A2.1	Runs	I can sprint for 20m in a linear path.
A2.2		I can start to run from different starting positions.
A2.3		I can run around an obstacle course circuit.
A2.4	Jumps	I can jump for height.
A2.5		I can jump for distance.
A2.6	Throws	I can perform an underhand throw.
A2.7		I can perform an overhand throw.

Table 2.5: Maltese PE curriculum Topics in the Athletics Area (MEDE, 2023, p.2)

Area Educational Dance	Topic	Year 1 and Year 2 Learning Outcomes
D2.1	Movement	I can follow a range of non-locomotor movements like bend, stretch, twist, turn, jump on the sport, rise/sink, and fall.
D2.2		I can follow a range of locomotor movements such as walk, run, jump, hop, skip, gallop, and leap.
D2.3		I can imitate different balances on different body parts of the body.
D2.4		I can move safely in space as an individual but in a group-atmosphere using different directions (forward, backward, and sideways).
D2.5		I can clap to the rhythm of fast and slow tempo.
D2.6	Compositional Ideas	I can repeat four different choreographed movements in response to a variety of music.

Table 2.6: Maltese PE curriculum Topics in Educational Dance (MEDE, 2023, p.2)

Area Outdoor / Recreational	Topic	Year 1 and Year 2 Learning Outcomes
OR2.1	Trekking	I can trek a 2Km route.
OR2.2	Orienteering	I can find familiar locations within the school.

Table 2.7: Maltese PE curriculum Topics in the Outdoor/Recreational Areas (MEDE, 2023, p.2)

It is observed that the Fundamentals Area in the curriculum must not be equated to include all the topics related to FMS. FMS such as running, jumping, and throwing are found in the Athletics area, while balance, weight transfer and directions are found in the Gymnastics area. In the Maltese PE Curriculum for Year 1 and Year 2 FMS related topics are spread across all the Areas.

Research on FMS in PE education in Malta is still in its infancy. DeGabriele (2001) studied the use of improvised "home-made" equipment to compensate for a lack of appropriate equipment in the right amount and variety to teach movement skills in PE using a case study. The case study was a success with 82% of the students indicating that the "home-made" equipment was satisfactory for them to practice the movement skills that they had been assigned (DeGabriele, 2001, p.62). A teachers' manual was also developed providing PE teachers with a wide variety of activity ideas to teach movement skills using the improvised equipment (DeGabriele, 2001, p.113).

Bonnici et al., (2008) investigated motor skill proficiency in one hundred local primary school students in Year 3 and Year 5 using filming and an FMS battery assessment tool. It was revealed that a significant overall level of motor skill deficiency exists among the Year 3 and Year 5 students. Grech et al., (2009) investigated FMS proficiency in local Form 1 students and again a low level of FMS proficiency was reported. Muscat et al., 2015 researched the link between FMS and PA competency in 73 children, aged 11-12 years attending middle-state schools in Malta. A correlation was found between FMS and PA while no correlation was found between PA and academic achievement.

Sant (2019) explored the barriers and factors inhibiting FMS development from the point of view of Maltese primary school teachers. A case study investigating whether the Canadian Agility and Movement Skill Assessment actually supports PE teachers with FMS assessment in a Year 4 class was also carried out. Sant (2019) reported that the majority of PE teachers admitted that while room for improvement in primary PE exists, the outside school experiences shaping students are far more hindering the students' journey towards FMS proficiency. It was also found that PE teachers think that the use of standardised FMS proficiency assessment tools is a viable tool to help them in their FMS proficiency assessment and they support the idea of a nationalised standardised tool across primary schools in Malta (Sant, 2019, p.59).

No local studies investigating FMS in primary school students with ASD were reported in the literature.

2.3.5 Critique of FMS as a Pedagogical Focus

Some researchers have critiqued the use of FMS as a pedagogical focus (Almond, 2014; Pot et al., 2014). Amongst other they argue that:

a) Not all FMS are fundamental;
b) Individual FMS only lead to a limited number of activities and therefore skill transfer is limited;
c) FMS are learnt by doing rather than being taught.

Barnett et al., (2016) counter present the case that FMS are an important pedagogical focus. They argue that one must identify which skills are FMS from an analysis of the different skills and not from their inclusion or otherwise in the multitude of assessment frameworks that have been mainly developed to assist with the identification of children with development issues. Such assessment frameworks also do not typically include FMS that are typically useful in many activities, and which can be achieved with minimal training.

A number of studies also show that in a number of early childhood intervention programs where young children were provided with well-equipped free playtime, the children did not significantly improve their FMS, and only in the instructed instances are significant improvements in FMS recorded (Robinson et al., 2009; Goodway et al., 2003). Barnett L et al., (2016) conclude their counter arguments by maintaining that a FMS competence component is a "*seriously useful focus"* (Barnett, 2016, p.223).

2.4 FMS Challenges for Primary Students on the Autism Spectrum

A growing body of evidence suggests that impairments in motor skills precede, and worsen social and communication skills in infants with a high risk of ASD indicating a need to shift focus from socio communicative deficits to a motor perspective in order to facilitate early diagnosis (Harris 2017; MacDonald et al., 2014), suggesting that more research is required to determine the definitive FMS markers of ASD (Zwaigenbaum, 2015).

Various studies have demonstrated that primary school children on the autism spectrum exhibit a substantial delay in FMS development compared to their age matched peers irrespectively of whether fine or gross motor skills are being compared. The studies typically compared the performance of a group of children on the autism spectrum with that of typically developing children or standardised normative data (Gandotra et al., 2020; Zhang et al., 2007). Most of such studies have narrowly focused on motor deficits

associated with ASD such as coordination, posture, and gait rather than having a focus on the fundamental movement skills. They have also been based on a range of ages from preschool, school and youth.

Gandotra et al., (2020) carried out a systemic review of published literature to analyse results where the studies had researched FMS in very young (<6 years) or school age children (6 – 12 years) with ASD. Thirteen studies were reviewed for the school age category (which more closely matches the primary school age), comprising a total of 382 participants with a mean age of 9.3 years. Nine of the studies compared the performance of the children with ASD to that of typically developing children standardised normative data for the assessment test used. Three studies compared the performance with that of children with other developmental disorders and one study compared the performance among children with the spectrum of autism disorders.

Of the studies between 67% and 80% of children with ASD had definite to borderline impairments in locomotor skills, between 53% and 82% had definite to borderline impairments in object control skills and between 33% and 58% had definite to borderline impairments in balance skills (Gandotra et al., 2020). These findings suggest that children with ASD have significant difficulties to perform tasks that rely on perceptual-action coupling strategies or coordinated movements. When the comparison is made among the group of children on the autism spectrum, it was found that while all the children had movement impairments, children with Aspergers syndrome showed a lesser degree of impairments in their overall FMS composite than those with Persuasive developmental disorder not otherwise specified (PDD-NOS) and Autism. (Ghaziuddin,1998).

The reviewed results also show that most children with ASD demonstrated FMS impairments that lasted throughout childhood, with delayed FMS developmental trajectories from an early age, with the delays becoming increasingly pronounced with age. School age children (6 to 12 years) typically performed movement skills similar to typically developing children of approximately half their age (4 to 6 years) (MacDonald, 2014). Due to their typically poor inter-personal skills, children with ASD withdraw from playing games with their peers further reducing their opportunities to improve their FMS.

Interestingly, few studies provide a detailed description of the constellation of behaviours demonstrated by the children with ASD participating in the studies. It is important that studies include a description of behaviours and a 'severity' measure, since the management of a wide range of behaviours in a class is a key challenge, and such measures can offer a basis for comparison (Colombo-Dougovito, 2019).

2.4.1 FMS Assessment for Primary Students on the Autism Spectrum

Fundamental Movement Skills development begins during early childhood and continues to evolve on a developmental continuum until later childhood. Several assessment tools have been created to assess FMS development in children on this continuum, using standardised movement assess batteries employing a broad range of FMS.

Such assessment tools use either a product-oriented or process-oriented approach. A product-oriented tool measures the performance outcome (e.g. time to perform a task or number of errors made), while a process-oriented tool focuses on the technique used to perform a particular task (e.g. stretches arms to catch a ball or bends knees to cushion a landing).

The most popular assessment tools used for primary school children are (Liu et al., 2013):

(i) Test of Gross Motor Development 2nd or 3rd edition (TGMD-2/3)

(ii) Movement Assessment Battery for Children 2nd edition (MABC-2)

(iii) Bruininks-Oseretsky Test of Motor Proficiency 3rd edition (BOT-3)

(iv) Development Coordination Disorder Questionnaire (DCDQ)

(v) Psychomotor Motor proficiency test (MOT 4-6)

(vi) Mullen Scales of Early Learning (MSEL)

(vii) Peabody Developmental Motor Scales 3rd edition (PDMS-3)

Such tests typically take between 30 minutes to 90 minutes to be administered to one child. Most of the assessment frameworks also include normative data to be able to compare the child's assessment to that of typically developing peers. Several of the assessment frameworks have different versions that differ in their assessment content and normative data samples.

Table 2.8 summarises and compares the main attributes (Version, Orientation, Age range of applicability, and salient features of the assessment) of the various tests listed above. The comparison is carried out using the latest published version of the various assessment tools.

Test – Latest version	Orientation	Age Range years	Description
Test of Gross Motor Development 3rd edition (TGMD-3)	Process	3 to 10	TGMD-2 assesses locomotion skills (running, galloping, hopping, leaping, horizontal jumping and sliding) and object control skills (two handed strike, stationary dribbling, catching, kicking, overhand throwing, and underhand rolling). TGMD-3 assesses 13 FMS divided into two subsets, Locomotion skills and ball skills. Each TGMD-3 subset takes about 20 minutes to complete, therefore 40 minutes for administer the complete test. TGMD-3 provides standard scores, percentile scores and age equivalents based on more recent normative data (2014 – 2017).
Movement Assessment Battery for Children 3rd edition (MABC -3)	Product	3 to 6, 7 to 10, 11 to 16	MABC-2 assesses manual dexterity (coin insertion, bead threading, path tracing), ball skills (catching, tossing, striking) and balance (single leg balance, toe walking, jumping) using specific guidelines. MABC-3 Includes normative data (2014-2017). There are different tests for each of the three age bands. The test takes about 30 to 45 minutes to complete.
Bruininks-Oseretsky Test of Motor Proficiency 3rd edition (BOT-3)	Product	4 to 21	BOT-3 evaluates fine and gross motor skills using 61 tests organised in eight subtests. These eight subtests are fine motor precision, fine motor integration, manual dexterity, upper limb coordination, bilateral coordination, balance, strength and dynamic movement. BOT-3 includes updated norms to cater for today's population diversity. It takes between 60 and 90 minutes to complete. BOT-3 also introduces three supplementary scores, skilled manual performance, planning and coordination and movement fundamentals, as well as an optional extended balance score.
Development Coordination Disorder Questionnaire (DCDQ)	Product	5 to 15	The DCDQ is administered to parents. The test contains 15 questions about the child's motor performance, and parents are asked to compare their child's performance to that of peers using a 5-point Likert scale. The 15 questions are grouped in three groups namely, control during movement, fine motor and handwriting and general coordination. The test takes about 15 minutes to complete.
Motor Proficiency Test (MOT 4-6)	Product	4 to 6	Specifically designed for 4-6 years of age, MOT 4-5 assesses six subtests, grasp, pinch, in-hand manipulation, bilateral coordination, upper limb sequencing and balance, on a scale of 0 to 10, using 18 tasks. It also has normative data based on a sample of German pre-school children. The test takes about 25 minutes to complete.
Mullen Scales of Early Learning (MSEL)	Product	2 to 68 months	Assesses 5 areas, Gross Motor, Visual Reception, Fine Motor, Expressive Language and Receptive Language. The test typically takes about 60 minutes to complete for 5-year-olds.
Peabody Developmental Motor Scales 3rd edition (PDMS -3)	Process	Birth to 5	PDMS-3 assesses gross and fine motor skills using 5 core subtests. These are body control, body transport, object control, hand manipulation and eye-hand coordination. A supplementary subtest scores physical fitness to address overweight, obesity and fitness testing in preschool children. Scoring may be compared to normative scoring derived from scoring 1452 children between (2016-2021). It takes 60-90 minutes to complete the test.

Table 2.8: Summary of main FMS assessment tools

2.4.2 Adapted PE Techniques to Teach Primary Students with ASD

Various techniques have been developed to assist teaching and supporting primary children on the autism spectrum in the PE class (Grenier, 2013). The use of evidence-based teaching methods, practice and patience is required to successfully engage a student on the autism spectrum in physical exercise.

Teaching methods that have been developed to assist with children on the autism spectrum in the PE class are:

a) Visual supports – that facilitate communication, add structure and routine, provide sequencing and colour coding, and minimise sports jargon (Grenier, 2013, p.18).
b) Technology aided instruction and reinforcement using tablets and specialised applications (apps) such as the LAMP words for life© app (Hourcade, 2013).
c) Video Modelling – viewing of videos of the other students and the teacher demonstrating a task, as well as digital tools to analyse movement (Taheri-Torbati, 2019).
d) Equipment – A variety of equipment of different sizes, textures, weight and shapes is required to attract the student on the autism spectrum to participate in the PE class (Zhang et al., 2007).
e) Applied Behaviour Analysis (ABA) – ABA has demonstrated successful results when used with students with ASD (Grenier, 2013, p.33). ABA uses a systematic sequence of consequences to alter a person's response. It is based on the premise that behaviour can be adapted through the use of stimuli and rewards (positive and negative) via a reinforcement learning process based on the Premack principle (which states that a person will perform a less desirable activity to have the opportunity to perform a desired activity) (Herrod et al., 2023). Early intervention ABA (before the age of 5 years) is described as Early intensive behavioural intervention (EIBI). The application of ABA techniques in a high intensity, one to one setting is known as Intensive behavioural intervention (IBI).
f) Classroom Pivotal Response Teaching (CPRT) is considered an evidence-based practice. It is designed around 8 key components, Student attention, clear and appropriate language, easy and difficult task, shared control, multiple cues, direct reinforcement, contingent consequence, and reinforcement of attempts (Ketcheson, 2017).

g) University of North Carolina Treatment and Education of Autistic and related Communications Handicapped children (TEACCH) guidelines for teaching children on the autism spectrum are based around six guidelines. These are the organisation of the physical environment, the sequencing of activities and their scheduling, the use of visual cues, routines and flexibility, structured work and activity systems and the use of visually structured assignments (Mesibov et al., 2005).
h) Laban Movement Concepts have recently been used to map the physical language of children with ASD (Federman, 2023), as well as to develop movement programs to assist such children (Connolly, 2023).

Understanding how the students communicate and taking time to create a bond between the student and the PE teacher and LSE is very important. A personalised FMS learning plan must then be developed. Ultimately the way PE teacher and LSE adapt the goal, communicate with the student and handle the different challenges are critical success factors.

2.4.3 Early Intervention as a Means to Facilitate the Learning of FMS

Colombo-Dougovito (2019) carried out a systemic review of FMS interventions for children and adolescents on the autism spectrum. The review showed that an early intervention in any form can have a beneficial impact on the development of FMS in children on the autism spectrum.

The literature is inconclusive on whether the frequency and duration of interventions have an impact on the effectiveness of the intervention for improved learning of FMS. Logan et al., (2011) had found no correlation between the duration of FMS and its effectiveness for improved FMS learning in typically developing children. Bremer et al., (2015), tested two different frequencies and duration (1/hr per week for 12 weeks and 2hrs/week for 6 weeks) on a small sample of 4-year-old children on the autism spectrum and also found that both groups registered a same level of improvements, independently of the intensity. Palmer et al., (2023) also found that an intervention structured around TEACCH guidelines did not significantly improve gross motor quotient scores in the ASD participants. However, during guided physical activity in which the children were encouraged to explore intrinsically enjoyable activities participants chose to engage in running, swinging, throwing, and climbing leading to an improvement in the running and kicking raw scores.

In a more recent study, Case and Yun (2019) found that interventions that had 16 total hours or more had a significantly larger improvement effect that those that had less that 16 total hours. They also found that interventions carried out in experimental settings had significantly larger effect than interventions carried out in a practical setting. More research is required to determine the amount of contact time required for long term improvements from such interventions.

A few studies have carried out a follow up to evaluate the long-term retention of the FMS skills improved via intervention. Bremmer et al., (2015) followed up participants 6 weeks after the end of the intervention and observed a retention of motor skill improvements for the group that had the longer but less intense intervention, and no retention of motor skill improvements for the group that had the shorter more intense intervention. Follow up assessments carried out by Ketcheson, (2017) after four weeks and Guest, (2017) after eight weeks also showed retention of motor skill improvements following the intervention.

Most of the reviewed studies carried out with children with ASD used visual cues for their intervention and adapted their delivery method. Significant improvements in motor development were observed, however the literature is inconclusive as to whether these improvements are solely due to the intervention or whether they are arising from the intervention adapted presentation enabling the children with ASD to better understand what is expected from them and how to do it (Colombo-Dougovito, 2019). A study by Wulf et al. (2010), suggests that improvements could also have been derived due to the focused nature of the intervention.

Interestingly, a study to determine whether active video games contribute to the development of FMS in children on the autism spectrum found that there was no significant increase in object control skills following a 2-week intervention of playing Kinect Sports on the Xbox Kinect. However, the study did report an improvement in the students on the autism spectrum perceptions of their own motor skills. The study did have a number of weaknesses such as its reliance on parent reported activity, its relatively short duration (six, 45-to-60-minute sessions, over 2 weeks) and its conduct with an unstructured in home environment rather than a structured therapy session (Edwards, 2017).

Busti-Ceccareli et al., (2020) reported that several studies have confirmed that motor training interventions had a positive effect on the social and communication skills of the children as rated by the parents and on engagement in peer interaction as rated by direct observation.

A weakness of most studies is the absence of a control group making it hard to determine whether the improvement was a result of better communication, the opportunity to practice, or maturation. Colombo-Dougovito (2019) also reported that more than 70% of participants in the studies were male implying that the lack of female participants is another weakness since it is not possible to determine whether interventions with females on the autism spectrum will benefit in the same way as their male counterparts.

The early intervention improvements demonstrated suggest that motor skill delays in ASD could potentially be secondary to the condition and not an intrinsic feature since any amount of intervention led to an improvement (Colombo-Dougovito, 2019).

2.4.4 Difficulty Introduced by the Autism Spectrum Range

The autism spectrum by definition gives rise to a constellation of behaviours leading to wide variability in the ability of those affected by it. The studies in the literature mostly compare children with ASD with typically developing cohorts and no effort is made to accurately determine the individual capabilities of the children on the autism spectrum. This is a key weakness since it becomes very difficult to compare study participants as well as to compare participants across studies. It is also difficult to understand which interventions are the most effective for the individual child's abilities.

An accurate determination of capabilities vis-a-vis the autism spectrum will help researchers to accurately determine results and identify which interventions hold promise at the various points along the spectrum.

The Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-V) defines three levels that define the level of incompatibility of the autistic traits of a person with an ASD diagnosis with neurotypical expectations, indicating the level of support required in their day-to-day life (APA, 2013).

The three levels are described in more depth below (APA, 2013):

a) **Level – 1 Requires Support**: is used to describe individuals who are usually able to communicate in full sentences most of the time, but may have trouble in an extended conversation. They have social anxiety, and may have trouble moving between activities, trying out new things or organising and planning. They can also act neurotypical but it burns them out in the long term.
b) **Level – 2 Requires Substantial Support**: is used to describe individuals who find

it hard to communicate or socialise. They have a higher degree of social anxiety, and have trouble changing between activities or trying out new things. They typically engage in repetitive behaviours (stimming) that are out of norm and demonstrate very focused interests. also have difficulty with organisation and planning. They therefore have a difficulty in masking their behaviour and require a larger effort to self-regulate.

c) **Level – 3 Requires Very Substantial Support**: is used to describe individuals who have a difficulty to express themselves verbally or using body language or facial expressions. It is very hard for these individuals to complete day to day tasks, to socially interact or deal with any form of change (change in activity, focus, location). They rarely initiate a communication or an interaction. They typically demonstrate most of the aspects of Level 1 and 2. They are also unable to mask their behaviour and require a very larger effort to self-regulate.

2.5 Summary

The evolution of movement education has been outlined since its origins in gymnastics for youth, its interplay with applied aesthetics, new gymnastics, natural methods and Laban movement analysis, as well as the learning to move – moving to learn debate that led to movement and fundamental movement skill education forming part of primary school PE curricula. The fundamental movement skill learning outcomes in the Maltese year 1 and 2 curriculum are then analysed.

While plenty of research on the challenges of teaching FMS to children on the autism spectrum and benefits of early interventions have been carried out comparing children with ASD to typical developing children, surprisingly few studies have looked addressed the variability in support levels required by different children on the autism spectrum and the impact on the teaching and learning of FMS. Furthermore, few studies have looked at the teaching of FMS to primary school children on the autism spectrum from a PE teacher and Learning support educator perspective.

This study researching "*teaching pedagogy and resources for fundamental skill development in primary school children with autism*" in Malta "*from a PE teacher and LSE perspective*" is therefore at the forefront of research on this subject. It is also the first time that such a study is being carried out locally. The next chapter describes the methodology used to carry out this research.

Chapter 3

Methodology

3.1 Introduction

This chapter describes the main aim of this research study and its ontology and epistemological perspectives. It describes the mixed-method research design adopted and the process of selecting the participants, collection of the data and subsequent analysis. This is followed by an outline of measures that could improve the quality of the study and ethical considerations.

3.2 Main Aim and Research Questions

The main aim of this research is to identify the essential teaching pedagogy and resources needed by PE Teachers and LSEs to assist the PE Teacher – LSE team to improve the development of FMS of Primary students with ASD.

The key research questions for this research are:

a) What are the factors affecting FMS development in primary students with ASD?
b) How do local PE Teachers and LSEs assess the FMS of primary students with ASD?
c) What are the tried and tested, as well as leading edge pedagogy methods and teaching resources used or indicated as essential by local PE teachers and LSEs, to improve FMS development in primary students with ASD?
d) Do local PE Teachers and LSEs support the hypothesis that early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years?

e) What is the self-reported level of preparedness of local PE Teachers and LSEs to teach FMS to primary students with ASD?

The main benefit of this research will be to guide stakeholders and policy makers on the actions needed to improve the teaching of FMS to primary students with ASD.

3.3 Ontology and Epistemology

Grix (2019) describes Ontology as being concerned with answering the question "*What's out there to know*?" Grix (2019, p.189). Ontology is a branch of philosophy that is concerned with what exists and what is it's nature. Ontology addresses whether there is a *Realist* stance which asserts that only one reality exists independently from its environment and context, or an *Idealist* stance which asserts that multiple realities exist that are shaped by their different environments or contexts. These two ontological stances exist on a continuum. The realist stance is further subdivided into naïve (direct) realism where reality is objective, observable and measurable, structural realism where reality can be described but its nature is uncertain or critical realism where reality can be understood through critical examination. Critical realism bridges the gap between naïve realism and idealism (Maxwell, 2012).

The ontological status of autism has caused considerable debate (Kourti, 2021). On the one hand, proponents of its roots in the fields of psychiatry and psychology suggest a naïve realism stance aimed at a reality that is solely dependent on the autism subject's biology and behavioural characteristics. While on the other hand proponents of the neurodiversity movement argue towards an approach that considers social constructs, environment, and context (Kourti, 2021). Kourti (2021) make the case that a Critical Realism ontology can reconcile the two positions. Critical Realism can challenge the dominant behaviourist approaches to understanding autism.

This research follows a Critical Realism ontology since this acknowledges the unique perspectives and challenges of each individual autism subject and challenges the notion of a single objective reality. It also links to an idealist stance that PE teachers and LSEs could have an impact on the very results of this study. Results are dependent on the subjective realities of the participants including their emotions and interpretations. Results are also permanently under change, flexible and influenced by what stakeholders do.

Epistemology is the theory of knowledge and deals with how knowledge is gathered and from which sources. Grix (2019) describes Epistemology as being concerned with answering the question "*What and how can we know about it*?" Grix (2019, p.189). Within epistemology there are several approaches such as positivism, interpretivism, feminism or postmodernism. This research study adopts an interpretive epistemology. An interpretive approach treats human behaviour as unique and distinctive where their actions are shaped by their environment (a phenomenological approach). It strives to interpret the human perceptions and the meaning of their behaviour, seeking to see things from their point of view (empathise). As a consequence of the interpretative epistemology there is the possibility of contradictions and inconsistencies arising from the subjective explanations that interpretivists produce (Grix, 2019).

3.4 Research Design

A mixed-method research approach was adopted which included:

(i) A qualitative component using one-to-one interviews with five professionals working with young children on the autism spectrum, and

(ii) A quantitative component using a self-constructed online questionnaire distributed to PE teachers and LSEs in Malta and Gozo.

The overall objective of a mixed-method research design is to provide a better comprehension by using a qualitative and quantitative approach in a single study, enabling a stronger understanding than using each approach on its own (Creswell et al., 2017). Better comprehension is obtained by integrating one set of results with another, thereby enhancing the validity of inferences. A mixed-method approach is also well suited to support the investigation of complex research questions in small sample populations. A mixed-method approach also guided by the critical realism ontology selected for this study can also enhance the depth of the research. A disadvantage of mixed-method research design is the increased time required to carryout the study, as well as the subsequent result integration.

In this study, an equal weighting and priority was given to the two research methods, therefore both the qualitative, and quantitative data collection were carried out in parallel, within the same time period.

3.4.1 Qualitative Research – Interview Design

Qualitative interviews allow researchers to delve deeply into the interviewees' wealth of knowledge and experience. Interviews allow researchers to explore topics in more depth than other research methods such as questionnaires. They are especially useful when complex phenomena are at play. A semi-structured interview approach was selected for this research study because it allows an opportunity to delve further into emergent topics and relevant issues identified by the interviewee, providing a degree of flexibility which enriches the data collection.

A generic interview question list was piloted with an interviewee who did not participate in the research and the feedback was used to fine tune the interview question list.

A customised interview question list was then designed for each interviewee, taking into consideration the interviewee's experience, background, environment, and motivation. The interview questions were organised in different sections along the five research questions outlined in Section 1.3. Open-ended questions were created to allow interviewees to express themselves, avoiding questions that might introduce a bias in the response. A copy of the interview questions used for each interviewee is attached in Appendix B.

3.4.2 Quantitative Research - Questionnaire Design

A self-constructed questionnaire was used to ensure relevance in the local context. Google Forms® was used to create the questionnaire and manage the response collection. A mix of quantitative multiple-choice questions and qualitative open-ended questions was used. The questionnaire was designed to contain five sections.

The first section targeted the respondents' demographics, including age bracket, highest level of education, occupation and whether teaching in a primary, secondary or a mix of both. The second section was aimed at understanding the respondents' experience with teaching or supporting students on the autism spectrum in their PE classes. They were asked whether they taught students on the autism spectrum in their PE classes and what percentage of their PE classes included such students.

The third section had the objective of understanding the amount of training received by respondents to teach FMS to students on the autism spectrum, and whether

this training was hands on or theoretical. In the fourth section respondents were asked to rate the difficulty to teach or support the FMS identified in the Maltese Primary School PE curriculum.

In the fifth section respondents were asked to describe how the FMS capabilities of primary students on the autism spectrum were determined. They were also asked about their familiarity with different FMS assessment tools, as well as their preferred use of these tools when assessing FMS capabilities in primary students on the autism spectrum. In the sixth section respondents were asked about their teaching strategy when teaching FMS to primary students on the autism spectrum. They were also asked to indicate familiarity with specialised teaching techniques developed for students on the autism spectrum, as well as their preferred use of such techniques. Respondents were also asked to rate the difficulty posed by stereotypical behaviours in students on the autism spectrum when teaching them FMS in the PE class. Respondents were also asked to estimate the number of instruction hours required for improvements to be observed in different FMS. Respondents were asked about the resources required to teach FMS to primary students on the autism spectrum, as well as the resources' availability.

In the seventh section respondents were asked whether they support the hypothesis that an early intervention focusing on FMS development in primary student on the autism spectrum will improve the overall development of the student in later years. They were also asked about their recommended extra-curricular activities for such students as well as on how they rate collaboration between PE teachers and LSEs. In the eight section respondents were asked to rate their level of preparedness to teach/support FMS to primary students on the autism spectrum. Finally, respondents were asked for their recommendations on how to improve.

Since the questionnaire used was specifically created for this study, it had not been validated in previous research. The questionnaire was distributed to five test users to assess the effectiveness of the questions and to measure the actual time required to complete.

Several modifications were made, which included improving the layout of some of the questions for smartphone use, simplification of the content and rewording of some questions and answer choices to improve understanding by the respondents.

A copy of the questionnaire is attached in Appendix A.

3.5 Participant Selection, Eligibility and Sample Size Estimation

Five adult professionals working with young children on the autism spectrum were selected to be interviewed. The interview participants were selected based on their relevant knowledge, experience in the field as well as care giving experience. A mix of experiences was targeted:

1. Interviewee 1: A PE primary school teacher
2. Interviewee 2: A Learning Support Educator
3. Interviewee 3: A Coach from Special Olympics
4. Interviewee 4: A Professional working in a centre catering for children with Autism
5. Interviewee 5: A Representative from an autism related association

Collectively the interviewees represented more than 30 years of collective experience working with children on the autism spectrum. All the interviewees were female and were between 27 and 40 years of age. All of them have worked with children on the autism spectrum and were experts in their respective domains.

Two of the interviewees roped in specialised colleagues in occupational therapy to assist with answering the more detailed questions around fundamental movement skills, and the related assessment frameworks. Most interviewees had a graduate degree in physical education, psychology, or an inclusion related subject. Some had post graduate degrees in sports and inclusion. Most attended regular continuous professional training.

With respect to the questionnaire, eligibility criteria were set to include all PE teachers and LSEs in Malta and Gozo. It is estimated that there are around 225 PE teachers. A recent announcement by the Education Ministry indicated that there are 2862 LSEs in state schools in Malta and Gozo (The Malta Independent, 2024). It is therefore estimated that the total number of PE teachers and LSEs in Malta and Gozo is around 3250.

Based on this population size assumption, a sample size of 76 responses is required for a 95% confidence level with a 11% margin of error. Table 3.1 summarises the key variables used in the sample size calculation.

Sample Size Calculation Equation	$\text{Sample Size} = \frac{\frac{z^2 p(1-p)}{e^2}}{1+\left(\frac{\left(\frac{z^2 p(1-p)}{e^2}\right)-1}{N}\right)}$
Confidence Level	**95%**
Margin of Error	**11%**
Sample Proportion	**50%**
N	**3,250**
z	**1.96**
e	**0.11**
p	**0.5**
Sample Size estimated	**76**

Table 3.1: Sample size estimation

3.6 Data Collection – Interviews and Questionnaire

One-to-one interviews were carried out between April and May of 2024, depending on the availability of the interviewees. An invitation letter outlining the objective of the interview was shared with the interviewees and their consent was obtained before the interview. The interviews were transcribed for later analysis.

With respect to the questionnaire, the data collection was carried out between February of 2024 and April of 2024. Participants were invited to participate by sharing a weblink to the questionnaire on the social media groups "*Physical Education Malta* & *Gozo*" and "*LSEs (Let us help everyone)*". The questionnaire was configured to ensure anonymity of the data collected. A total of 78 responses were collected over the period.

Online data collection methods provide a convenient platform to administer the data collection. Online data collection excludes members of the target population who are not digitally savvy, or who do not use social media. The reliance on respondent participation instead of a random sample invitation to participate can also potentially lead to a bias in the data collected.

3.7 Analysis of the Data Collected

A thematic analysis of the interview data was carried out. Braun et al., (2006) identify a six phased approach to thematic analysis. In the first phase the interview transcripts are analysed to identify the recurring points and potential themes. In the second phase initial codes are generated across the different interview transcript data. The data is

then collated and organised according to each code. In the third phase the data is organised into potential themes. In the fourth phase the potential themes are reviewed within the context of the research questions and coded extracts. In the fifth phase the final themes are identified. In the sixth phase compelling extracts from the interview transcripts are identified to strengthen the themes.

With respect to the questionnaire, the answers to the various questions were processed in Microsoft Excel© and graphs of the various results prepared. Statistical analysis were performed using IBM SPSS® software. Since the data obtained was predominantly categorical, a Fisher exact test was used to assess correlations between the results obtained from the questionnaire.

A cut-off value of $P< 0.05$ was taken as the margin of significance, therefore only correlations falling below that boundary are considered as "*significant*" and indicative of the existence of dependency between the different categorical variables. The Fisher's exact test was used instead of the Chi Squared test because of the small number of samples (<5) available for certain variable combinations. Open ended questions were grouped according to the theme of the answer. The labelled data was then used to carry out the analysis.

3.8 Enhancing the Quality of the Study

The quality of the interviews was enhanced through the selection of interviewees with the appropriate experience. With respect to some of the specialised questions related to FMS assessment some interviewees recommended other specialists in the field. These were contacted and their feedback obtained also. Care was taken to develop a connection with the interviewees and their anonymous contribution was highlighted, enabling them to be more comfortable during the interview. All interviewees allowed me adequate time to transcribe their responses.

The inclusion of both PE teachers and LSEs in the questionnaire ensured a much wider reach of data collection and led to a richer contribution from their collective experience of supporting students with ASD. Care was taken to ensure that the questionnaire could be easily filled when using a smartphone small screen to make it easier to participate. Multiple choice question choices were randomised to avoid top of selection bias. Open ended questions were also used where applicable to enable respondents to provide customised feedback. Adequate time was provided to enable the highest possible number of questionnaire responses.

3.9 Ethical Considerations

An online University of Malta, University Research Ethics Committee (UREC) form was submitting as per the UREC guidelines. As per the online submission, ethical approval from UREC was not required.

The identity of the interviewed adult stakeholders is known, however all information obtained was anonymised and it is not possible to reverse engineer the identity of the interviewed person. An information letter and a participant consent form were shared before the interview. The information letter provided participants with the background related to this research while the consent form outlined the criteria under which the interviews would be carried out. An email and contact number were also provided to enable participants to obtain more information about the study. Consent to conduct the interview was obtained before carrying out the interview.

The online questionnaire had an online information cover page to the questionnaire, that notified potential respondents that participation was voluntary, and that the data collected would be anonymous. An email and contact number were also provided to enable participants to obtain more information about the study. No questions were asked, or data collected, that could be used to identify an online questionnaire respondent.

Chapter 4

Research Findings and Discussion

4.1 Introduction

In this chapter the focus is on the presentation of the results obtained from the interviews, followed by those obtained from the questionnaire. A critical discussion on all the results obtained is then presented.

4.2 Qualitative Analysis

A thematic analysis of the interview transcripts resulted in the following five themes:

1) The factors affecting FMS development in primary students with ASD;
2) The issues related to FMS capabilities assessment;
3) The Pedagogy methods and teaching resources used or identified as essential;
4) Support for early intervention to improve FMS development;
5) PE teacher and LSE preparedness to teach FMS to primary students with ASD;

Each theme will be described in more detail in the sections below.

4.2.1 Factors Affecting FMS Development in Primary Students with ASD

All the interviewees agreed that FMS development was very important for primary students on the autism spectrum. If the students tended to lead a sedentary lifestyle at home, watching TV or their tablet excluded from physical activity, then they have a significant disadvantage with respect to their FMS development. In fact, Interviewee 2

commented that "*a sedentary lifestyle at home can be one of the key indicators on whether the FMS development goals will be achieved or otherwise*".

FMS delays are a key factor affecting development however if properly addressed through therapy and assistance the gap to typically developing children can be significantly reduced. Ideally such intervention happens as early as possible.

Furthermore, children on the autism spectrum exhibit a number of stereotypical behaviours that make the learning of FMS a challenge such as impairments in social interaction with others, physical aggressiveness (tantrums, hitting, kicking, scratching), a preference for repetitive activities (hand flapping, rocking or echolalia), a preoccupation with certain objects or a single activity or sensory overload to external stimuli. Children on the autism spectrum sometimes also have multiple non communicative diseases that impact their general health and might act as a limiting factor in physical activity. Interviewee 4 stated that "*Movement is very beneficial for all children but especially for children with autism since it helps them regulate their behaviour*".

An important reflection was made by Interviewee 1 who observed that "*A factor that is not given the importance it deserves is the time it takes children on the autism spectrum to adapt to a new surrounding such as a new school, a new class, a new gym or new play ground*". Children need to be given their time to get familiar with their new surroundings.

4.2.2 FMS Capabilities Assessment

Students are usually diagnosed by the Child Development and Assessment Unit (CDAU) at a young age. The child is screened by a Paediatrician, a Psychologist, an Occupational Therapist and a Physiotherapist. The CDAU then issues a report which is shared with the school where the student attends.

The main assessment method of students on the autism spectrum is the Autistic Diagnostic Observation Schedule (ADOS), a semi structured interview as well as a play-based assessment that aims to assess the student's communication and interaction ability as well as whether they have any restricted or repetitive patterns of behaviour. It also assesses the student's creativity and tries to determine strengths and weaknesses. A clinical Autism Diagnostic Interview (ADI) is also held with the parents to understand the development history of the student. An individual education assessment plan (IEP) is then developed for the child.

There was a weak awareness of the different FMS assessment frameworks among the

interviewees, and none had come across such assessments in practice. Interviewee 3 stated that "*There are many FMS assessment tools that can be used, however we need to be taught how to use them, because ultimately their effectiveness is their applicability in practice*"

Experience with students with ASD indicates that such students have a difficulty with balancing, impacting other activities such as their ability to hop or balance on a swing. Motor coordination, hand-eye coordination and agility are also challenging for such students. A key challenge of the autism spectrum is the wide range of abilities of students on the spectrum. Interviewee 2 observed that "*Sometimes it is very difficult, especially at a young age to observe the difference when doing simple movements between typically developing children and those on the autism spectrum*". This makes it very difficult to manage in a classroom setting without assistance from the LSEs.

4.2.3 Pedagogy Methods and Teaching Resources

An individual education plan was seen as essential to address the FMS weaknesses of children with ASD. All agreed that movement is a way to manage stereotypical behaviours such as stimming and tantrums. Interviewee 1 also observed that "*movement is also a way to expend energy enabling the child to focus on tasks at hand when sitting down*".

Interviewees were aware of the need to use visual cues to facilitate communication. Although most have heard of CPRT and TEACCH, none have been trained on how to use these techniques and they had not come across the use of such techniques in practice. Some interviewees stressed the need to breakdown the activity tasks, demonstrate them not only using the body but also by using visual cues. Interviewee 3 stated that "*if communication is successful the child would typically try to carry out the activity. It is important to focus on the ABCs, agility, balance, and coordination*".

Repetition is key, with some initiatives such as the Special Olympics young athletes programme having 3 sessions per week. It is also important to motivate the child using rewards and praise.

Children are taught both in an individual setting and a group setting. The individual setting addresses the gaps identified on the IEP, while the group setting helps the children to develop their social and team skills. In the group setting it is typical to have 3 adults managing the group, one giving instructions, and the others assisting the children. Variation in the children's capabilities remains a key challenge. Interviewee 1 observed that:

> *it is also very important that the PE teacher and LSE coordinate well together so that the LSE can bring the appropriate visual flashcards and equipment to the lesson.*

Interviewees recommended the following resources when teaching FMS, adapted PE lessons, cushions (balance), trampoline (Jumping and balance), tunnel (crawling), swing (balance and holding), different ramps (walking up and down, balance), stairs, bean bags, hoops, resistance bands and soft balls.

4.2.4 Early Intervention to Support FMS Development

All interviewees agreed that early intervention supports FMS development. Interventions should be carried out as early as possible since it gets harder to teach older children. Interviewee 5 observed that:

> *improvements are noted when an effort in communication is made and enough repetition is afforded, especially when the intervention is happening at a young age. This does not only apply to children with autism but to everyone.*

Improvements in movement are usually observed over a few weeks, such as learning to go up the steps using alternating feet, as well as improvements in hopping. Balancing activities take longer, but positive changes are usually observable. All mentioned that when progress is achieved the response from the parents is one of encouragement and a sense of pride, as well as a sigh of relief.

Extra-curricular activities that stimulate movement such as swimming, athletics and gymnastics were also recommended, followed by team games later.

4.2.5 Preparedness to Teach FMS to Primary Students with ASD

Although interviewees had received training on inclusion in the PE class, none had received training on how to specifically teach FMS to primary students with ASD. All learnt on the job and through continuous professional education (CoPE) courses provided to them by their workplace. Learning support educators receive training, however few are specialised on the autism spectrum per se, although with experience the student is sometimes able to communicate better with the LSE than with the PE teacher.

Interviewee 2 also observed that:

> *when training on the pedagogy used to teach children on the autism spectrum is given, the focus is often on the traditional academic subjects and PE tends to not receive the importance it deserves.*

4.3 Quantitative Analysis

4.3.1 Distribution among PE Teachers/LSEs and their Demographics

The questionnaire contained questions to obtain the Occupation (whether a PE Teacher or an LSE), age-bracket and highest educational level of the respondents.

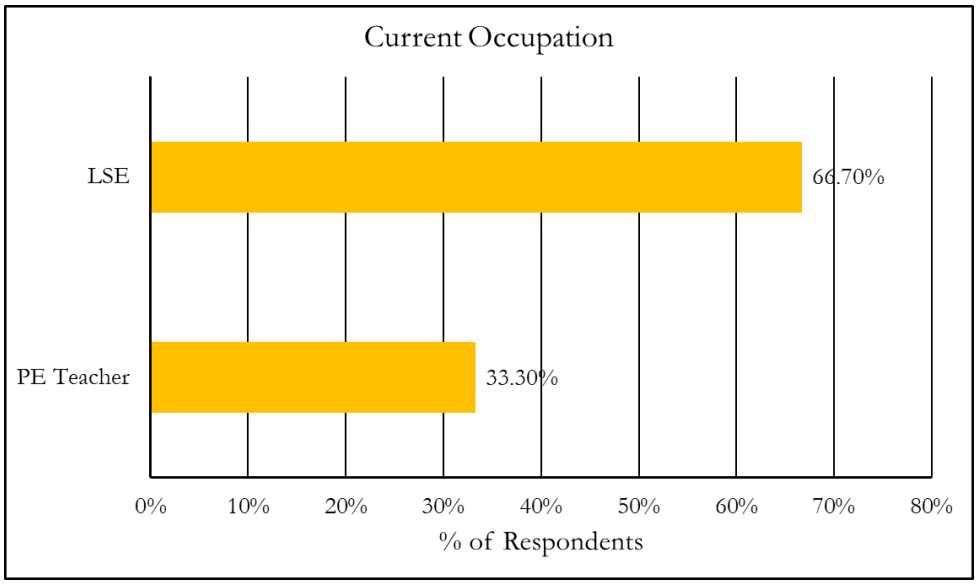

Figure 4.1: Distribution of LSEs and PE Teachers among the Respondents

Figure 4.1 charts the distribution of responses between PE teachers and LSEs. The majority of the respondents were LSEs (66.70%), while PE Teachers made up 33.30% of the respondents. This was to be expected given the larger proportion of LSE's to PE teachers in the population. It is estimated that there are approximately around 225 PE Teachers and 3025 LSEs in Malta. Therefore, PE teachers are better represented in this study compared to LSEs.

Figure 4.2 illustrates the age distribution among the respondents. Most respondents were within the 20 to 30 age bracket (30.77%), followed by the 31 to 40 age bracket (29.49%), and the 41 to 50 age bracket (26.92%). Only (12.83%) of respondents were older than 51 years of age.

The smaller number of older respondents could be a consequence of the questionnaire distribution method chosen. Respondents had to have a Facebook© account and be members of the "*Physical Education Malta & Gozo"* group or the "*LSE's (Let us Help Everyone*" group. An age participation bias could have been introduced due to the higher

prevalence of social media use among the younger age groups.

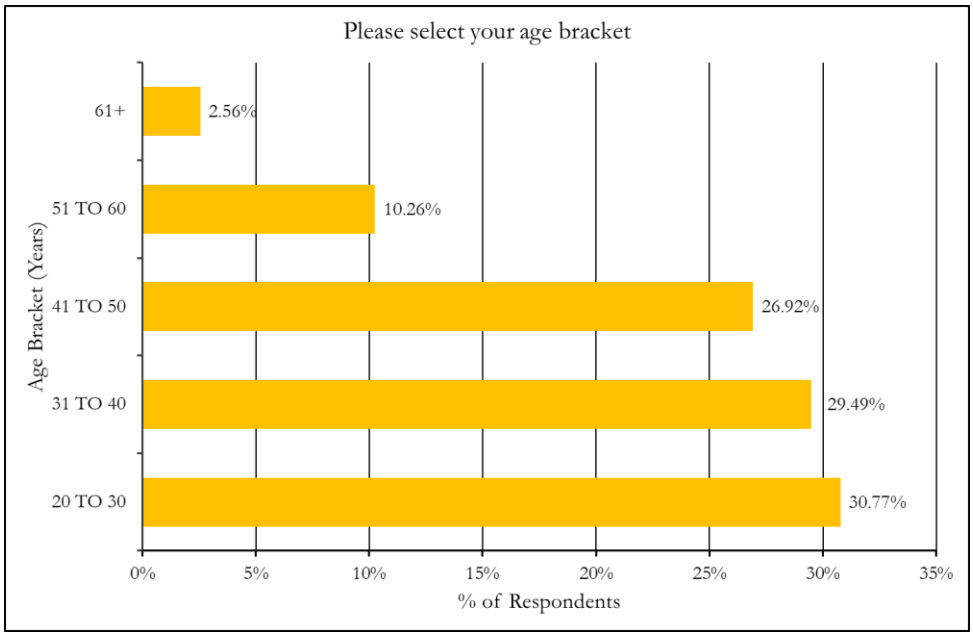

Figure 4.2: Age distribution of respondents

Figure 4.3 shows the majority of respondents in the 20 to 30 age bracket were PE teachers. While LSEs dominated responses in the 30+ brackets. The age distribution of PE teachers and LSEs in Malta is not known.

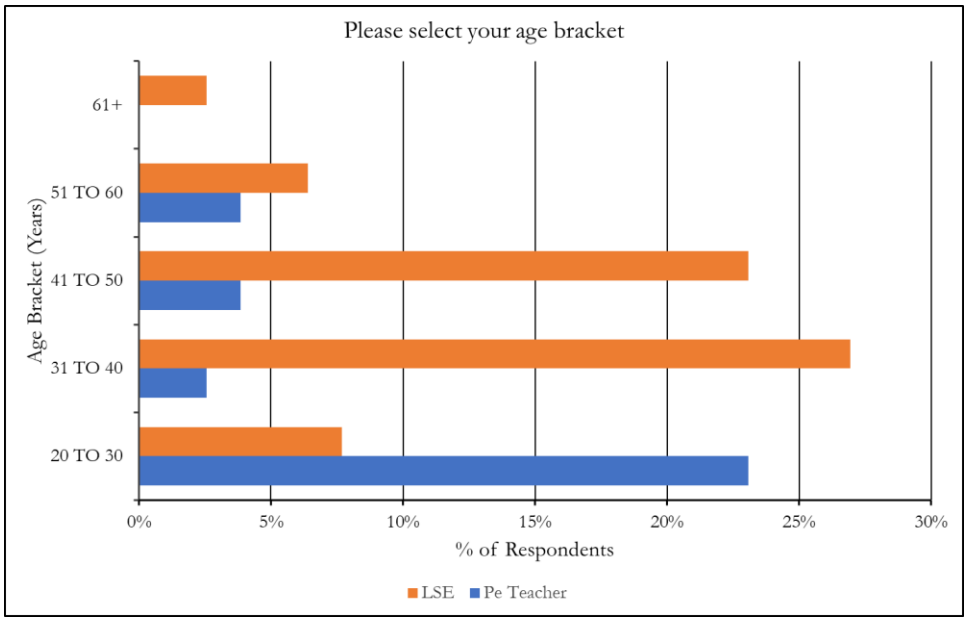

Figure 4.3: Age distribution among PE teachers and LSEs

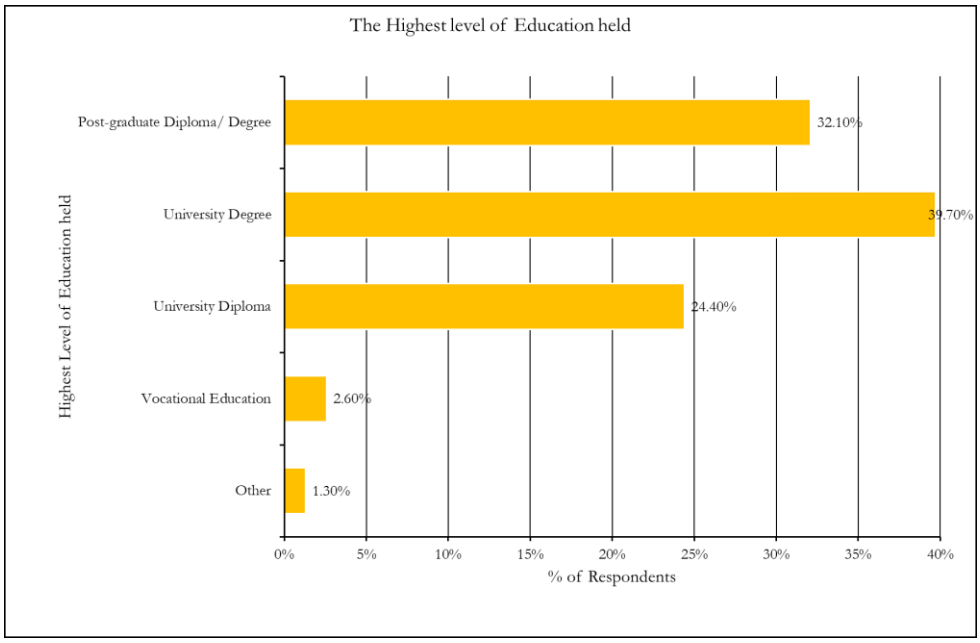

Figure 4.4: Education distribution of respondents

Figure 4.4 shows the highest education attained distribution among the respondents. The majority have completed a University Degree (39.70%). Many respondents (32.10%) possessed postgraduate qualifications. Respondents whose highest qualification was a university diploma made up 24.40% and only 3.9% replied that the highest qualification attained was vocational education or other.

4.3.2 Experience with Students on the Autism Spectrum in the PE Class

The following questions were asked to determine the teaching and support experience of the respondents to children with ASD. Figure 4.5 illustrates the distribution of PE classes among the primary and secondary age groups or both, taught or supported by the respondents.

Most respondents currently teach or support students in secondary classes (51.28%). Those that teach or support students in primary classes represent 38.46% of the respondents, while 10.26% indicted that they teach or support students in a mix of secondary and primary schools.

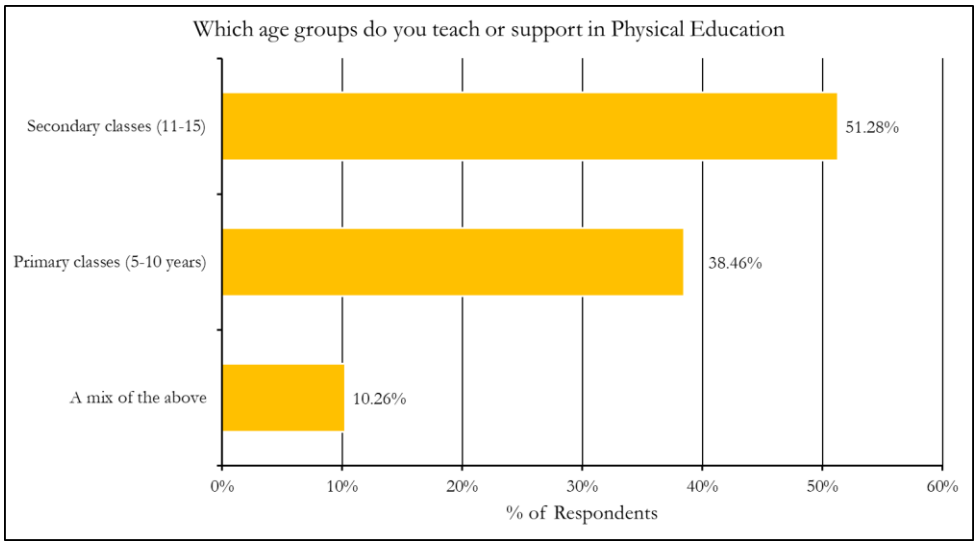

Figure 4.5: Current Experience (Cohort)

Only 2 PE teachers compared to 28 LSEs indicated that they teach primary classes only. On the other hand 8 PE teachers and no LSEs indicated that they teach a mix of primary and secondary classes. While 16 PE teachers and 24 LSEs indicated that they teach secondary classes only.

Figure 4.6 summarises whether students with ASD are taught or supported in the PE class. The presence of students with ASD in the PE practical class was indicated by 80.80% of the respondents. Only 19.20% of respondents, 5 PE teachers and 10 LSEs indicated that they did not have students with ASD in their PE practical class.

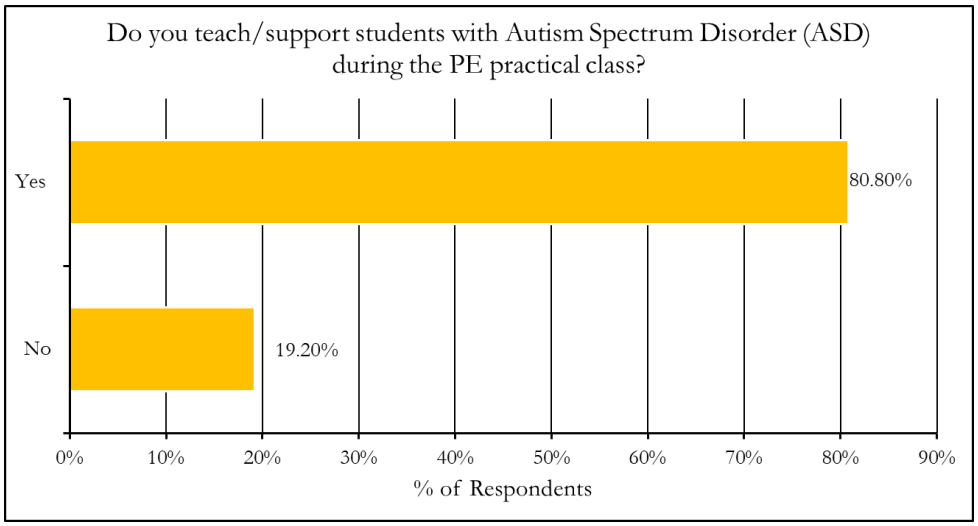

Figure 4.6: Presence of students with ASD in the PE practical class

Figure 4.7 summarises the results for how many PE practical classes include students with ASD. Of the respondents who indicated that they had children on the autism spectrum in the PE class, 41.27% indicated that 1-25% of their PE practical classes included such students. While 15.87% indicated that 76-100% of their PE practical classes included such students.

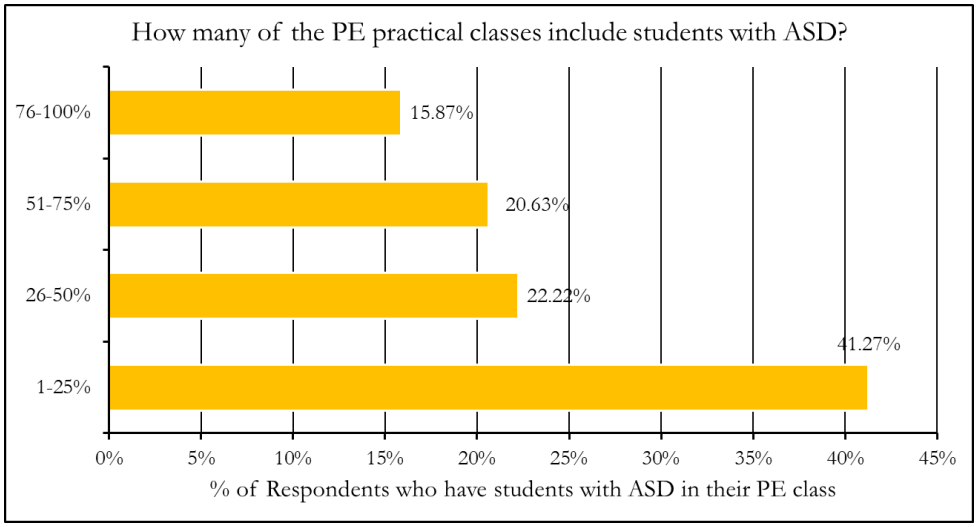

Figure 4.7: Proportion of PE classes having students on the autism spectrum

4.3.3 Training to Teach FMS to Primary Students with ASD

Figure 4.8 summarises which proportion of respondents received training to teach primary students with ASD. A total of 34.62% of the respondents indicated that had not received any specialised training at any level on teaching FMS to primary students with ASD. Of these 7 respondents were PE teachers and 20 respondents were LSEs, indicating that the lack of specialised training impacts both PE teachers and LSEs.

From the 65.38% of respondents who indicated that they had received specialised training on teaching FMS to primary students with ASD, the results illustrated in Figure 4.8 show that 72.55% indicated that they had received at least one training of 5 days or less, while only 27.45% indicated that they had received at least one training of more than 5 days.

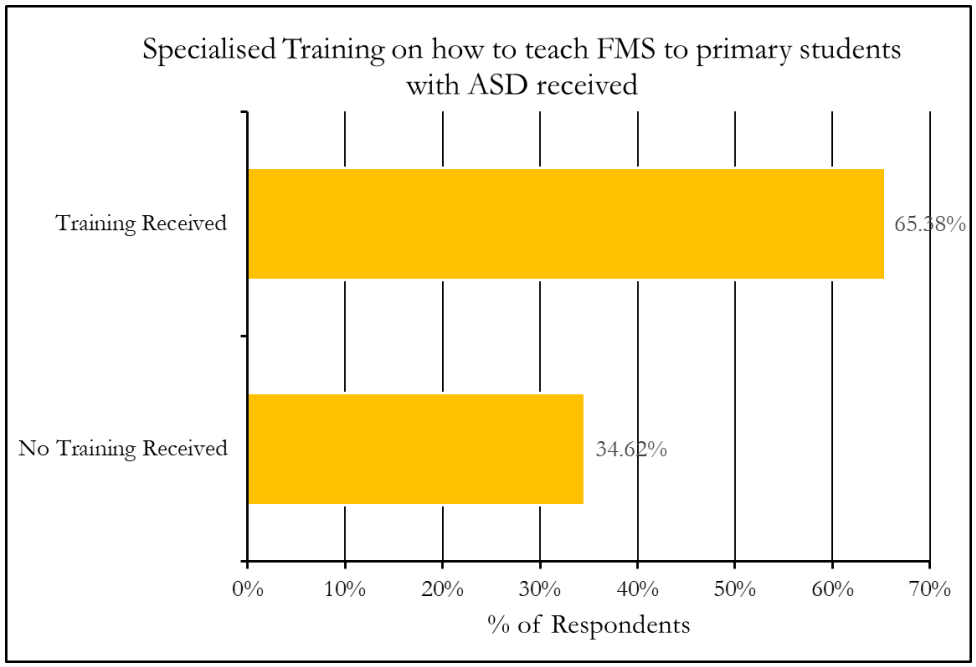

Figure 4.8: Training to teach FMS to primary students with ASD Received

Interestingly 10 LSEs indicated that they had received at least one training of more than 5 days compared to only 4 PE teachers. While 22 LSEs and 15 PE teachers indicated that they had received at least one training of 5 days or less. Only 4 respondents indicated that they had only received training as part of a Continuous Professional Development programme, 3 PE Teachers and 1 LSE.

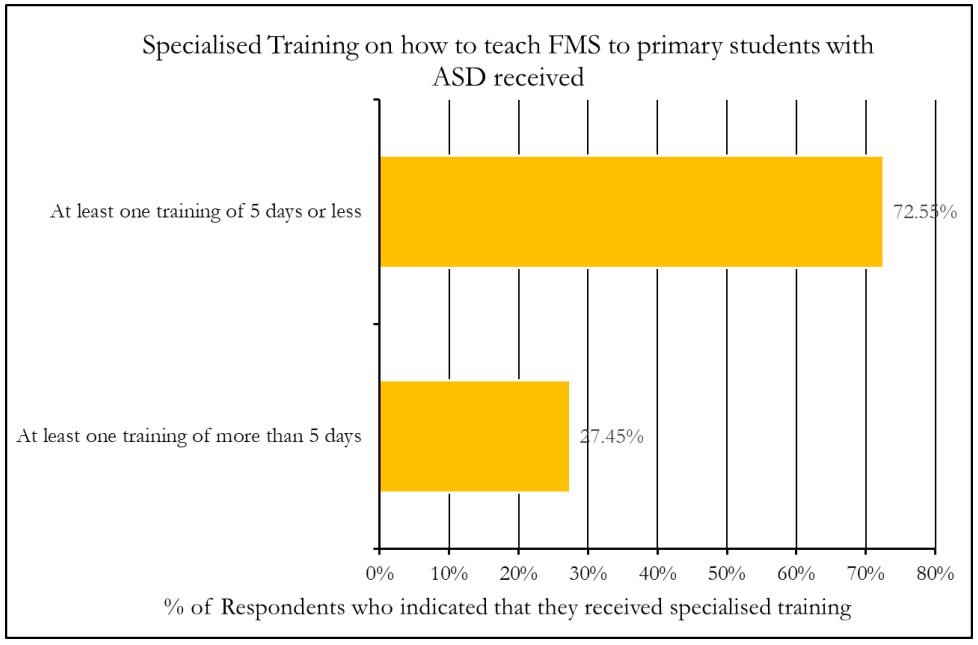

Figure 4.9: Amount of specialised training received among respondents

The most common level at which specialised training was delivered was at the University Diploma level and it was mainly attended by LSEs. The second most common level was at Postgraduate level and at this level it was mainly attended by PE teachers. Training of 5 days or less was more equally distributed across all four levels University Degree, Postgraduate, University Diploma and Continuous Professional Development.

Figure 4.10 charts the type of training received by respondents. Only 14.10% of the respondents who indicated that they had received training on how to teach FMS to primary students with ASD replied that the training was "Hands on". The majority (85.90%) indicated that their training was a "Theoretical training".

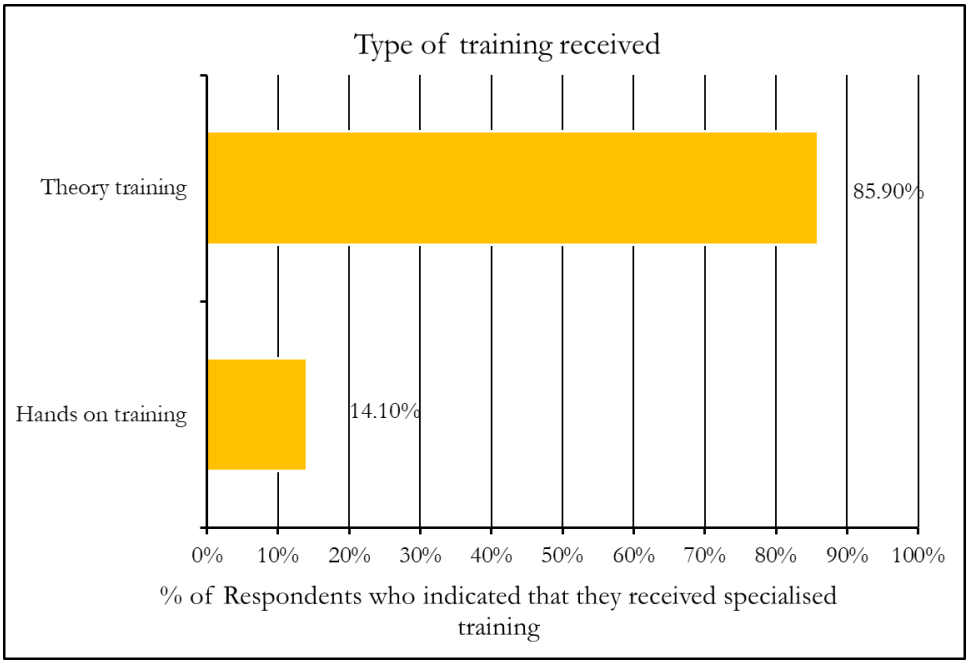

Figure 4.10: Type of training received

All respondents indicated familiarity with at least one of the teaching techniques developed for teaching students with ASD. As shown in Figure 4.11, the most commonly selected was the Picture Exchange Communication System (PECS), which was indicated as being familiar to 50% of the respondents. Video demonstration was also indicated as being familiar with 46.20% of the Respondents. The high incidence of selection of PECS or Video demonstration, or both simultaneously indicates that there is a high familiarity with the need to communicate graphically or visually with students with ASD. Familiarity with Adapted Behaviour Analysis was also indicated by 48.70% of the respondents. Interestingly from the 27 respondents who indicated familiarity with specialised teaching frameworks such as TEACCH, CPRT or ICPL only 4 were PE teachers.

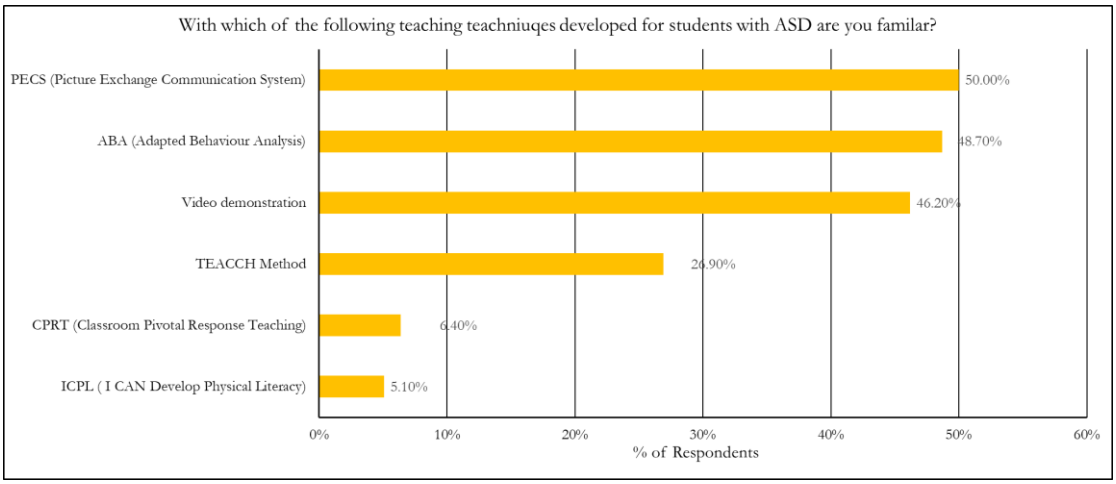

Figure 4.11: Knowledge of teaching techniques developed for students with ASD

4.3.4 Difficulty to Learn FMS

The Maltese primary curriculum identifies a number of FMS and corresponding learning outcomes. Respondents were asked to rate the difficulty for primary school students with ASD to learn these FMS. Interestingly Throwing and Running were rated as the least difficult to learn, followed by Catching and Agility.

Figure 4.12 illustrates the relative difficulty to learn the FMS in the Maltese Primary Curriculum indicated by respondents. The most difficult FMS to learn was rated as the combination of movements, followed by Orientation of space and time.

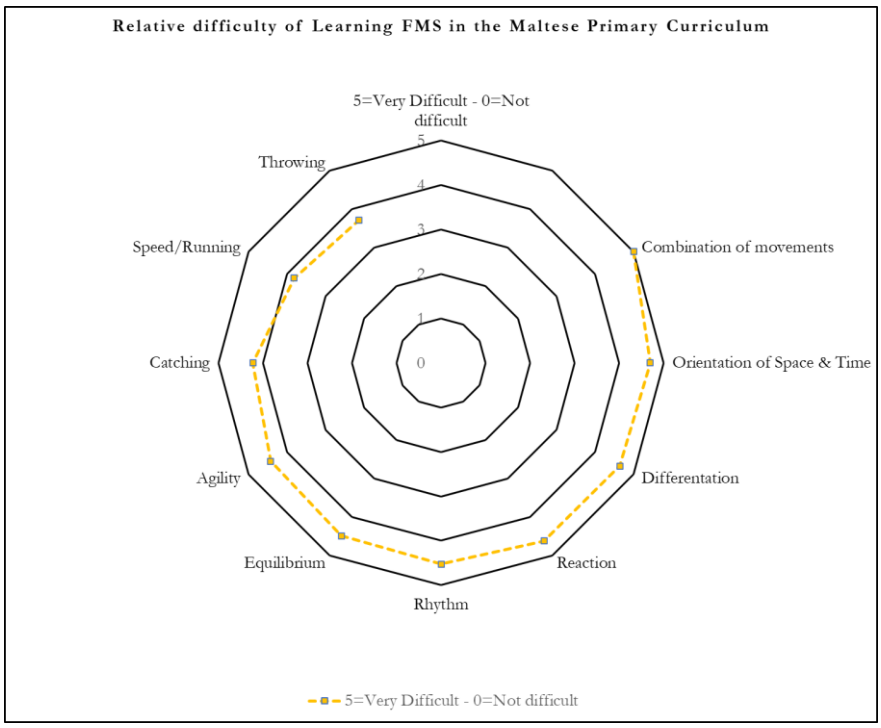

Figure 4.12: Relative difficulty to learn FMS

4.3.5 FMS Capability Assessment

As shown in figure 4.13 a majority of teachers (34.60%) stated that they don't teach/support primary school students. A total of 24.40% indicated that no assessment of the FMS was carried out. The most frequent FMS assessment method was indicated as being an assessment formed during the PE practical class. Only 12.80% of respondents indicated that an onboarding assessment was shared by the school and that an onboarding meeting with parents was also held.

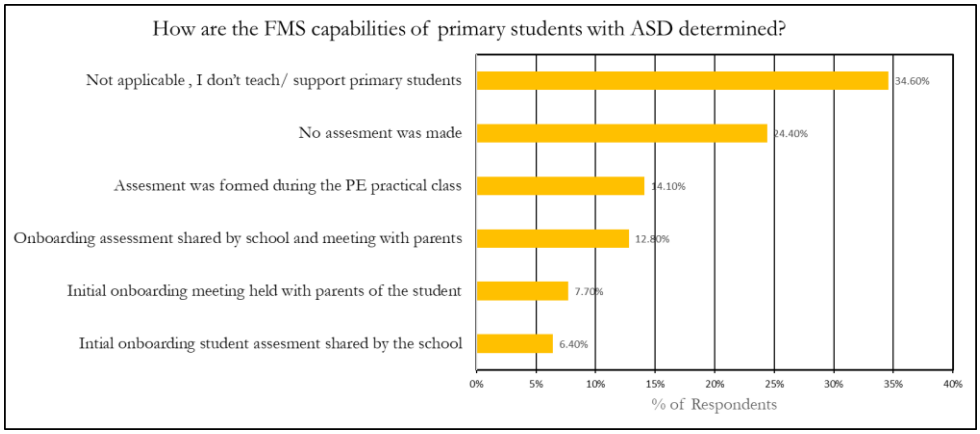

Figure 4.13: Assessment of FMS capabilities

Figure 4.14 illustrates that a majority of respondents (64.10%) indicated that they are familiar with the Maltese PE syllabus learning outcome assessment criteria. The second most familiar FMS assessment tool was the Test of Gross Motor Development (TGMD). Less than 10% of respondents were familiar with the other FMS assessment tools. Of concern, 14.20% of respondents indicated that they were not familiar with any FMS assessment tool including the Maltese PE syllabus learning outcome assessment criteria.

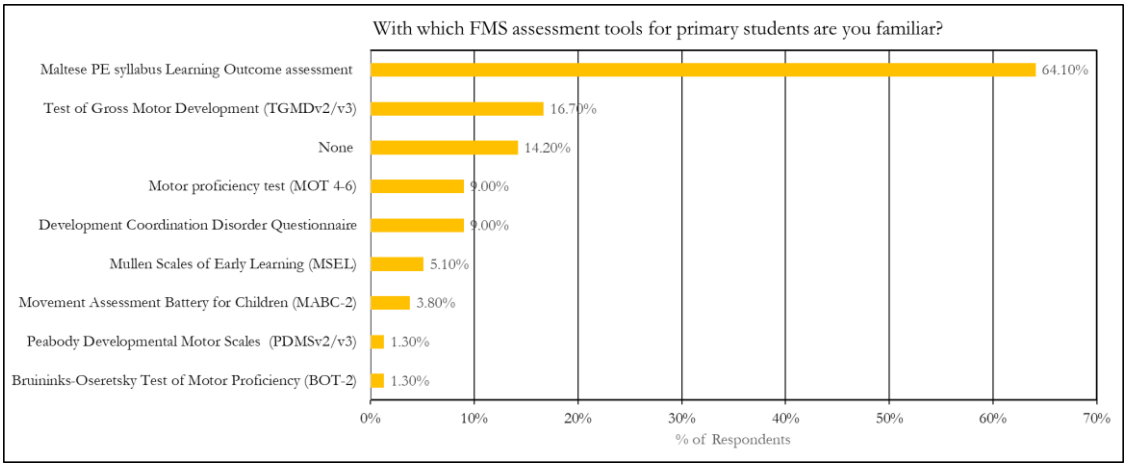

Figure 4.14: Familiarity with FMS assessment tools

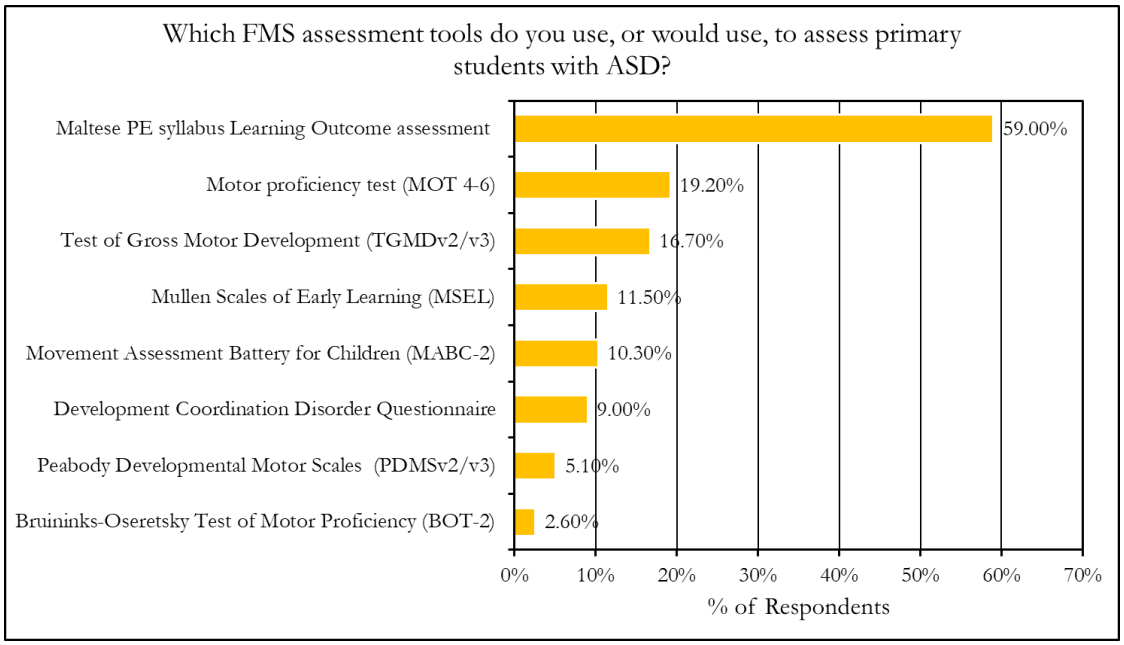

Figure 4.15: Which FMS assessment tool do you/would you use?

Figure 4.15 shows which FMS assessment tool is used or would be used by respondents. A significant number of respondents (59.00%) would use the Maltese PE syllabus learning outcomes as the assessment tool, to assess the FMS capabilities of primary students with ASD. While 19.20% and 16.70% of respondents indicated that they would use the Motor Proficiency Test (MOT 4-6) and the Test of Gross Motor Development (TGMD v2/v3) respectively. Four respondents, all LSEs indicated that they would not use any of the tools for their assessment of FMS in primary students with ASD. Eight respondents equally distributed between PE teachers and LSE indicated that they would only use the MOT 4-6 Test, the test most selected on its own.

A significant relationship (P <0.001, Table C8) was found between the presence of students with ASD in the PE practical class and familiarity with Fundamental Movement Skill assessment tools. A closer inspection of the results shows that this correlation is arising from the high proportion of users who are using the Maltese PE curriculum learning outcomes as their assessment tool.

4.3.6 Pedagogy Used when Teaching FMS

Figure 4.16 summarises the teaching or support strategy that would be used by respondents. A majority of 70.50% of respondents indicated that they use or would use a differentiated inclusion strategy where the ASD students assisted by the LSEs follow an

adapted lesson plan while forming part of the main class. A common inclusive strategy where all students follow the same lesson plan is used or would be used by 26.90% of the respondents. Only 2.60% of respondents would use a separated class strategy where the students with ASD assisted by the LSEs are separated on their own.

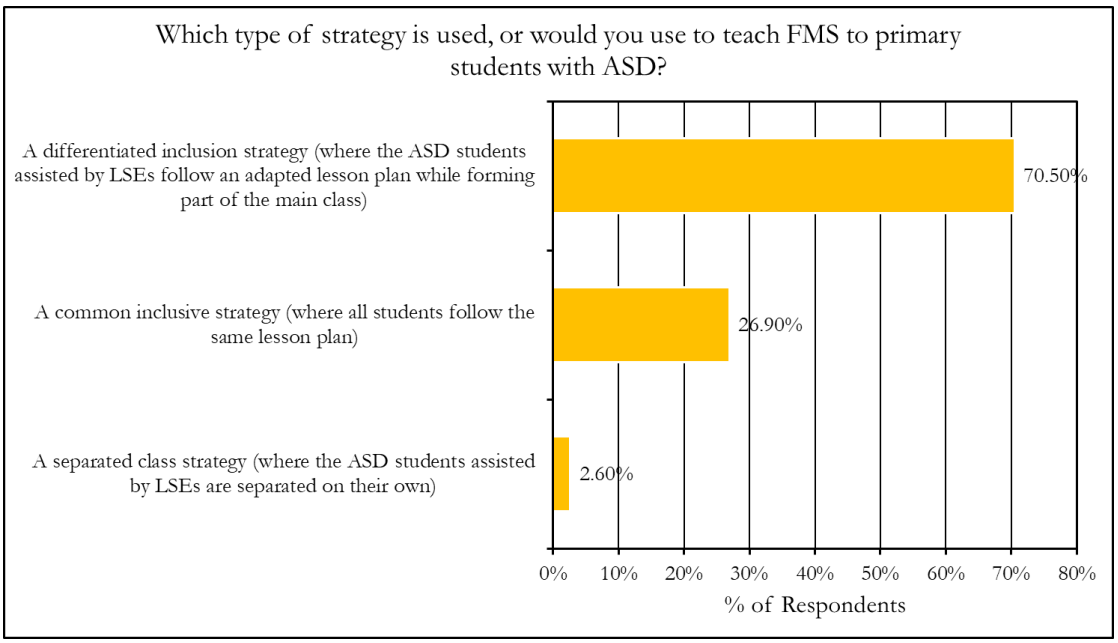

Figure 4.16: Pedagogy used to teach FMS to primary students with ASD

Figure 4.17 illustrates the preferred method to teach FMS to primary students with ASD. A majority of 62.80% of respondents would demonstrate the key components of a particular FMS in a progressive manner and allow the student time to practice. While 30.80% of respondents would teach FMS using participation in a game involving the FMS.

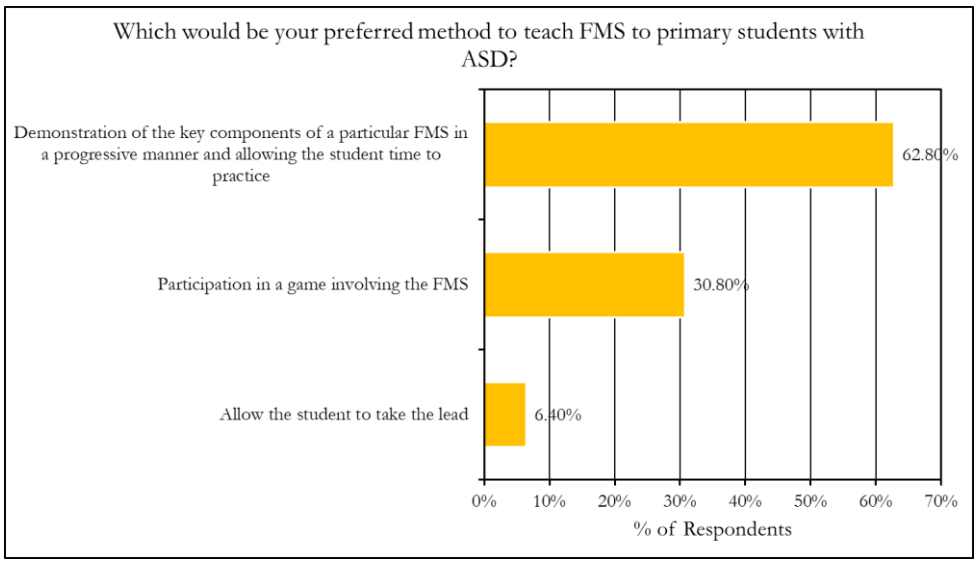

Figure 4.17: Preferred method to teach FMS to primary students with ASD

Only 6.40% of respondents would allow the student to take the lead and guide him along to learn the FMS.

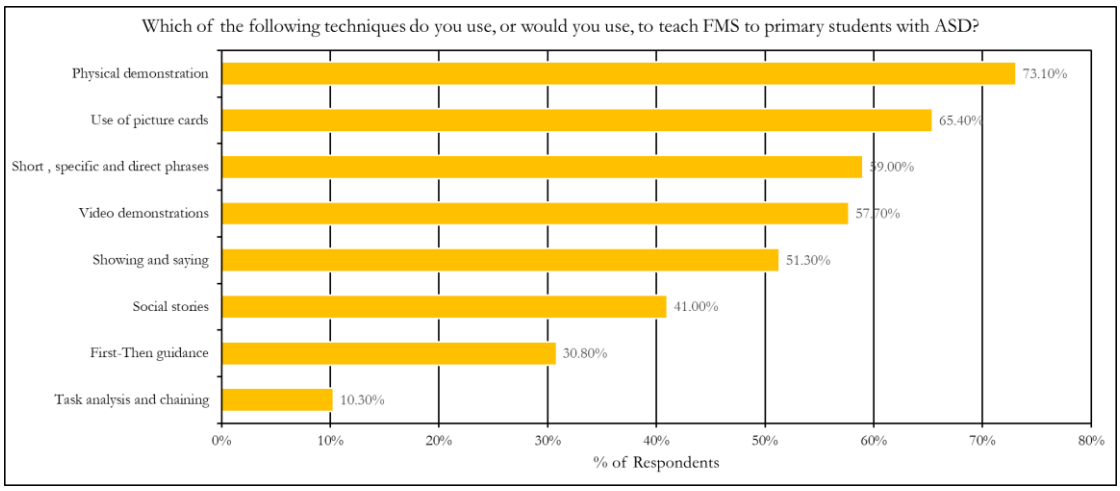

Figure 4.18: Techniques used or would use to teach FMS to primary students

As shown in Figure 4.18 a vast majority of respondents (57% or more) would use Physical demonstration, picture cards, short direct phrases and video demonstrations. Interestingly a much smaller proportion of respondents would use social stories or First-Then guidance. While only 10.30% would use task analysis and chaining to teach FMS.

4.3.7 Stereotypical Behaviour Challenges when Teaching FMS

Sensory overload difficulties, Communication impairments and a Lack of attention to non-preferred activities were the stereotypical activities besides Gross/Fine motor skill difficulties that were rated by respondents as "*Very Difficult*" to handle when teaching FMS.

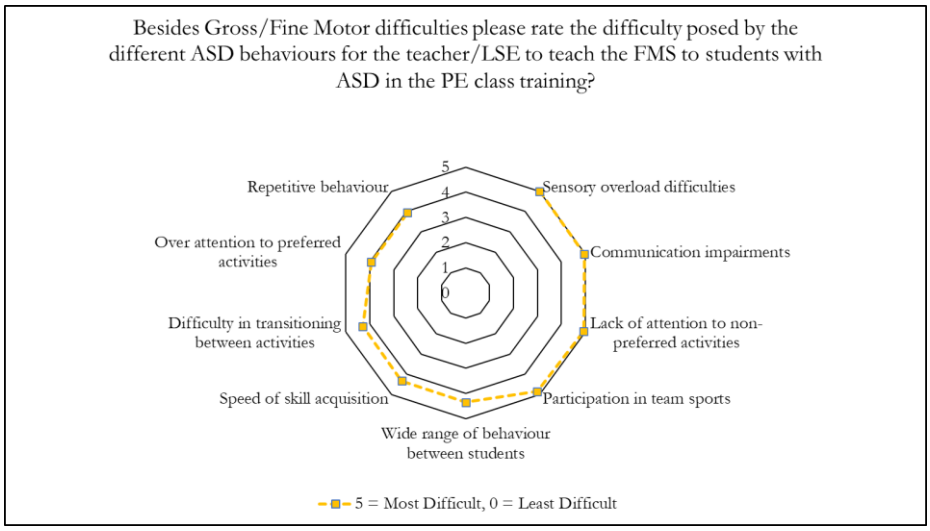

Figure 4.19: Difficulty ranking of stereotypical behaviours presented

The stereotypical behaviours were also ranked using a weighted ranking basis (Scale 0 to 5 – where 5 is most difficult and 0 not difficult) on the radar graph shown in Figure 4.19. On the otherhand "*Repetitive behaviour*" and "*Over attention to preferred activities*" were rated at the "*Least Difficult*".

4.3.8 Time to Register FMS Skill Improvements

Figure 4.20 illustrates the weighted average instruction time indicated by respondents to register improvements in the FMS. Dribbling, bouncing, striking, galloping and leaping, balance, jumping vertically/horizontally and catching were all indicated as requiring between 20 and 25 hours of instruction before improvements may be registered. While kicking, hopping, underhand rolling, underhand throwing, overhand throwing and running were indicated as requiring between 15 and 20 hours of instruction before improvements may be registered.

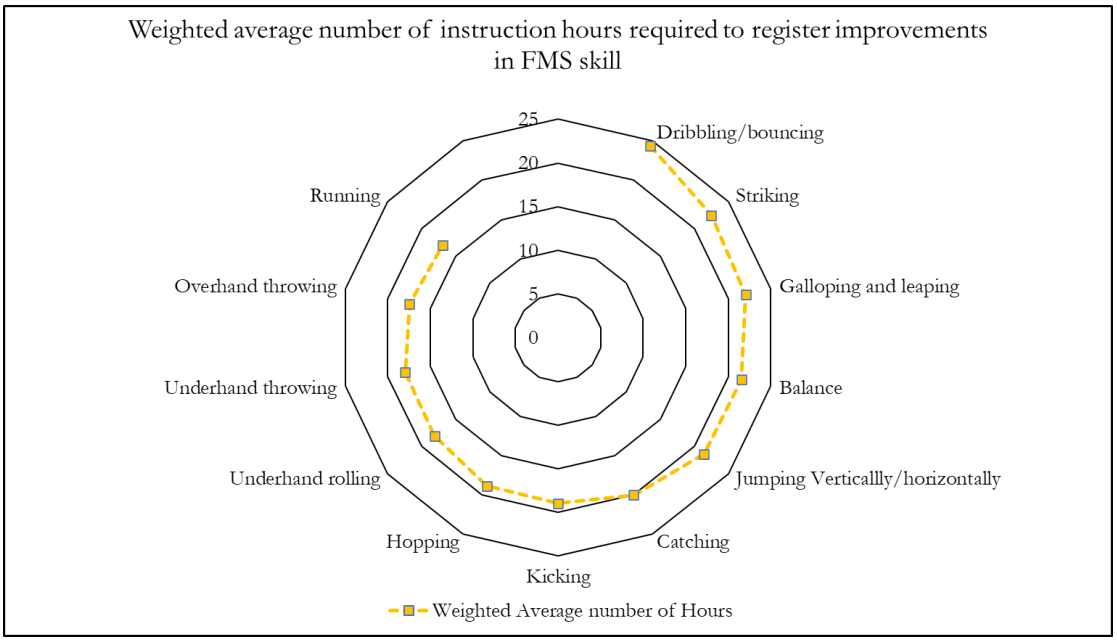

Figure 4.20: Instruction time to register improvements in FMS

4.3.9 Resource Requirements and Availability

The relatively most important resources indicated by respondents for teaching FMS to primary students with ASD were adapted PE lesson plans followed by picture cards and First Then visual schedules. Choice boards, Count down strips, Token boards, Sensory timers and Tablets with specialised apps were indicated as being of lesser importance.

Figure 4.21 illustrates a radar plot of the relative importance of different resources.

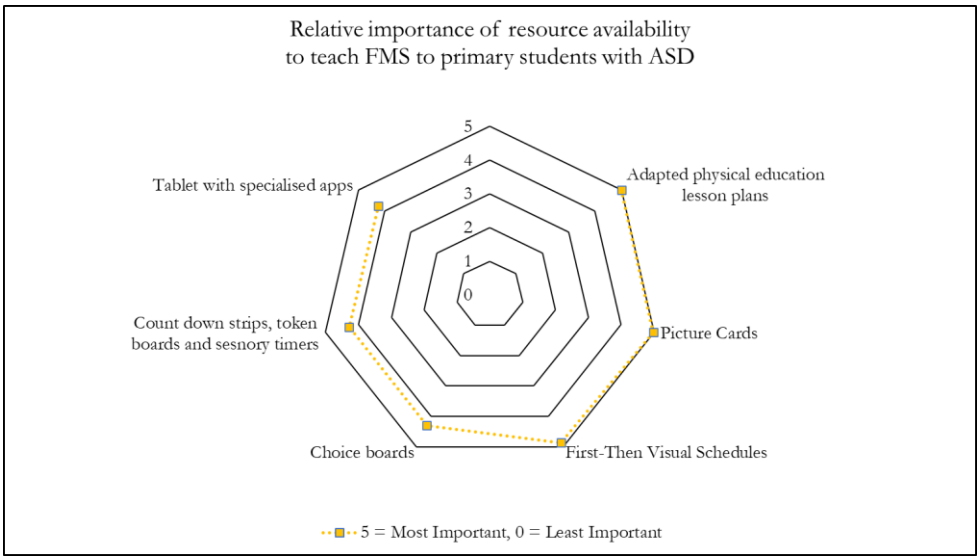

Figure 4.21: Importance of Resource availability

Figure 4.22 illustrates the indicated availability of resources by the respondents. Picture cards were indicated as available by 55.10% of the respondents. However adapted lesson plans were indicated as available by only 33.30% of the respondents. Interestingly 24.40% of the respondents indicated that none of the listed resources were available.

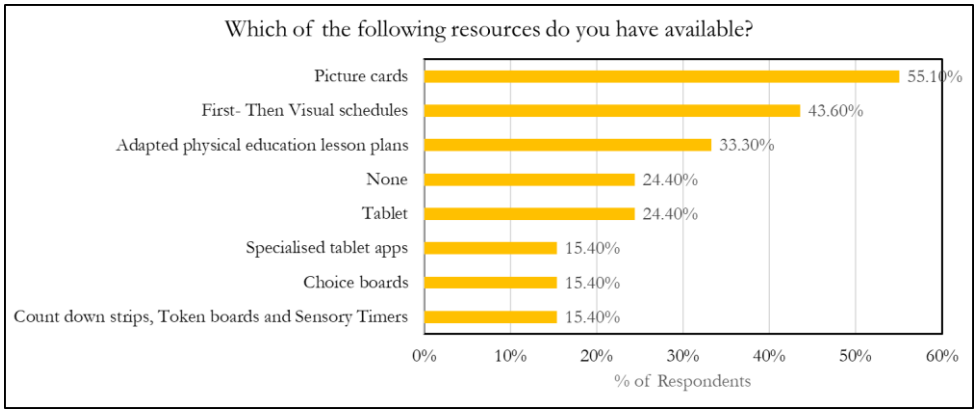

Figure 4.22: Resource availability

4.3.10 Early Intervention Focusing on FMS

Respondent support for early intervention focusing on FMS is summarised in Figure 4.23. Most respondents (82.00%) strongly support or support the hypothesis that an early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years. Only 18% are neutral or don't support.

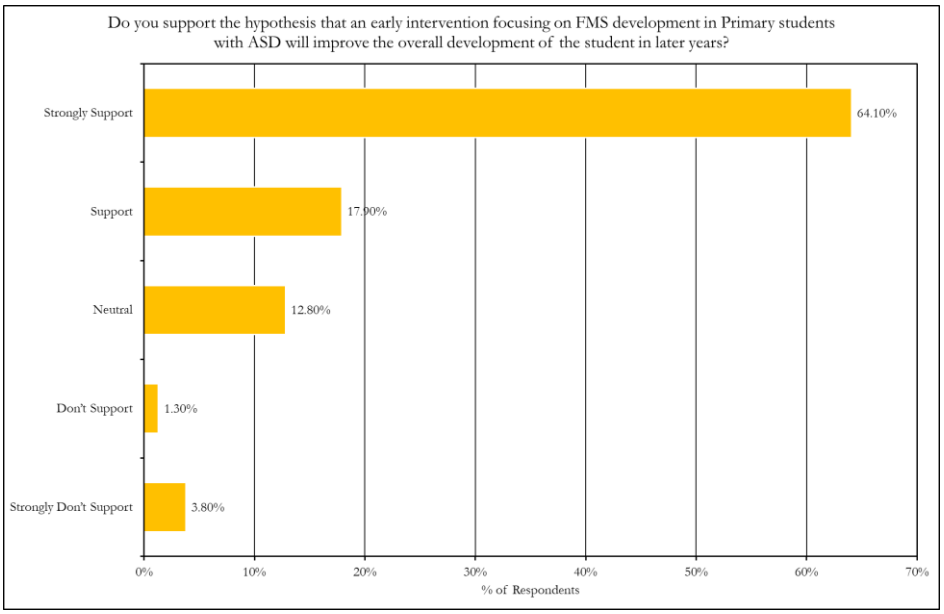

Figure 4.23: Support for Early Intervention focusing on FMS

No correlation was found between support for early intervention focusing on FMS and the education level of respondents (P=0.690, Table C2), the occupation (P=0.171, Table C3), and the presence of students with ASD in the PE practical class (P=0.924, Table C4).

4.3.11 Beneficial Extra Curricular Activities

The beneficial extra-curricular activities indicated by the respondents are shown in Figure 4.24. Most of respondents (70.50%) recommend aquatic exercise programmes as an appropriate extra-curricular activity to improve FMS in primary students with ASD, followed by gymnastics and dance classes. Few respondents recommend football or tai-chi.

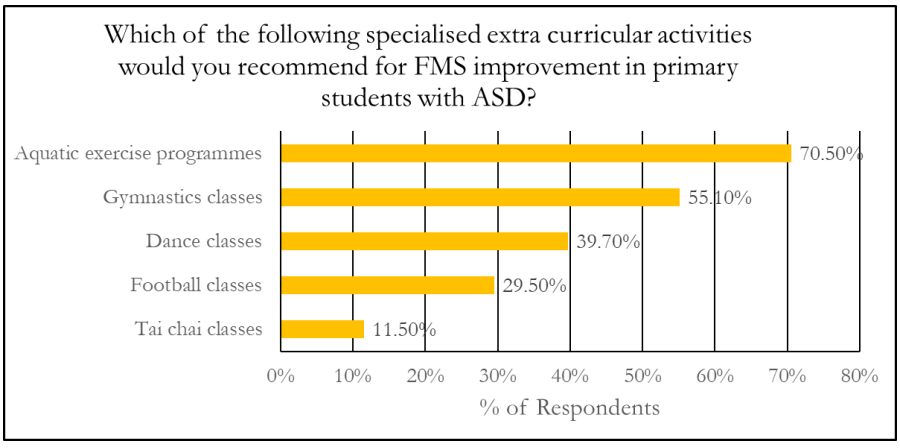

Figure 4.24: Beneficial Extra Curricular Activities

4.3.12 Collaboration between PE teacher and LSE

Figure 4.25 summarises how respondents rated collaboration between the PE teacher and LSE when teaching FMS to primary students with ASD. Most respondents (44.80%) indicated that they rate collaboration between the PE teacher and the LSE when teaching FMS to primary students with ASD as Outstanding or Good. While 41.00% of respondents rated the collaboration to be Neutral. Only 14.10% of respondents indicated that collaboration was weak or poor.

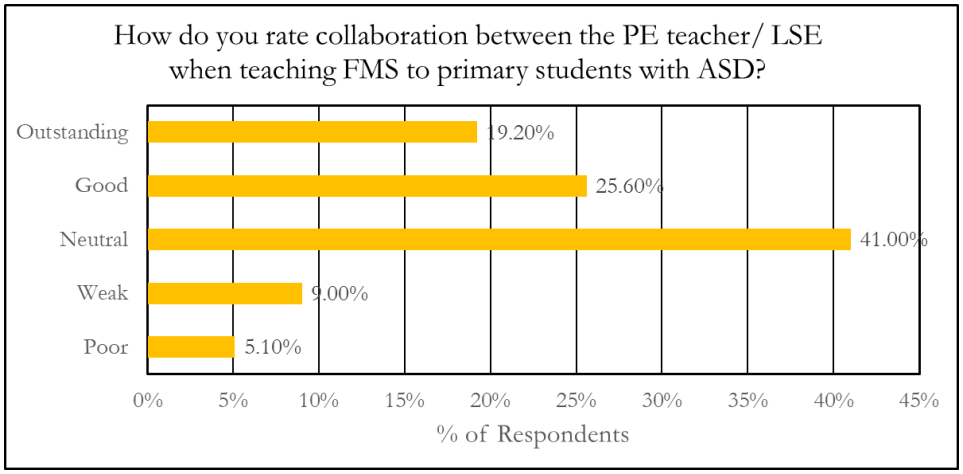

Figure 4.25: Collaboration between PE teacher and LSE

4.3.13 Preparedness to teach FMS to Primary Students with ASD

The self-reported preparedness to teach FMS to primary students with ASD by the respondents is shown in Figure 4.26. The majority of respondents (42.30%) indicated that they rate their preparedness to teach FMS to primary students with ASD as Neutral. Only 32.10% of respondents rated themselves as "Very Prepared" or "Prepared", while 25.70% rated their preparedness as "Less Prepared" or "Not Prepared".

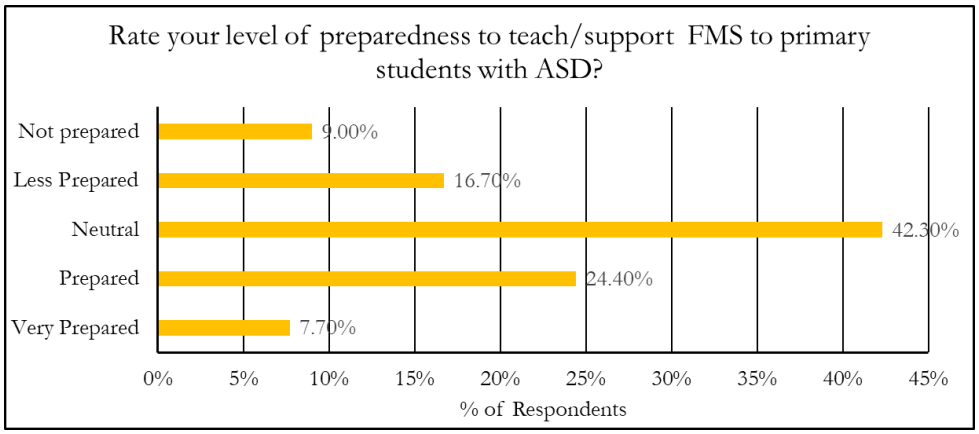

Figure 4.26: Self-reported preparedness to teach FMS to primary students with ASD

No correlation was found between the self-reported preparedness to teach FMS to primary students with ASD and the education level of respondents (P=0.320, Table C5), and the presence of students with ASD in the PE practical class (P=0.555, Table C7). A weak correlation was found between the self-reported preparedness to teach FMS to primary students with ASD and the occupation of respondents (P=0.023, Table C6).

4.4 Discussion of Results

In this section a discussion of the results obtained from the interviews and the questionnaire is made. The discussion is framed within the five research questions of this study.

4.4.1 Factors Affecting FMS Development in Primary Students with ASD

Motor delays are a key factor affecting FMS development in primary school children with autism. The interviewees indicated that experience with students with ASD indicates that such students have a difficulty with balancing, impacting other activities such as their ability to hop, or balance on a swing. They also typically exhibit a difficulty with motor coordination, hand-eye coordination, and agility. This was also confirmed by the respondents to the questionnaire who rated combination of movements, and orientation of space and time, as the most difficult FMS for primary students with ASD to learn. These

results are in line with those observed by Colombo-Dougovito (2019) and Gandotra et al., (2020).

Throwing, Running and Catching were rated as the relatively easier FMS to learn by the questionnaire respondents. This was also confirmed by the interviewees who indicated that sometimes it is very difficult to tell the difference when performing these skills, between typically developing students and those with ASD especially in the early primary school ages. In the literature most of the studies have typically focused on comparing the motor deficits associated with ASD to those of typically developing children, across a wide range of ages. The systematic review carried out by Gandotra et al., (2020) has reviewed the various studies comparing FMS performance in children with ASD to those of typically developing children. The literature is however lacking on long term studies that have specifically targeted FMS development in children with ASD, with an aim to understand the factors that impact such development in the long term.

Sensory overload difficulties, Communication impairments and a Lack of attention to non-preferred activities were the stereotypical activities besides Gross/Fine motor skill difficulties that were rated by questionnaire respondents as "Very Difficult" to handle when teaching FMS to primary students with ASD. This was also reinforced by some of the interviewees who recommended that more importance needs to be given to the time it takes such children to adapt to their new school, class and gym surroundings. They observed that the children typically become more cooperative once they have become accustomed to their new environment, and that the appropriate time should be allowed for them to gain this familiarity.

Communication impairments have a direct impact because it is often the reason why the students are not understanding what is required of them to practice the FMS and therefore do not perform it. This lack of understanding in turn causes children with ASD to withdraw from playing with their peers reducing their opportunities to improve their FMS. The literature, Colombo-Dougovito et al., (2019) and Wulf et al., (2010) suggests that interventions where an effort was made to communicate using the appropriate visual cues and adapted delivery have led to FMS improvements.

A key difficulty outlined by the interviewees and the respondents via the open-ended questions was the wide range of behaviours inherent to the autism spectrum and the wide variability in the abilities of those affected by it. Such a wide variability in the children's abilities in a class setting makes it very difficult to manage the class, and could in itself be a limiting factor for FMS development.

Such variability requires an excellent collaboration between the PE teacher and the LSE, both in preparation for the PE class and also during the PE class. Wide variability also makes it very difficult to manage without a one-to-one setup supporting the child with autism.

4.4.2 Fundamental Movement Skill Assessment of Primary Students with ASD

The CDAU diagnoses children with ASD at a young age. The main assessment method used is the Autistic Diagnostic Observation Schedule (ADOS). The ADOS assessment tool is focused on assessing the student's communication and interaction capabilities as well as any restrictive or repetitive behaviours. The ADOS does not assess FMS. A root cause of this, is that motor deficiencies are not seen as an autism marker under DSM-V. (APA, 2013).

In fact, there was a weak awareness of the different FMS assessment tools among the interviewees, and none had come across their use of such assessment tools in practice. From the questionnaire respondents, 24.40% indicated that no assessment was made, with 14.10% indicating that an assessment of FMS was formed during the PE class. Only 12.80% of respondents indicated that an onboarding assessment was shared by the school and that an initial onboarding meeting was also held with the parents of the student.

The most familiar FMS assessment tool indicated by respondents (64.10%) was the Maltese PE syllabus learning outcomes. Less than 16.70% of respondents indicated familiarity with other FMS assessment tools. Of concern is the 14.20% of respondents who indicated that they were not familiar with any FMS assessment tool, implying that they are also not familiar with the Maltese PE syllabus learning outcomes. Most respondents (59.00%) also indicated that they are actually using the Maltese PE syllabus learning outcomes to assess the FMS of primary students with ASD.

These results are similar to those presented by Eddy et al., (2021) who observed that formal screening and/or objective assessment of FMS is not common practice in UK primary schools despite a focus on the development of FMS in the early years curriculum. UK teachers only record a single judgement of whether of a child is '*above*', '*at*' or '*below*' the expectation set out in the curriculum, and no standard measure of FMS assessment is used. It was also indicated that whereas a large appetite for school-based FMS assessment is present, knowledge presents a major barrier (Eddy et al., 2021). Teachers also demonstrated

a low level of accuracy when discriminating between FMS movements.

A further barrier to school-based assessments of FMS was the long-time duration required to carry out a proper FMS assessment, especially when using pre-defined FMS frameworks within a school setting. Teachers identified 30 to 60 minutes as the maximum available time within which to assess the whole class, in contrast with current FMS assessment frameworks which require 30 to 60 minutes to assess one child (Klingberg et al., 2019). It must however be noted that the study was addressing the FMS assessment needs of typically developing children, rather than those of children with ASD.

Due to the important benefits of FMS developments to children with ASD, a case can be made to utilise standard FMS assessment tools to assess the FMS development of children with ASD, since it is hard to capture the small deltas in FMS development registered by children with ASD. The wide use of the Maltese PE syllabus learning outcomes criteria as the key assessment tool used in the PE class to assess FMS presents an opportunity. A special purpose FMS assessment tool that is more appropriate for the special case of assessing FMS in children with ASD could be created to complement the Maltese PE syllabus learning criteria. Care could be taken to reach a compromise between suitability and the time that is required to assess FMS development on an individual basis in a school-based environment.

4.4.3 Pedagogy and Resources to Teach FMS to Primary Students with ASD

Several teaching techniques have been developed for the purpose of teaching children with ASD. A summary of the techniques that may be specifically using for teaching adapted PE has been described in section 2.4.2. All questionnaire respondents indicated familiarity with at least one of the teaching techniques developed for teaching students with ASD (refer to Figure 4.11).

The literature review has outlined the need for visual demonstration using graphical picture cards, physical demonstrations, and video modelling when teaching or supporting FMS development to children with ASD (Colombo-Dougovito et al., 2019). The importance of task analysis and chaining, as well as short, specific, and direct First-Then guidance within a social story framework, was also highlighted.

A high incidence of respondents indicated familiarity with PECS (50%) or video demonstration (46.20%), demonstrating a high familiarity with the need to communicate graphically or visually with students with ASD. Respondents (48.70%) were also familiar

with ABA. Only a few respondents indicated familiarity with TEACCH (26.90%), CPRT (6.40%) or ICPL (5.10%). Of concern are the 50% of respondents who did not indicate familiarity with PECS, for teaching or supporting children with ASD. This could be because respondents did not realise that Picture Exchange Communication system is referring to picture cards, or that respondents did not realise that they could select multiple options when answering the question.

These results were also reinforced by the interviewees, who indicated the importance of using picture cards and graphical demonstrations when teaching or supporting FMS development to students with ASD. Several interviewees stressed the need to breakdown the FMS activities and to demonstrate them using visual cues as well as the body. As interviewee 3 stated "*if communication is successful the child would typically try to carry out the activity*", an aspect also mentioned by Wulf et al. (2010). Adequate frequent repetition as well as motivation through reward and praise were also indicated as key aspects to develop FMS in children with ASD. Interviewees were aware of TEACCH and CPRT, however none had been trained on how to use these techniques and none were aware of their use in practice.

Encouragingly, respondents indicated that they use, or would use, physical demonstrations (73.10%), picture cards (65.40%), short, specific direct phrases (59.00%) and video demonstration (57.70%) when teaching or supporting primary students with ASD. However, only 10.30% of respondents indicated the use of task analysis and chaining.

A finding from the interviews was that when teaching or supporting FMS development in children with ASD, they were being taught both in an individual and group setting. The individual setting is useful to address gaps in the IEP while the group setting is useful to develop their social skills. This was confirmed by the respondents to the questionnaire were 70.50% of the respondents indicated that a differentiated inclusion strategy is used, or would be used, when teaching FMS to primary students with ASD, where the ASD students assisted by the LSEs follow an adapted lesson plan while forming part of the main class.

More research would need to be done to understand the effectiveness of using, or prospectively using, a common inclusive strategy indicated by 26.90%, from the point of view of the difficulty posed by a wide variety of FMSs in the children with ASD who are present in class. While such a strategy could be effective when the disparity in the FMS capabilities among the children is small, it is much more difficult to be effective with a wide range of FMS capabilities among the children. More research is also required to understand

why 2.60% of questionnaire respondents are using a separated class strategy where the ASD students assisted by their LSEs are separated on their own.

Interviewees have emphasised the need for good collaboration and communication between the PE teacher and LSEs. When managing a class in a group setting containing students with ASD it was important to have several adults assisting in the management of the group. Good communication between the PE teacher and LSE is important when teaching FMS to ensure that the appropriate resources, such as appropriate picture cards are prepared and brought to the PE class. Approximately 45% of questionnaire respondents indicated collaboration between the PE teacher and LSE when teaching FMS to primary students with ASD as being Outstanding (19.20%) or Good (25.60%). However, the large proportion of respondents who rated such collaboration as Neutral (41.00%), Weak (9.00%), or Poor (5.10%), in aggregate representing 55.10% of the respondents, indicates that collaboration between the PE teacher and LSE is an area for improvement.

Interviewees indicated that repetition was key for skill retention, sometimes as frequent as having session three times a week. Questionnaire respondents have indicated that dribbling, bouncing, striking, galloping and leaping, balancing, jumping and catching as the more difficult skills for primary students with ASD to learn. It was indicated that these more difficult FMS would require between 20 and 25 hours of instruction before improvements may be registered. Assuming a one-hour PE lesson per week this therefore implies that some improvements could potentially be registered towards the end of the second school term. Activities such as kicking, hopping, underhand rolling, underhand throwing, overhand throwing and running were indicated as less difficult to learn by respondents to the questionnaire, requiring between 15 and 20 hours of instruction before improvements may be registered. Using the same assumptions made earlier, improvements could potentially be registered towards the start of the second school term. These results are in line with those published by Case and Yun (2019) who found that interventions that had 16 total hours or more had a significantly larger improvement effect that those that had less hours.

Regarding the frequency of the interventions, and its correlation with the long-term retention of the FMS improvements, it is still difficult to get a direction from the literature. This is because not enough studies have been carried out. Bremer et al., (2015), tested two different frequencies and duration (1/hr per week for 12 weeks and 2hrs/week for 6 weeks) on a small sample of 4-year-old children on the autism spectrum and also found that both groups registered a same level of improvements, independently of the intensity. However

interestingly Bremer et al., (2015) reported that a post-test follow-up 6 weeks after the end of the intervention showed that the group having 1/hr per week for 12 weeks of instruction demonstrated a high FMS retention. More research is required to determine whether a 2hrs/week for 12 weeks would have resulted in a more significant FMS retention.

Interviewees recommended the following resources when teaching FMS, adapted PE lessons, cushions (balance), trampoline (Jumping and balance), tunnel (crawling), swing (balance and holding), different ramps (walking up and down, balance), stairs, bean bags, hoops, resistance bands and soft balls. The most important resources indicated by questionnaire respondents for teaching FMS to primary students with ASD were adapted PE lesson plans, followed by picture cards and First Then visual schedules. Choice boards, count down strips, Token boards, Sensory timers and Tablets with specialised apps were indicated as being of lesser importance.

Only 55.1% indicated the availability of picture cards, a must have resource when teaching primary children with autism. The availability of adapted PE lesson plans was indicated by only 33.30% of the respondents.

Development of adapted PE lesson plans to teach FMS to primary children with ASD would be more efficient if carried out as a collective effort, an initiative that could potentially be led by the Institute of Physical Education. Such an effort could also aim to establish a link with the Maltese PE learning objectives criteria for Year 1 and 2. The availability of resources is an area that could potentially be easily addressed, since the resources requested are easily available.

4.4.4 Local PE teachers and LSEs Support for an FMS Early Intervention

Most of the questionnaire respondents Strongly Support (64.10%) or Support (17.90%), collectively representing 82% of respondents, the hypothesis that an early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years. Interviewees also strongly support such a hypothesis, and in fact they observed that one of the key markers of success during the PE class was linked to whether a student led a sedentary or physically active lifestyle at home. Both interviewees and respondents recommend aquatic exercises or gymnastics as appropriate extra-curricular activities to help FMS development.

The strong support for early intervention confirms the belief among local PE

teachers and LSEs in the benefits that such an early intervention would bring. This is also supported by the literature as outlined in section 2.4.3. The systemic review carried out by Colombo-Dougovito (2019) of FMS interventions for children and adolescents on the autism spectrum clearly showed that an early intervention in any form can have a beneficial impact on the development of FMS in children on the autism spectrum.

It also Colombo-Dougovito (2019) to suggest that the early intervention improvements demonstrated suggest that motor skill delays in ASD could potentially be secondary to the condition and not an intrinsic feature since any amount of intervention led to an improvement.

4.4.5 Self-reported Preparedness to Teach FMS to Primary Students with ASD

Most of the questionnaire respondents were Neutral (42.30%) about their preparedness to teach or support FMS to primary students with ASD. Only 7.70% feel Very Prepared and 24.40% feel Prepared. This is a key issue since although 82% of respondents support an early intervention hypothesis to improve FMS development, less than 33% of respondents feel prepared to teach FMS to primary students with ASD.

A total of 34.62% of the respondents indicated that had not received any specialised training at any level on teaching FMS to primary students with ASD. Of these 7 respondents were PE teachers and 20 respondents were LSEs, indicating that the lack of specialised training impacts both PE teachers and LSEs.

From the 65.38% of respondents who indicated that they had received specialised training on teaching FMS to primary students with ASD, 72.55% indicated that they had received at least one training of 5 days or less. Interestingly 10 LSEs indicated that they had received at least one training of more than 5 days compared to only 4 PE teachers. While 22 LSEs and 15 PE teachers indicated that they had received at least one training of 5 days or less.

The most common level at which specialised training was delivered was at the University Diploma level and it was mainly attended by LSEs. The second most common level was at Postgraduate level and at this level it was mainly attended by PE teachers.

Many questionnaire respondents (85.90%) indicated that their training was a "Theoretical training" rather than a "Hands-on" training. Interviewees stressed the importance of "Hands-on" training. Delivering a "Hands-on" training to PE teachers and

LSEs is not easy and requires a lot of preparation. Two approaches could be considered. A central approach where a model hands-on adapted PE lesson, including instruction on how to teach and support children with autism in a hands-on way is developed and delivered in a special school adapted PE class. PE teachers and LSEs can then attend as observers and participants in the adapted PE class for their hands-on training. Such an approach has the advantage that it simplifies preparation and availability of resources. It also facilitates administration. Another approach could be that an instructor team delivers such hands-on training in a distributed approach, visiting the PE teachers and LSEs in their school environment. This introduces more variability and is more difficult to administer.

4.5 Summary

This chapter presented the results of the interviews and the questionnaire responses. A critical discussion and analysis of the results obtained from the interviews and the questionnaire (mixed approach) was then made. Several results complement each other between the results obtained from the interviews and the questionnaire, as well as those found in the literature.

Chapter 5

Conclusion

5.1 Main Findings of this Study

This research study has explored the PE teaching pedagogy and resources for teaching and supporting FMS development in primary children with ASD. Coordination of movements, orientation in space and time, and balancing were indicated as the most FMS most difficult for primary children with ASD to learn. Sensory overload and communication impairments were the stereotypical behaviours that has the most impact on the ability of primary students with ASD to learn FMS. It was observed that an adequate time needs to be given to such students to get acquainted with their school environment, since this improves their openness to cooperate. Improvements are registered when an effort is made to communicate with children with ASD, since this helps them understand what is required from them.

Most respondents (59%) indicated that they use the Maltese PE syllabus learning outcomes as the main FMS assessment tool. The case was made to compliment the Maltese PE syllabus learning outcomes with a special purpose FMS assessment tool that is targeted at assessing the FMS development of children with ASD. Encouragingly, 70.50% of the respondents indicated that a differentiated inclusion strategy is used, or would be used, when teaching FMS to primary students with ASD, where the ASD students assisted by the LSEs follow an adapted lesson plan while forming part of the main class. This is ideal since the individual setting is useful to address gaps in the IEP while the group setting is useful to develop their social skills.

Dribbling, bouncing, striking, galloping and leaping, balancing, jumping and catching

were indicated as the more difficult skills for primary students with ASD to learn, requiring between 20 and 25 hours of instruction before improvements may be registered. While easier tasks such as kicking, hopping, underhand rolling, underhand throwing, overhand throwing, and running would still require between 15 and 20 hours of instructions to register improvements.

Respondents indicated that they use, or would use, physical demonstrations (73.10%), picture cards (65.40%), short, specific direct phrases (59.00%) and video demonstration (57.70%) when teaching or supporting primary students with ASD. They also indicated that the most important resources required for teaching FMS to such students were, adapted PE lesson plans, followed by picture cards and First Then visual schedules. However, only 55.1% indicated the availability of picture cards, a must have resource when teaching primary children with autism and the availability of adapted PE lesson plans was indicated by only 33.30% of the respondents.

The large proportion of respondents who rated collaboration between the PE teacher and LSE as Neutral (41.00%), Weak (9.00%), or Poor (5.10%), in aggregate representing 55.10% of the respondents, indicates that collaboration between the PE teacher and LSE is an area for improvement.

A strong majority of 82% of respondents as well as all interviewees support the hypothesis that an early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years. However, only 7.70% of respondents feel Very Prepared and 24.40% of respondents feel Prepared to teach or support FMS to children with ASD. This is a key issue since although 82% of respondents support an early intervention hypothesis to improve FMS development, less than 33% of respondents feel prepared to teach FMS to primary students with ASD.

5.2 Strengths and Limitations

The key strength of this study was the inclusion of both PE teachers and LSEs, as well as its focus on FMS development in primary children with ASD. The mixed approach which included interviews and a self-constructed questionnaire, as well as the strong questionnaire response was a strength.

This study contains a few limitations which are outlined below:

a) The questionnaire online distribution using social networks introduced a sampling bias whereby members of the target population who are not active online or

members of the social networks, were excluded from the study.

b) The relatively small number of respondents compared to the target population could have introduced a non-response bias, whereby the members of the target population who did not participate could have a different view to those that did.

c) An acquiescence bias could have been introduced by respondents when answering questions that evaluate their actions. An extreme response bias could also have been introduced when responding to items on a scale, whereby the extreme ends of the scale tend to be selected.

d) An order bias could also have been introduced by how the questionnaire questions were ordered in sequence, potentially influencing the respondent's perception.

5.3 Recommendations Arising from this Study

The following recommendations are aimed at improving the teaching and support of FMS development in primary school children with ASD by local PE teachers and LSEs:

a) It is very important that an early diagnosis is made and that early intervention on FMS is initiated as early as possible.

b) Parents need to ensure that children with ASD are involved in physical activity at home, rather than leading a sedentary lifestyle, since this is a key success indicator for FMS development.

c) More training, ideally hands-on training, is needed to increase the preparedness of PE teachers and LSEs to teach/support FMS to children with ASD. A centralised approach such as that proposed by TEACCH in North Carolina (where the PE teacher and LSEs attend hand-on training in a special school setting), or a distributed approach where instructors visit the PE teacher and LSEs in their school environment can be used.

d) A better initial capability assessment of the children's FMS capabilities is required to try to reduce the variability in the children's abilities in a class setting. A wide FMS variability in the same class makes it very difficult to manage the class and could be a limiting factor for FMS development.

e) The use of the Maltese PE curriculum learning objectives criteria as the key FMS assessment tool is an advantage. Due to the important benefits of FMS developments to children with ASD, and since it is hard to capture the small deltas in FMS development registered by children with ASD, a specialised FMS

assessment tool could be developed to complement the Maltese PE syllabus learning outcomes assessment criteria. This tool would apply specifically when assessing children with ASD.

f) A project led by the Institute of Physical Education and Sports at the University of Malta could address the lack of adapted PE lesson plans when teaching FMS to primary children with ASD. A standard resource kit to teach such adapted PE lessons plans could also be developed and used as a guide when equipping schools with resources. In this way there is also a faster route to productive use between tools developed as part of research projects and their use in real-life school environments.

5.4 Recommendations for Further Research

In addition to the recommendations for improvement outlined in section 5.3, the following recommendations for further research have been identified during this study:

a) A study to understand FMS variability in students with ASD in mainstream classes, and to comprehend how best to reduce such variability. More research is also required to understand why 2.60% of questionnaire respondents are using a separated class strategy where the ASD students assisted by their LSEs are separated on their own during the PE class.
b) A study to understand the ideal frequency, session duration, and total intervention hours for long term FMS development and retention in students with ASD.
c) A study to understand the behaviour and performance of students with ASD in local PE classes.
d) The collaboration between the PE teacher and LSE as an area for improvement based on the finding as indicated by 55.10% of the respondents.

5.5 Final Conclusion

Proficiency in fundamental movement skills is an important milestone in childhood development leading to a positive spiral of engagement in physical activity. Several studies have demonstrated the importance and benefits of fundamental movement skill interventions for children on the autism spectrum since such interventions had a positive

effect on their fundamental movement skills development, leading to improvements in their social and communication skills resulting in enhanced participation in class.

This study evaluated the essential teaching pedagogy and resources identified by PE Teachers and Learning Support Educators in Malta necessary to improve the development of fundamental movement skills of primary school children on the autism spectrum using a mixed research method approach. Stakeholders were interviewed and an online questionnaire was distributed to PE teachers and Learning Support Educators in Malta and Gozo.

The factors affecting fundamental movement skill development in primary students on the autism spectrum in Malta were investigated, as well as how local PE Teachers and Learning Support Educators assess the fundamental movement skills of these students. The established and leading-edge pedagogy methods and teaching resources, indicated as essential by local PE teachers and Learning Support Educators, to improve fundamental movement skill development of these students were also determined.

Eighty two percent (82%) of questionnaire respondents as well as all interviewees support the hypothesis that an early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years. Yet only 33% of questionnaire respondents from among local PE teachers and LSEs feel prepared to teach FMS to primary students with ASD. This study has made several recommendations to address this problem with an objective to make the belief of the AAHPER that '*today's physical education is the subject which children learn to move as they move to learn*" a reality for primary students with ASD in local PE classes (AAHPER, 1965, p.24.).

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Appendix A - Questionnaire

Physical Education Teaching Pedagogy and Resources for Fundamental Skill Development in Primary Students with Autism in Malta.

My name is Maria Attard and I am a student at the University of Malta, presently reading for a Masters in Teaching and Learning in Physical Education. I am presently conducting a study for my dissertation titled Physical Education Teaching Pedagogy and Resources for Fundamental Skill Development in Primary Students with Autism in Malta. The supervisor of this dissertation is Dr. Lara Tonna Grima.

The aim of this study is to research the challenges, teaching pedagogy and resources used, or recommended to be used, by Physical Educators and Learning Support Educators (LSEs) in Malta when teaching Fundamental Movement Skills (FMS) to primary students with Autism Spectrum Disorders (ASD).

Your participation in this study would help to identify best practices and gaps, if any, in the teaching methods and resources used to teach Fundamental Movement Skills during inclusive adapted PE practical classes to primary students with Autism. The collected data will enable me to propose recommendations on strategies to better prepare and support Physical Educators and LSEs when teaching practical PE lessons which include students with Autism. The data collected from this research will be used solely for this purpose.

It is estimated that the questionnaire should take about 15-20 minutes to complete. Data collected will be anonymous, and your anonymity will be safeguarded.

Participation in this study is entirely voluntary; in other words, you are free to accept or refuse to participate, without needing to give a reason. You are free to withdraw from the study at any time, without needing to provide any explanation and without any negative repercussions.

Thank you for your consideration. Should you have any questions or concerns, please do not hesitate to contact me by e-mail on maria.attard.19@um.edu.mt. You can also contact my supervisor on telephone number 23402952 or by email on lara.tonna@um.edu.mt.

Continuing to respond to this online questionnaire indicates that

- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older
- You give your consent to participate in the online questionnaire

Maria Attard

1. Please select your age bracket.
Mark only one oval.

- ◯ 20 to 30 years
- ◯ 31 to 40 years
- ◯ 41 to 50 years
- ◯ 51 to 60 years
- ◯ 61+ years

2. The highest level of education that you hold is:
Mark only one oval.

- ◯ Vocational Education
- ◯ University Diploma
- ◯ University Degree
- ◯ Post-graduate Diploma
- ◯ Post-graduate Degree
- ◯ Other

3. Are you ?
Mark only one oval.

- ◯ A PE teacher
- ◯ A Learning Support Educator (LSE)

4. For which age groups do you provide teaching or support in Physical Education?
Tick all that apply.

- ☐ Primary classes (5-10 years)
- ☐ Secondary classes (11-15 years)
- ☐ A mix of the above
- ☐ Other

5. Do you teach/ support students with ASD during the PE practical class:
Mark only one oval.

- ◯ Yes
- ◯ No

6. How many of your PE practical classes include students with an ASD?
Mark only one oval.

- ◯ 1-25%
- ◯ 26-50%
- ◯ 51-75%
- ◯ 76-100%

7. Have you had any training on how to teach FMS to students with ASD, and what was the cumulative time spent on each training. *
Mark only one oval per row.

	No training	5 days or less	More than 5 days
Undergraduate Degree modules	◯	◯	◯
Postgraduate Degree modules	◯	◯	◯
Diploma modules	◯	◯	◯
Continuous Professional Developmental courses	◯	◯	◯

8. Was the training received a:
Mark only one oval.

- ◯ Hands on training
- ◯ Theory training

9. In general, how would you rate the difficulty for Primary students with ASD to carry out the following Fundamental Movement Skills identified in the Maltese Primary School Curriculum?

Mark only one oval per row.

	Easy	Fair	Difficult
Differentiation			
Equilibrium			
Combination of movements			
Orientation of Space & Time			
Reaction			
Rhythm			
Agility			
Speed/ Running			
Throwing			
Catching			

10. How are the Fundamental Movement Skill capabilities of primary students with ASD determined?

Mark only one oval.

- An initial onboarding student assessment was shared by the school
- An initial onboarding meeting was held with the parents of the student
- Both of the above
- An assessment was formed during the PE practical class
- None of the above, no assessment was made
- Not applicable, I don't teach/support primary students

11. With which of the following Fundamental Movement Skills assessment tools used for primary students are you familiar ?

Tick all that apply.

- ☐ Test of Gross Motor Development 2nd or 3rd edition (TGMD-2) or (TGMD-3)
- ☐ Movement Assessment Battery for Children 2nd edition (MABC-2)
- ☐ Bruininks- Oseretsky Test of Motor Pro ciency 2nd edition (BOT-2)
- ☐ Development Coordination Disorder Questionnaire (DCDQ)
- ☐ Motor pro ciency test (MOT 4-6)
- ☐ Peabody Developmental Motor Scales 2nd or 3 rd edition (PDMS-2) or (PDMS-3)
- ☐ Mullen Scales of Early Learning (MSEL)
- ☐ Learning Outcome assessment as outlined in the Maltese PE syllabus
- ☐ Other:

12. Which of the following Fundamental Movement Skills assessment tools do you use, or would use, to assess primary students with ASD?

Tick all that apply.

- ☐ Test of Gross Motor Development 2nd or 3rd edition (TGMD-2) or (TGMD-3)
- ☐ Movement Assessment Battery for Children 2nd edition (MABC-2)
- ☐ Bruininks- Oseretsky Test of Motor Pro ciency 2nd edition (BOT-2)
- ☐ Development Coordination Disorder Questionnaire (DCDQ)
- ☐ Motor pro ciency test (MOT 4-6)
- ☐ Peabody Developmental Motor Scales 2nd or 3 rd edition (PDMS-2) or (PDMS-3)
- ☐ Mullen Scales of Early Learning (MSEL)
- ☐ Learning Outcome assessment as outlined in the Maltese PE syllabus
- ☐ Other:

13. What type of strategy is used or would you use during the PE practical class to teach FMS to primary students with ASD?

Mark only one oval.

- A common inclusive strategy (where all students follow the same lesson plan)
- A separated class strategy (where the ASD students assisted by Learning Support Educators are separated on their own)
- A differentiated inclusion strategy (where the ASD students assisted by Learning Support Educators follow an adapted lesson plan while forming part of the main class)

14. Which would be your preferred method to teach Fundamental Movement Skills to Primary students with ASD?

Mark only one oval.

- Participation in a game involving the FMS
- Demonstration of the key components of a particular FMS in a progressive manner and allowing the student time to practice
- Allow the student to take the lead

15. With which of the following teaching techniques developed for students with ASD are you familiar?

Tick all that apply.

- [ ] TEACCH (Treatment and Education of Autistic and related Communicationhandicapped Children)
- [ ] CPRT (Classroom Pivotal Response Teaching)
- [ ] ICPL (I CAN Develop Physical Literacy)
- [ ] PECS (Picture Exchange Communication System)
- [ ] Video demonstration
- [ ] ABA (Adapted Behaviour Analysis)

16. Which of the following techniques do you use, or would you use, to teach FMS to primary students with ASD?

Tick all that apply.

- [ ] Short, specific and direct phrases
- [ ] Showing and saying
- [ ] Physical demonstration
- [ ] Use of picture cards
- [ ] First-Then guidance
- [ ] Video demonstrations
- [ ] Social stories
- [ ] Task analysis and chaining

17. Besides Gross/Fine Motor difficulties please rate the difficulty posed by different ASD behaviours for the teacher/LSE to teach the FMS to students with ASD in the PE class.

Mark only one oval per row.

	Very Difficult	Difficult	Not Difficult
Over attention to preferred activities	◯	◯	◯
Participation in team sports	◯	◯	◯
Communication impairments	◯	◯	◯
Repetitive behaviour	◯	◯	◯
Lack of attention to non-preferred activities	◯	◯	◯
Difficulty in transitioning between activities	◯	◯	◯
Speed of skill acquisition	◯	◯	◯
Wide range of Behavior between students	◯	◯	◯

18. How many hours of instruction do you think is necessary before improvements in the FMS skill may be observed?

Mark only one oval per row.

	10 hours	20 hours	30 hours or more
Balance	⬭	⬭	⬭
Running	⬭	⬭	⬭
Underhand rolling	⬭	⬭	⬭
Galloping and leaping	⬭	⬭	⬭
Underhand throwing	⬭	⬭	⬭
Jumping vertically/ horizontally	⬭	⬭	⬭
Dribbling/ boucning	⬭	⬭	⬭
Overhand throwing	⬭	⬭	⬭
Catching	⬭	⬭	⬭
Hopping	⬭	⬭	⬭
Striking	⬭	⬭	⬭
Kicking	⬭	⬭	⬭

19. RANK the relative importance of the availability of the resources listed below, to teach FMS to primary students with ASD?

Tick all that apply.

	Most Important	2nd	3rd	4th	5th	Least important
Adapted physical education lesson plans	⬭	⬭	⬭	⬭	⬭	⬭
Picture cards	⬭	⬭	⬭	⬭	⬭	⬭
Count down strips, Token boards and Sensory Timers	⬭	⬭	⬭	⬭	⬭	⬭
Choice boards	⬭	⬭	⬭	⬭	⬭	⬭
First- Then Visual schedules	⬭	⬭	⬭	⬭	⬭	⬭
Tablet with specialised apps	⬭	⬭	⬭	⬭	⬭	⬭

20. Which of the following resources do you have available?

Tick all that apply.

- ☐ Adapted physical education lesson plans
- ☐ Picture cards
- ☐ Count down strips, Token boards and Sensory Timers
- ☐ Choice boards
- ☐ First- Then Visual schedules
- ☐ Tablet
- ☐ Specialised tablet apps (eg. LAMP words for life app)
- ☐ None of the above
- ☐ Other

21. Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?

Mark only one oval.

	1	2	3	4	5	
Don't Support	⬭	⬭	⬭	⬭	⬭	Strongly Support

22. Which of the following specialised extra curricular activities would you recommend for FMS improvement in primary students with ASD?

Tick all that apply.

- ☐ Aquatic exercise programmes
- ☐ Tai chi classes
- ☐ Dance classes
- ☐ Gymnastics classes
- ☐ Football classes

23. How do you rate collaboration between the PE teacher/ LSE when teaching FMS to primary students with ASD?

Mark only one oval.

	1	2	3	4	5	
Poor	⬭	⬭	⬭	⬭	⬭	Outstanding

24. Rate your level of preparedness to teach/support FMS to primary students with ASD?

Mark only one oval.

	1	2	3	4	5	
Not Prepared	⬭	⬭	⬭	⬭	⬭	Very Prepared

25. Do you have any recommendations on how to improve the teaching of fundamental movement skills in primary school classes that include students with ASD? If yes, please outline the recommendations.

_____

Appendix B - Interview Questions

Interview Guide

Title: Physical Education Teaching Pedagogy and Resources for Fundamental Skill Development in Primary Students with Autism in Malta..

Main Aim: The main objective of the interview is to obtain the stakeholders' perspectives about the essential teaching pedagogy and resources needed by local physical educators and learning support educators to assist the PE teacher-Learning support educator team to improve the development of fundamental movement skills in primary students with ASD.

Research Questions

1) What are the factors affecting FMS development in primary students with ASD?
2) How do local PE Teachers and LSEs assess the FMS of primary students with ASD?
3) What are the tried and tested, as well as leading edge pedagogy methods and teaching resources used or indicated as essential by local PE teachers and LSEs, to improve FMS development in primary students with ASD?
4) Do local PE Teachers and LSEs support the hypothesis that early intervention focusing on FMS development in primary students with ASD will improve the overall development of the student in later years?
5) What is the self-reported level of preparedness of local PE Teachers and LSEs to teach FMS to primary students with ASD?

5 Interviewees

Interviewee 1: A Primary School PE Teacher
Interviewee 2: A Learning support educator
Interviewee 3: A coach from the Special Olympics
Interviewee 4: A professional working in a specialised centre for children with autism
Interviewee 5: A representative from an autism related association

Interviewee 1: A PE primary school teacher

Section A: Participants' Information (Information will remain confidential)
Gender and Occupation:
Experience in the field:

Section B: Introductory Questions
1. Have you come across students with ASD in your experience and at what age group were they?
2. How many students with ASD do you typically teach in a particular level?
3. How are the Fundamental Movement Skills of the students with ASD assessed and are you made aware of their capabilities assessment?
4. When teaching Fundamental Movement Skills are students with ASD taught in an inclusive setting or in a separate stream?
5. Which Fundamental Movement Skills identified in the Maltese Primary School Curriculum are typically the more difficult for students with ASD to learn?
6. Which behaviours typical of students with ASD cause difficulty when teaching Fundamental Movement Skills?
7. Is there a structure that supports the continuous communication between the PE teacher/LSE and the parents of students with ASD?
8. Is any special support provided to the PE teacher when delivering inclusive teaching lessons?

Section C: Questions to support dissertation research question 1
9. What are the factors affecting Fundamental Movement Skill development in primary school students with Autism?
10. Do you feel that PE teachers are well prepared to teach Fundamental Movement Skills to primary students with ASD?

Section D: Questions to support dissertation research question 2
11. Have you come across Fundamental Movement Skills assessment tools such as TGMD-3, MABC-2 or BOT-2?
12. Which Fundamental Movement Skills assessment method do you use?

Section E: Questions to support dissertation research question 3
13. Are you familiar with specialised teaching techniques developed for students with ASD such as TEACCH (Treatment and Education of Autistic and related Communication handicapped Children) or CPRT (Classroom Pivotal Response Teaching)?
14. Would you prefer to use Participation in a game setting, Demonstration of the key components of Fundamental Movement Skills or allowing the student to take the lead?
15. Which ASD friendly techniques do you use when teaching Fundamental Movement Skills to primary students with ASD?

16. How many hours of instruction does it typically take before improvements in the Fundamental Movement Skills may be observed?
17. Which resources do you use to teach Fundamental Movement Skills to primary students with ASD?
18. Which ASD resources do you have access to?
19. Which resources would you like to have access to, to support teaching of FMS to primary students with ASD?
20. Which specialised extra-curricular activities would you recommend for FMS improvement in primary students with ASD?
21. How would you improve the collaboration between the PE teacher/ LSE when teaching FMS to primary students with ASD?

Section F: Questions to support dissertation research question 4

22. Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?

Section G: Questions to support dissertation research question 5

23. Which training would you like to obtain to support you in teaching FMS to primary students with ASD?
24. Do you have any recommendations on how to improve the teaching of fundamental movement skills in primary school classes that include students with ASD? If yes, please outline the recommendations.

Interviewee 2: A Learning Support educator

Section A: Participants' Information (Information will remain confidential)
Gender and Occupation:
Experience in the field:

Section B: Introductory Questions

1. Have you come across students with ASD in your experience and at what age group were they?
2. How many students with ASD do you typically support at the same time?
3. How are the Fundamental Movement Skills of the students with ASD assessed and are you made aware of their capabilities assessment?
4. When learning Fundamental Movement Skills are students with ASD supported in an inclusive setting or in a separate stream?
5. Which Fundamental Movement Skills identified in the Maltese Primary School Curriculum are typically the more difficult for students with ASD to learn?
6. Which behaviours typical of students with ASD cause difficulty when learning Fundamental Movement Skills?
7. Is there a structure that supports the continuous communication between the PE teacher/LSE and the parents of students with ASD?

Section C: Questions to support dissertation research question 1

8. What are the factors affecting Fundamental Movement Skill development in primary school students with Autism?
9. Do you feel that LSEs are well prepared to teach Fundamental Movement Skills to primary students with ASD?

Section D: Questions to support dissertation research question 2

10. Have you come across Fundament Movement Skills assessment tools such as TGMD-3, MABC-2 or BOT-2?
11. Which Fundamental Movement Skills assessment method do you use?

Section E: Questions to support dissertation research question 3

12. Are you familiar with specialised teaching techniques developed for students with ASD such as TEACCH (Treatment and Education of Autistic and related Communication handicapped Children) or CPRT (Classroom Pivotal Response Teaching)?
13. Would you prefer to use Participation in a game setting, Demonstration of the key components of Fundamental Movement Skills or allowing the student to take the lead?
14. Which ASD friendly techniques do you use when teaching Fundamental Movement Skills to primary students with ASD?
15. How many hours of instruction does it typically take before improvements in the Fundamental Movement Skills may be observed?

16. Which resources do you use to teach Fundamental Movement Skills to primary students with ASD?
17. Which ASD resources do you have access to?
18. Which resources would you like to have access to, to support teaching of FMS to primary students with ASD?
19. Which specialised extra-curricular activities would you recommend for FMS improvement in primary students with ASD?
20. How would you improve the collaboration between the PE teacher/ LSE when teaching FMS to primary students with ASD?

Section F: Questions to support dissertation research question 4

25. Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?

Section G: Questions to support dissertation research question 5

26. Which training would you like to obtain to support you in teaching FMS to primary students with ASD?
27. Do you have any recommendations on how to improve the teaching of fundamental movement skills in primary school classes that include students with ASD? If yes, please outline the recommendations.

Interviewee 3: A coach from Special Olympics

Section A: Participants' Information (Information will remain confidential)
Gender and Occupation:
Experience in the field:

Section B: Introductory Questions

1. Have you come across athletes with ASD in your experience and at what age group were they?
2. How many athletes with ASD do you typically coach in a particular level?
3. How are the Fundamental Movement Skills of the athletes with ASD assessed and are you made aware of their capabilities assessment?
4. When coaching Fundamental Movement Skills are athletes with ASD coached in an inclusive setting or in a separate stream?
5. Which Fundamental Movement Skills identified in the Maltese Primary School Curriculum are typically the more difficult for athletes with ASD to learn?
6. Which behaviours typical of athletes with ASD cause difficulty when coaching Fundamental Movement Skills?
7. When coaching athletes with ASD are you supported by other coaches/ assistants?
8. Is any special support provided to the coach when delivering inclusive coaching lessons?

Section C: Questions to support dissertation research question 1

9. What are the factors affecting Fundamental Movement Skill development in young athletes (5-10 years) with ASD?

Section D: Questions to support dissertation research question 2

10. Have you come across Fundamental Movement Skills assessment tools such as TGMD-3, MABC-2 or BOT-2?
11. Which Fundamental Movement Skills assessment method do you use?

Section E: Questions to support dissertation research question 3

12. Are you familiar with specialised teaching techniques developed for students with ASD such as TEACCH (Treatment and Education of Autistic and related Communication handicapped Children) or CPRT (Classroom Pivotal Response Teaching)?
13. Would you prefer to use Participation in a game setting, Demonstration of the key components of Fundamental Movement Skills or allowing the athlete to take the lead?
14. Which ASD friendly techniques do you use when coaching Fundamental Movement Skills to primary students with ASD?
15. How many hours of instruction does it typically take before improvements in the Fundamental Movement Skills may be observed?
16. Which resources do you use to teach Fundamental Movement Skills to young

athletes (5-10 years) with ASD?

17. Which ASD resources do you have access to?
18. Which resources would you like to have access to, to support teaching of FMS to young athletes (5-10 years) with ASD?
19. Which specialised extra-curricular activities would you recommend for FMS improvement in young athletes (5-10 years) with ASD?
20. How would you improve the collaboration between the coach/ assistant coach when teaching FMS to young athletes (5-10 years) with ASD?

Section F: Questions to support dissertation research question 4

21. Do you support the hypothesis that an early intervention focusing on FMS development in young athletes (5-10 years) with ASD will improve the overall development of the athlete in later years?

22. Do you feel that coaches are well prepared to teach Fundamental Movement Skills to young athletes (5-10 years) with ASD?
23. Which training would you like to obtain to support you in teaching FMS to young athletes (5-10 years) with ASD?
24. Do you have any recommendations on how to improve the coaching of fundamental movement skill development to young athletes (5-10 years) with ASD? If yes, please outline the recommendations.

Interviewee 4: A Professional working in a centre catering for children with Autism

Section A: Participants' Information (Information will remain confidential)
Gender and Occupation:
Experience in the field:

Section B: Introductory Questions

1. What age groups do you typically work with and how many children with ASD do you typically teach in a particular level?
2. How are the Fundamental Movement Skills of the children (5-10 years) with ASD assessed and are you made aware of their capabilities assessment?
3. When teaching Fundamental Movement Skills are children (5-10 years) with ASD taught in an individual setting or in a group?
4. Which Fundamental Movement Skills identified in the Maltese Primary School Curriculum are typically the more difficult for children (5-10 years) with ASD to learn?
5. Which behaviours typical of children (5-10 years) with ASD cause difficulty when teaching Fundamental Movement Skills?

Section C: Questions to support dissertation research question 1

6. What are the factors affecting Fundamental Movement Skill development children (5-10 years) with Autism?

Section D: Questions to support dissertation research question 2

7. Have you come across Fundamental Movement Skills assessment tools such as TGMD-3, MABC-2 or BOT-2?
8. Which Fundamental Movement Skills assessment method do you use?

Section E: Questions to support dissertation research question 3

9. Are you familiar with specialised teaching techniques developed for children (5-10 years) with ASD such as TEACCH (Treatment and Education of Autistic and related Communication handicapped Children) or CPRT (Classroom Pivotal Response Teaching)?
10. Would you prefer to use Participation in a game setting, Demonstration of the key components of Fundamental Movement Skills or allowing the children (5-10 years) to take the lead?
11. Which ASD friendly techniques do you use when teaching Fundamental Movement Skills to children (5-10 years) with ASD?
12. How many hours of instruction does it typically take before improvements in the Fundamental Movement Skills may be observed?
13. Which resources do you use to teach Fundamental Movement Skills to children (5-10 years) with ASD?
14. Which ASD resources do you have access to?
15. Which resources would you like to have access to, to support teaching of FMS to

children (5-10 years) with ASD?

16. Which specialised extra-curricular activities would you recommend for FMS improvement in children (5-10 years) with ASD?

Section F: Questions to support dissertation research question 4

17. Do you support the hypothesis that an early intervention focusing on FMS development in children (5-10 years) with ASD will improve the overall development of the child in later years?

Section G: Questions to support dissertation research question 5

18. Do you feel that PE teachers and LSEs are well prepared to teach Fundamental Movement Skills to children (5-10 years) with ASD?
19. Which training would you recommend to the PE teachers and LSEs to obtain to support them in teaching FMS to children (5-10 years) with ASD?
20. Do you have any recommendations on how to improve the teaching of fundamental movement skills in primary school classes that include students with ASD? If yes, please outline the recommendations.

Interviewee 5: **A representative from an autism related association**

Section A: Participants' Information (Information will remain confidential)
Gender and Occupation:
Experience in the field:

Section B: Introductory Questions

1. What age groups do you typically work with?
2. How are the Fundamental Movement Skills of the children (5-10 years) with ASD assessed and how are teachers and LSEs made aware of their capabilities assessment?
3. Do you think that when teaching Fundamental Movement Skills to children (5-10 years) with ASD they should be taught in an inclusive setting or in a separate stream?
4. Which Fundamental Movement Skills identified in the Maltese Primary School Curriculum are typically the more difficult for children (5-10 years) with ASD to learn?
5. Which behaviours typical of students with ASD cause difficulty when teaching Fundamental Movement Skills?
6. Is there a structure that supports the continuous communication between the PE teacher/LSE and the parents of children (5-10 years) with ASD?

Section C: Questions to support dissertation research question 1

7. What are the factors affecting Fundamental Movement Skill development in children (5-10 years) with Autism?

Section D: Questions to support dissertation research question 2

8. Have you come across Fundamental Movement Skills assessment tools such as TGMD-3, MABC-2 or BOT-2?

Section E: Questions to support dissertation research question 3

9. Are you familiar with specialised teaching techniques developed for students with ASD such as TEACCH (Treatment and Education of Autistic and related Communication handicapped Children) or CPRT (Classroom Pivotal Response Teaching)?
10. Which setting do you think would be most effective to teach Fundamental Movement Skills to children (5-10 years), Participation in a game setting, Demonstration of the key components of Fundamental Movement Skills or allowing the student to take the lead?
11. Which ASD friendly techniques would you recommend when teaching Fundamental Movement Skills to children (5-10 years) with ASD?
12. How many hours of instruction does it typically take before improvements in the Fundamental Movement Skills may be observed?
13. Which resources would you recommend to teach Fundamental Movement Skills to children (5-10 years) with ASD?

14. Which specialised extra-curricular activities would you recommend for FMS improvement in children (5-10 years) with ASD?

Section F: Questions to support dissertation research question 4

15. Do you support the hypothesis that an early intervention focusing on FMS development in children (5-10 years) with ASD will improve the overall development of the student in later years?

Section G: Questions to support dissertation research question 5

16. Do you feel that PE teachers and LSEs are well prepared to teach Fundamental Movement Skills to children (5-10 years) with ASD?
17. Which training would you recommend to support the PE teacher/ LSE in teaching FMS to children (5-10 years) with ASD?
18. Do you have any recommendations on how to improve the teaching of fundamental movement skills in primary school classes that include students with ASD? If yes, please outline the recommendations.

Appendix C - Crosstabulation Tables

PE practical classes that include students with ASD? * With which of the following Fundamental Movement Skills assessment tools used for primary students are you familiar? Crosstabulation

Count

		With which of the following Fundamental Movement Skills assessment tools used for primary students are you familiar?									
			Curriculum LOs	DCDQ	MABC	MOT	MSEL	Multiple Selected	None	TGMD	Total
PE practical classes that include students with ASD?		100	0	0	0	0	0	0	0	0	100
	1–25%	0	26	0	0	2	1	2	4	2	37
	26–50%	0	6	4	1	0	1	2	1	1	16
	51–75%	0	9	0	0	0	0	3	1	2	15
	76–100%	0	5	1	0	0	0	1	2	1	10
Total		100	46	5	1	2	2	8	8	6	178

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	238.726[a]	32	<.001
Likelihood Ratio	270.514	32	<.001
N of Valid Cases	178		

a. 38 cells (84.4%) have expected count less than 5. The minimum expected count is .06.

Table C.1: Correlation between having PE classes that include students with ASD & Familiarity with FMS assessment tools

Highest level of Education. * Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years? Crosstabulation

Count

		Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?					
		1	2	3	4	5	Total
Highest level of Education.	Other	0	0	0	1	0	1
	Post-graduate Diploma/ Degree	0	0	4	4	17	25
	University Degree	1	1	5	5	19	31
	University Diploma	2	0	1	4	12	19
	Vocational Education	0	0	0	0	2	2
Total		3	1	10	14	50	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	11.987[a]	16	.745	.580
Likelihood Ratio	12.256	16	.726	.603
Fisher-Freeman-Halton Exact Test	17.295			.690
N of Valid Cases	78			

a. 21 cells (84.0%) have expected count less than 5. The minimum expected count is .01.

Table C.2: Correlation between Educational Level & Early Intervention support

Occupation * Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years? Crosstabulation

Count

		Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?					
		1	2	3	4	5	Total
Occupation	LSE	2	0	4	10	36	52
	PE Teacher	1	1	6	4	14	26
Total		3	1	10	14	50	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	5.983[a]	4	.200	.191
Likelihood Ratio	5.970	4	.201	.246
Fisher-Freeman-Halton Exact Test	5.825			.171
N of Valid Cases	78			

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .33.

Table C.3: Correlation between Occupation & Early Intervention support

PE practical classes that include students with ASD? * Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years? Crosstabulation

Count

		Do you support the hypothesis that an early intervention focusing on FMS development in Primary students with ASD will improve the overall development of the student in later years?					
		1	2	3	4	5	Total
PE practical classes that include students with ASD?	1-25%	2	1	4	6	24	37
	26-50%	0	0	4	3	9	16
	51-75%	1	0	1	4	9	15
	76-100%	0	0	1	1	8	10
Total		3	1	10	14	50	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6.771[a]	12	.872	.907
Likelihood Ratio	7.737	12	.805	.899
Fisher-Freeman-Halton Exact Test	7.173			.924
N of Valid Cases	78			

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .13.

Table C.4: Correlation between presence of students with ASD in class & & Early Intervention support

Highest level of Education. * Rate your level of preparedness to teach/support FMS to primary students with ASD? Crosstabulation

Count

		Rate your level of preparedness to teach/support FMS to primary students with ASD?					
		1	2	3	4	5	Total
Highest level of Education.	Other	0	0	1	0	0	1
	Post-graduate Diploma/ Degree	3	5	7	8	2	25
	University Degree	3	6	15	5	2	31
	University Diploma	0	2	10	6	1	19
	Vocational Education	1	0	0	0	1	2
Total		7	13	33	19	6	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	18.181[a]	16	.313	.326
Likelihood Ratio	17.543	16	.351	.317
Fisher-Freeman-Halton Exact Test	17.562			.320
N of Valid Cases	78			

a. 19 cells (76.0%) have expected count less than 5. The minimum expected count is .08.

Table C.5: Correlation between Educational Level & Level of Preparedness to teach/support FMS to primary students with ASD

Occupation * Rate your level of preparedness to teach/support FMS to primary students with ASD? Crosstabulation

Count

		Rate your level of preparedness to teach/support FMS to primary students with ASD?					
		1	2	3	4	5	Total
Occupation	LSE	2	9	19	17	5	52
	PE Teacher	5	4	14	2	1	26
Total		7	13	33	19	6	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	11.035[a]	4	.026	.022
Likelihood Ratio	11.691	4	.020	.029
Fisher-Freeman-Halton Exact Test	10.729			.023
N of Valid Cases	78			

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 2.00.

Table C.6: Correlation between Occupation & Level of Preparedness to teach/support FMS to primary students with ASD

PE practical classes that include students with ASD? * Rate your level of preparedness to teach/support FMS to primary students with ASD? Crosstabulation

Count

		Rate your level of preparedness to teach/support FMS to primary students with ASD?					
		1	2	3	4	5	Total
PE practical classes that include students with ASD?	1–25%	5	6	17	6	3	37
	26–50%	0	3	8	4	1	16
	51–75%	2	2	6	5	0	15
	76–100%	0	2	2	4	2	10
Total		7	13	33	19	6	78

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	10.933[a]	12	.535	.555
Likelihood Ratio	13.851	12	.310	.461
Fisher-Freeman-Halton Exact Test	10.300			.555
N of Valid Cases	78			

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .77.

Table C.7: Correlation between presence of students with ASD in class & Level of Preparedness to teach/support FMS to primary students with ASD