DETERMINATION OF INTENSITY LEVEL BETWEEN SELECTED TRADITIONAL GAMES AMONG Z GENERATION

by

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CERTIFICATE

This is to certify that the dissertation entitled

DETERMINATION OF INTENSITY LEVEL BETWEEN SELECTED TRADITIONAL GAMES AMONG Z GENERATION

Is the bona fide record of research work done by

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During the period of October 2013

to June 2014

under my supervision

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LIST OF ABBREVATIONS

ACSM	American College of Sport Medicine
BMI	Body Mass Index
CDC	Centre of Disease Control and Prevention
CHD	Coronary Heart Disease
CPM	Count per Minute
DHC	Department of Health and Children
MVPA	Moderate to Vigorous Physical Activity
NASPE	National Association of Sport and Physical Education
NHMS	National Health and Morbidity Surveys
PA	Physical Activity
PE	Physical Education
SD	Standard Deviation
SPSS	Statistical Package for Social Science
WHO	World Health Organization
Gen X	X generation

Gen Y	Y generation
Gen Z	Z generation

ABSTRACT

DETERMINATION OF INTENSITY LEVEL BETWEEN SELECTED TRADITIONAL GAMES AMONG Z GENERATION

Physical inactivity can be associated with an increased variety of diseases, especially non communicable chronic diseases such as cardiovascular, hypertension and diabetes mellitus. Moreover, this could lead to a major consequence prevalence of overweight and obesity in Z generation (members of the generation of people born after 1995 or 2000s, who are confident user of new technology such as smartphones, tablets and wireless internet). Besides, there were numbers of Z generation whom did not meet the recommendation of moderate to vigorous physical activity (MVPA) to gain the health benefit. Traditional games could be an attractive alternative activitiy for the Z generations. Therefore, this study aims to determine the physical activity intensity in Z generation for the selected traditional games. Thus, primary school students (n=240), with (120 boys and 120 girls) aged 9 to 11 years old were recruited in this study. Parameter measured for the intensity determination was activity count per minute (CPM) by using accelerometer GTX3+. In addition to identify axes orientation involved in every traditional game using the same gadgets. Based on the two selected traditional games which were *Baling Tin* and Police and Thieves have found within moderate to vigorous physical activity (MVPA) level across the

parameter measured. As for the activity count per minute (CPM) found that *Baling Tin* (944.59 ± 193.88) and Police and Thieves (952.48 ± 191.04). There was no significant difference of mean activity count per minute (CPM) between two games with p value = 0.751. Axis orientation showed that axis 1 in *Baling Tin* (51673.69 ± 13002.93) while Police and Thieves (42043.12 ± 12415.06) and there was significant difference of mean axis 1 between two games with p value < 0.001. In axis 2 was 53437.12 ± 11396.60 (*Baling Tin*) and 50430.45 ± 12146.55 (Police and Thieves). There was a significant difference of mean axis 2 between two games with p value = 0.049. Axis 3, *Baling Tin* (58785.59 ± 11109.20) and Police and Thieves (54060.79 ± 12238.46) also showed there was significant difference of mean axis 3 between two games with p value = 0.002. In conclusion, this study found that all the two selected traditional games exhibit MVPA type of activity and axis 3 of both traditional games reached the highest value, followed by axis 2 and axis 1 had the lowest value.

ABSTRAK

PENGENALPASTIAN TAHAP INTENSITI TERHADAP PERMAINAN TRADISIONAL TERPILIH DALAM KALANGAN GENERASI Z

Kekurangan melakukan aktiviti fizikal dapat dikaitkan dengan peningkatan pelbagai jenis penyakit khususnya penyakit kronik seperti penyakit kardiovaskular, darah tinggi dan diabetis. Di samping menjadi punca utama berlakunya masalah obesiti dan lebihan berat dalam kalangan generasi Z (disebut sebagai kanak-kanak) hari ini. Kejadian ini ditambah pula dengan pengurangan jumlah kanak-kanak yang harus mencapai saranan yang ditetapkan iaitu dari tahap intensiti aktiviti fizikal sederhana kepada yang lebih lasak yang dapat memberi manfaat dalam kesihatan. Sehubungan itu, permainan tradisional boleh menjadi alternatif aktiviti fizikal yang dapat menarik golongan kanak-kanak untuk melakukan aktiviti fizikal. Oleh yang demikian, kajian ini bertujuan untuk mengenalpasti intensiti permainan tradisional yang telah dipilih. Dengan itu, pelajar sekolah rendah seramai 240 orang pelajar, (120 lelaki, 120 perempuan) yang berumur dari 9 hingga 11 tahun telah menyertai kajian ini. Kajian ini melibatkan pengukuran intensiti berdasarkan pengiraan aktiviti bagi setiap minit dengan menggunakan 'Accelerometer GTX3+'. Di samping bertujuan untuk mengenalpasti orientasi paksi yang terlibat dalam setiap permainan tradisional dengan menggunakan gajet yang sama. Berdasarkan keputusan yang diperolehi, kedua-dua permainan tradisional iaitu baling tin dan polisentri menunjukkan pencapaian tahap intensiti aktiviti fizikal sederhana kepada

yang lebih lasak berdasarkan pengukuran parameter yang terlibat. Pengiraan aktiviti bagi setiap minit menunjukkan Baling Tin (944.59 ± 193.88) dan Polisentri (952.48 ± 191.04). Tidak ada perbezaan yang signifikan bagi purata pengiraan aktiviti bagi setiap minit di antara kedua-dua permainan ini dengan nilai $p = 0.751$. Orientasi paksi pula menunjukkan bahawa paksi 1 pada Baling Tin (51673.69 ± 13002.93) manakala Polisentri (42043.12 ± 12415.06). Terdapat perbezaan yang signifikan bagi purata paksi 1 di antara kedua-dua permainan ini dengan nilai $p < 0.001$. Bagi paksi 2 pula 53437.12 ± 11396.60 (Baling Tin) dan 50430.45 ± 12146.55 (Polisentri). Terdapat perbezaan yang signifikan bagi purata paksi 2 di antara kedua-dua permainan ini dengan nilai $p = 0.049$. Paksi 3, Baling Tin (58785.59 ± 11109.20) dan Polisentri (54060.79 ± 12238.46). Terdapat perbezaan yang signifikan bagi purata paksi 3 di antara kedua-dua permainan ini dengan nilai $p = 0.002$. Kesimpulannya, kajian ini menunjukkan bahawa kedua-dua permainan tradisional yang dipilih mempunyai tahap intensiti aktiviti fizikal sederhana kepada yang lebih lasak dan paksi 3 bagi kedua-dua permainan tradisional mencapai nilai yang paling tinggi, diikuti paksi 2 dan paksi 1 mempunyai nilai yang paling rendah.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Based on Ministry of Education, 2002, in the Syllabus and Explanation of syllabus, Integrated Curriculum for Primary Schools (ICPS) or in Malay version known as *Kurikulum Bersepadu Sekolah Rendah (KBSR)*, it shows that traditional games only involved in year 1, 2 and 3.

Let's recall the kampong traditional games played by Malaysian X generation kids. Many games were creatively created from free and natural sources. Y generation kids still played some of them and it's totally strange for Z generation kids born after 2000. The coming generations may not have the luxury of playing or even knowing the games played during the bygone era unless documented the facts or keeping records regarding the traditional games were done. Some of traditional games are localized and some are also played from other countries. Here, some traditional games that had been recorded in Malaysia such as *Datuk Harimau, Polisentri, Buaya Katak, Naik Haji, Lompat Sebelah Pusing Sebelah* (Nasarah & Nasarah, 2005).

Recently, the coming generation perceive too much pressure from their parents. Even after school they have to go to the tuition classes. Burden of homework and so much of academic result oriented lead to little or no time for involving in outdoors physical activity. According to the study done by Ebben and

Brudzynski (2008), the most common reason for not exercising in college students is they did not have time and one of the priorities was the schools works. Time constraint was one of the reasons for children to avoid physical activity. Thus, this may lead to huge impact on their health, growth and mind development.

Parents no longer believe that playing outdoors is safe for their children. Parents adopt a variety of strategies to protect their children from the perceived danger of violence in the neighbourhood. A study in Canada, found that the majority of parents characterised their neighbourhood as unsafe and felt that their local neighbours could not be trusted to look after their children (Irwin et al., 2007). This lack of trust drove children away from the community spaces because adults choose indoor activities for their children rather than outdoor play. These views were mirrored in the children's perspectives, many of them expressing their anxiety about their safety in the local neighbourhood, particularly in relation to 'stranger danger', and this prevented them from playing outside.

To be able to encourage children to participate actively in physical activity, in this study we have concentrate on intensity level and nature of the selected traditional games with hope to motivate or influence physical activity in this particular group.

1.2 Terms and Definitions

A **traditional game** is also known as unstructured or informal games and often played during childhood days. They were designed in such a way that can develop lot of skills such as logical thinking, building strategy, concentration,

problems solving, aiming and lots more. Traditional games were creatively created from free and natural sources. It provides a creative and fun way to view other cultures. Danandjaja (1987) defined traditional game is one form of a children's game, which circulated verbally among the members of a particular collective, traditional shape and inherited from one generation to another and has many variation. The hallmark of the traditional game is the game is an old, unknown origin, who the creator and where it came from. Another definition reported by Soepandi et al., 1986, traditional game is any types of activity that either need or not the usage of materials or tools, that has been passed by our ancestor as a medium for fun and enjoyment. Srikate et al., (2008) reported that the meaning of Thai traditional games are original played by Thai children. They do it for entertainment, sometime they play with rules or sometimes not. Thai traditional games have music to make it more fun and enjoyable. The elements of nature are used in the making of these games. For example, sand castles, mud balls, rocks, stones, seeds, pods, grass and straw. Araújo, Jaqueira and Rodrigues (2008), reported that the existence of the traditional games actually to developed people, physical, mental and social attributes which all this factor is essential to justify the birth of culture.

As we know some characteristics of traditional games such as easy rules, fun, did not teach players to win and lose, values which are useful in daily life, no special skills needed, help to develop imagination and creativity, regional variation, non-conventional materials used, help to communicative skills and passed down from generation to generation. A study in Spain, traditional games played have

these important characteristics such as a wide variety of motor relationships, a lot of body experiences associated to compete as well as to share challenges and the use of objects that come from the daily surrounding environment (Lavega, 2005).

X Generation (Gen X) by Farlex Dictionary, 2013, was meant as members of the generation of people born between the mid-1960s and the mid-1970s who are highly educated and underemployed, reject consumer culture, and have little hope for the future.

Y Generation (Gen Y) by Farlex Dictionary, 2013, defined as members of the generation of people born since the early 1980s who are seen as being discerning consumers with a high disposable income.

Z Generation (Gen Z) is the fledgling generation, born after 1995, that follows the Millennial. Definitions of Gen Z vary, with some considering the year 2000 as its starting point. This generation can be considered the first true mobile mavens and seen as confident users of new technology. They will take for granted a world of smartphones, tablets and high-speed wireless Internet, untethered from the constraints of a landline or a traditional Internet connection. They won't distinguish between online and offline, since their mobile devices will keep them connected most of the time. This will create a unique mindset, especially when it comes to accessing information (Palley, 2012).

Intensity by Farlex Dictionary, 2013, was meant as great energy, strength, concentration, or vehemence, as of activity. Another definition of Intensity was the rate of energy expenditure (Caspersen et al., 1985).

Armstrong et al., (2000) proposed that **physical activity pattern** as current patterns and trends of physical activity that classified into physical inactivity (sedentary) and physical activity to confer a health benefit such as 'sufficient' time (150 minutes per week, using the sum of walking, moderate activity and vigorous activity (weighted by two) or 'sufficient' time and sessions (150 minutes and five sessions of activity per week).

Axes can be defined as the three dimensions of assessment offered by triaxial accelerometry (x = vertical, y= anterioposterior and z = mediolateral) are potentially important when assessing children's physical activity, due to the greater variety of movements undertaken by the children relative to adults (Rowlands et al., 2006).

1.3 Research Objectives

General Objective

1. Increase awareness for physical activity through traditional games.

Specific Objectives

1. To determine the intensity level of selected traditional games via activity count per minute (CPM).
2. To determine the physical activity pattern via three axes.

1.4 Significance of the Study

Based on World Health Organization (WHO), 2013, overweight and obesity among children are now on the rise among low-and middle-income countries, particularly in urban settings. More than 30 million overweight children are living in developing countries and 10 million in developed countries. Obesity statistics showed that overweight children were 38% of the child population in Malaysia (Mohd Sidik et al., 2004). Thus, Malaysia is no exception.

The fundamental cause of obesity and overweight is due to an energy imbalance between calories consumed and calories expended which involve an increased intake of energy-dense foods that are high in fat and an increase in physical inactivity due to increasingly sedentary nature of many forms of work, changing modes of transportation and increasing urbanization (WHO, 2013).

Childhood obesity is associated with a higher chance of obesity, premature death and disability in adulthood. But in addition, to increase future risks, obese children experience breathing difficulties, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and psychological effects (WHO, 2013).

Physical activity is an important determinant of health and fitness. Colley et al., (2011) reported that the tremendous rise in obesity rates particularly among children and physical fitness has declined. Sedentary behaviour is known to be the cause associated with obesity and metabolic disease among children. It

encompasses a broad range of sedentary activities for example, sitting in classrooms, watching TV, talking on the phone, using a computer and etc.

There is little evidence of literature about the intensity and quality of traditional games as a form of physical activity in children. In this study, there will be including of activity count per minute (CPM) parameters to identify the intensity level of the selected traditional games. Besides, this study hopes to investigate the nature of the games which has potential to promote the feeling of enjoyment, able to create attraction and intrinsic motivation to be sustained involvement with the consistency of doing physical activity. The purpose of this study is to be a reference for the future study in order to use this type of physical activity as an intervention which can give benefits to the health status in children. Besides that, it may also improve motor skills of the children through the process of learning and improve cardiovascular fitness.

In addition, information gathered via this study may be useful for the school authorities and program planners in readdressing the needs, interests and desires of the primary school children during physical education classes and co-curricular activities.

CHAPTER 2

Review of Literature

2.1 Health Benefits of Physical Activity

Regular physical activity helps preserving optimum structure and function of muscles, bones, joints and cardiovascular system. This can lead to enhancing quality of life. Physical activity such as skipping and weight bearing exercise are directly proportional to our body system especially musculoskeletal system. Besides that, physical activity also improve fitness, strength, flexibility, coordination, improved general health and as an assistance in weight management (Warburton et al., 2006).

The most serious of the hypokinetic chronic diseases is cardiovascular disease (CVD). Even though the clinical symptoms of the disease do not become apparent until adulthood, it is known that the origin of CVD lies in early childhood (Twisk et al., 2002). Conversely, Gregory (2000) reported that increasing level of physical activity contribute to longer life and protects against conditions for example diabetes, stroke, osteoporosis and certain types of cancer. Besides, research done by Deforche et al. (2006) found that physical activity plays an important role in the prevention of overweight and obesity particularly in children as well as in adolescents.

Physical activity helps improve performance in academic level. For example it helps individuals to improve concentration, enhanced memory and learning.

Several studies conducted in the United State of America by the California Department of Education support the suggestion that when a substantial amount of school time is dedicated to physical activity, academic performances meets and even exceed that of student whom were not receiving additional physical activity (Leslee & Mitchell , 2004). Another study by Pellegrini and Davis (1993); Pellegrini et al. (1995) found that the longer children worked on standardized tasks without having a break time, the less attentive to the task they became. Besides that, Hill et al. (2010) confirmed that physical exercise benefits cognitive performance within the classroom as well as self-directed play during school break times, which has been linked to improving concentration and behaviour during lesson times (Madsen et al., 2011).

In social context, Melissa (2007) reported that children who participated in physical activity will develop the communication skill, interpersonal, leadership and co-operation, creating of lasting friendship, increased interest in accepting responsibility, manage to deal with winning and losing wisely, helped build social skills among children and may reduce anti-social behavior. Besides, Butler and Weatherall (2006) point out that children develop and practice complex social and negotiation skills in order to gain membership of self-initiated play frames.

In addition, physical activity may also give benefits to mental health which improved psychological wellbeing and mental awareness. This includes reduction in depression, anxiety and stress. Children with lower physical activity levels have more symptoms of psychological distress than more active children (CMO, 2004). Creswell et al. (2005) reported that those children who are able to play in their own

way may experience a greater "sense of self", which has been linked to an increased ability to deal with stress. In another study, children who make their own decisions, use their own initiative and feel good about themselves are more likely to develop positive self-esteem (MHF, 1999).

Traditional game includes most of the character that can provide overall development of the children. Even though there are lots of activity that can be done, existence of this traditional game should be realize in order to support the development of the children.

2.2 Traditional Games as Part of Primary and Secondary School Syllabus

Based on Ministry of Education, 2002, in the Syllabus and Explanation of syllabus, Integrated Curriculum for Primary and Secondary Schools (ICPS), it shows that traditional games only involved in standard 1, 2 and 3 as the table 2.1 and Table 2.2 below:

Table 2.1 Physical Education Syllabus Guidelines for Primary School, Ministry of Education, 2002.

STANDARD	GAMES
standard 1	*Galah Panjang* and *Rebut Tiang*.
standard 2	*Galah Panjang* and *Rebut Tiang*.
standard 3	*Galah Panjang* and *Rebut Tiang*.
standard 4	Games involve of hockey, football, netball, athletic, long jump, softball and gymnastic.
standard 5	Games involve of softball, badminton, touch rugby, high jump, gymnastic.
standard 6	Games involve of basketball, volleyball, *sepak takraw*, shot put, hurdles and gymnastic.

Table 2.2 Physical Education Syllabus Guidelines for Secondary School, Ministry of Education, 2002.

STANDARD	GAMES
Remove	Football, table tennis, athletics (sprint event & shot put), artistic gymnastics, rhythmic gymnastics.
Form 1	Football, netball, table tennis, athletics (sprint event & shot put), artistic gymnastics, rhythmic gymnastics, gymnastics education.
Form 2	Handball, badminton, athletics (relay event & javelin), artistic gymnastics, rhythmic gymnastics, gymnastics education.
Form 3	Volleyball, softball, athletics (race & discus throw event), gymnastics, rhythmic gymnastics, gymnastics education.
Form 4	Hockey, tennis, *sepak takraw*, athletic (hurdles event, long jump & triple jump), artistic gymnastics, rhythmic gymnastics, gymnastics education.
Form 5	Basketball, cricket, rugby, athletic (race, high jump & pole vault event), artistic gymnastics, rhythmic gymnastics, gymnastics education.

2.3 Traditional Games as a Form of Physical Activity

Physical activity plays an important role to all individuals regardless of the demographic background and differences in gender. Currently, various public health guidelines have been published on the recommended volume and intensity of physical activity for health to the public as a reference reported by Marcus et al. (2006). Besides that, the American Heart Association, the US Surgeon General, Centers for Disease Control and Prevention (CDC) as well as American College of Sport Medicine had recommended 30 minutes per day of at least moderate-intensity physical activity on most and preferably all, days of the week.

According to Pate et al., 1995; Fletcher et al., 1995 and US Department of Health and Human Services, 1996, similar guidelines have been adopted for children. Based on US Department of Health and Human Services (2000) reported that although other consensus panels have recommended one (Cavill, Biddle & Sallis, 2001); US Department of Health and Human Services and US Department of Agriculture (2000) or more hours (Corbin & Pangrazi, 1999) of physical activity per day for children. Even though there is a debate on time needed to spend in physical activity, US Department of Agriculture has recommended 30 minutes of physical activity per day to prevent chronic disease and at least 60 minutes per day to manage weight. Nasarah & Nasarah (2005) reported that the some of the traditional games that play in Malaysia lasted until all members became tired when the game did not end.

Physical activity recommended by Fairclough & Stratton (2005), children need also to take part in activities that help to develop and maintain their musculoskeletal health, on at least two occasions per week. Activities involve such as weigh bearing that focus on developing muscular strength, endurance, flexibility and bone health.

Games incorporated movement activities representing moderate (3-6 METs) or vigorous (>6 METs) intensity (Ainsworth et al., 2000). Age-appropriate variations of tag games, obstacle courses, pillow polo, traditional sports (soccer, basketball, etc.), jump rope, relays, and potato sack races (as general examples) were used, incorporating gross motor activities such as running, jumping, kicking, throwing, and dodging. The program provided a mean of 29 minutes of PA of moderate to vigorous intensity (HR > 130 beats/min) each session, averaging 2,043 - 3,370 steps per session (Wiersma & Rubin, 2012).

There are many ways that children can do to meet the guidelines. These activities serve as a guide, so encourage children to do any of them, as long as they are age-appropriate. Many of these activities fall under two or three different categories, making it possible for children do each type of activity like vigorous-intensity aerobic, muscle- and bone-strengthening activity on at least 3 days each week. Also, some activities, such as bicycling or basketball, can be done at either a moderate or a vigorous-intensity, depending on children's level of effort. Examples of Moderate- and Vigorous-Intensity Aerobic Physical Activities and Muscle- and Bone-Strengthening Activities for Children as table 2.3 below:

Table 2.3 Moderate- and Vigorous-Intensity Aerobic Physical Activities and Muscle- and Bone-Strengthening Activities for Children (Coded from Centers for Disease Control and Prevention, 2011).

Type of Physical Activity	Age Group Children
Moderate–intensity aerobic	• Active recreation, such as hiking, skateboarding, rollerblading • Bicycle riding • Brisk walking
Vigorous–intensity aerobic	• Active games involving running and chasing, such as tag • Bicycle riding • Jumping rope • Martial arts, such as karate • Running • Sports such as soccer, ice or field hockey, basketball, swimming, tennis • Cross-country skiing
Muscle-strengthening	• Games such as tug-of-war • Modified push-ups (with knees on the floor) • Resistance exercises using body weight or resistance bands • Rope or tree climbing • Sit-ups (curl-ups or crunches) • Swinging on playground equipment/bars
Bone-strengthening	• Games such as hopscotch • Hopping, skipping, jumping • Jumping rope • Running • Sports such as gymnastics, basketball, volleyball, tennis

Note: Some activities, such as bicycling, can be moderate or vigorous intensity, depending upon level of effort.

Casey, (2010) reported that Children who are playing traditional game use their own language, rules and values and play helps them to develop their own identities. Besides that, playing traditional games can be an important way of creating bonds with other children (Dunn et al., 2004). Another study by Mackett and Paskins (2008) found that free play like traditional games can involve children in high levels of physical activity. Playing traditional game would allow children to gain the higher physical activity levels were associated with longer playtimes (Ridgers et al., 2007; Parrish et al., 2009).

2.4 Traditional Games as a Form of Play

Play can be defined and understood in a number of different ways. Several studies focus on the form of play which is commonly referred to as 'free' or 'unstructured' play. This construction of play is defined by the playwork field as "a process that is freely chosen, personally directed and intrinsically motivated" (Play Wales, 2005). Play is fundamental to children's happiness and well-being, usually every individual spend their childhood by playing regardless of whatever type of game as long as it gives joy and entertainment to fill the spare time. It is a way for children to vent and get to make friends and interact with each other. Thus, characteristic poses by traditional game is parallel to the concept of the active play and it may use as tool for the children to engage with the activities.

There is strong evidence that playing is central to children's physical, psychological and social well-being. Whilst playing, children can experience real emotions, create their own uncertainty, experience the unexpected, respond to new situations and adapt to a wide variety of situations. Play enables children to form friendships and attachments to adults and to places, allowing for the development of familiarity and intimacy with both. It can provide opportunities for independent learning and building confidence, resilience, self-esteem and self-efficacy (Lester and Russell, 2008; NICE, 2010; Coalter and Taylor, 2001). Gardner and Ward (2000) reported that whilst play can bring families closer together, strengthening parent–child relationships. Another study by Armitage (2004) found that playing away from adult supervision is equally important, allowing

children to acquire independent mobility explore the world on their own terms and create their own identities.

The importance of play, particularly outdoor play, for increasing levels of physical activity, alongside other positive influences on a child's well-being, such as opportunities to understand and respect the natural world. However, children seem to be getting fewer opportunities to play. Elkind (2008) reported that a combination of poor play environments, busy school schedules and an increase in structured activities has meant that this beneficial and basic children's right has become sidelined, often perceived as an 'unaffordable luxury'. In addition, play is a basic right for all children and is worthwhile for the enjoyment it brings to children and their families in the moment. If we view play primarily as a means to achieve long-term physical, psychological and social benefits we are in danger of losing sight of the essence of play as intrinsically motivated behaviour, something children do in their own time, following their own ideas, in their own way, for their own reasons (Cole-Hamilton, 2011).

2.5 Impact Level of Intensity to Children Health Status

The term "physical activity" can be describes as many forms of movement, which including activities that involve the large skeletal muscles in our body. Physical activity is regulated by three which are duration, intensity and frequency. Here will be discussing more on intensity level. Generally, the level of intensity can be express as light, moderate and vigorous intensity that requires more oxygen than sedentary behavior and thus promotes cardiovascular fitness and other health benefits.

Methods of identifying intensity level are vary which include of energy expenditure (EE), Metabolic Equivalent of Task (METs), activity count per minute (CPM) and heart rate (HR). Accelerometer is commonly used in the research settings today. Accelerometers are capable of measuring and storing measurements of the intensity, frequency, pattern, and duration of activity. Accelerometer data are recorded by the activity monitor and then analyzed on the computer by using particular software. There will be cut point sets to determine the intensity level for children as well as adult. These cut point were derived as part of past published research aimed at quantifying activity level using ActiGraph products. All cut point sets are scaled to 60s epochs. Even if the cut point set was originally defined for sub-60s epoch files, the cut points were scaled in ActiLife as Count per Minute (CPM). Examples of cut point set such as Freedson Children (2005), cut point for sedentary 0-149 CPM, light 150-499 CPM, moderate 500-3999 CPM, vigorous 4000-7599 CPM and very vigorous 7600 and above CPM. These cut points are based on the MET formula. MET = 2.757 + (0.0015*CPM) -

(0.08957*age) - (0.000038*CPM*age) with assumed MET thresholds of 3, 6, and 9 METs (which produce cut point boundaries of 500, 4000, and 7600 CPM respectively). Puyau et al. (2002) classify as sedentary 0-799 CPM, light 800-3199 CPM, moderate 3200-8199 CPM and vigorous 8200 and above CPM. Besides, Mattocks et al. (2007) classify the cut point as sedentary 0-100 CPM, light 101-3580 CPM, moderate 3581-6129 CPM and vigorous 6130 and above CPM.

Impact level of intensity may influence in children's health status. Ruiz et al. (2006) reported that physical activity of vigorous intensity may have a greater effect on preventing obesity in children than does physical activity of lower intensity. Another study by Abbott et al. (2004) found that children who were in top tertiles for both vigorous activity and hard activity had significantly lower body fat percentage than those in the middle and lowest tertiles. Besides that, study done by Janz et al. (2002) shows that low level of vigorous physical activity and high levels of television viewing are associated with fatness in young children during the adiposity rebound period.

In cardiovascular fitness, Smith (2010) reported that researchers and professional organizations recommend that young children spend several hours in active play each day and that at least an hour of this time be spent in moderate to vigorous physical activity (MVPA). This activity involves sustained movement and an increase in heart rate. Children engaging in more than 40 minutes of vigorous physical activity per day had higher cardiovascular fitness (CVF) than those who engaged in less than 18 minutes of vigorous physical activity per day (Ruiz et al.,

2006). Gutin et al. (2002) reported that the CVF fitness in obese adolescent was significantly improved by high intensity physical training.

Bone defined by Farlex Dictionary (2013) is hard, rigid form of connective tissue constituting most of the skeleton of vertebrates, composed chiefly of calcium salt. Bones are the framework for child's growing body. Thus, the intensity level of physical activity may have an impact on children's bone health and can prevent osteoporosis to occur in later life. In a study in Denmark, Heidemann et al. (2013) reported that there was a positive relationship between the log odds of moderate to high-level physical activity versus low level activity and Bone Mineral Content (BMC), Bone Mineral Density (BMD) and Bone Area (BA). Children with an increased proportion of time in moderate to high level activity as opposed to sedentary and low-level activity achieved positive effects on BMC, BMD and BA. Another study reported by Gunter et al. (2012) found that physical activity undertaken in childhood, particular activities, which apply large forces quickly convey optimal benefit to bone mass, size and structure. Hind & Burrows (2007) found that although weight-bearing exercise appears to enhance bone mineral accrual in children, particularly during early puberty; it remains unclear as to what constitutes the optimal exercise programme. Vigorous day-to-day physical is associated with indices of BMC and geometry in adolescents, whereas light or moderate physical activity has no detectable association. Therefore, promoting physical activity in childhood is unlikely to benefit skeletal development unless high-impact activities are also increased (Sayers et al., 2011)

2.6 Steps Count in Children

There are also studies that used cut point of daily steps count to provide the estimated recommendation for the moderate to vigorous type of activity in children. Evidence suggests that a total daily physical activity volume of 10000 – 14000 steps/day is associated with 60 – 100 minutes of MVPA in preschool children which is approximately the age of 4 to 6 years old (Timmons et al., 2007). Besides, For preschool children to obtain 60 minutes of moderate to vigorous physical activity published data have benchmarked 10000 -14000 steps daily (Locke et al., 2011). Other pervious study also has been reported that 60 minutes of MVPA in primary/elementary school children appears to be achieved on average within a total volume of 13000 to 15000 steps per day in boys and 11000 to 117000 steps per day in girls (Locke et al., 2011). Analysis of accelerometer step and activity count data collected concurrently in a nationally representative U.S. sample demonstrated that for those 6–11 years old who attained $\geqslant$ 60 minutes/day of MVPA on average, the optimal steps/day thresholds ranged from $\geqslant$ 6,500 to $\geqslant$ 10,500 steps/day (censored) and from $\geqslant$ 8,500 to $\geqslant$ 13,500 steps/day (uncensored), depending on the activity count cut point used to define moderate intensity. For adolescents (i.e., 12–17 years of age) who attained $\geqslant$60 minutes/day of MVPA on average, optimal steps/day thresholds ranged from $\geqslant$7,500 to 11,500 steps/day (censored) and from $\geqslant$ 10,500 to 14,000 steps/day (uncensored), depending on the activity count cut point that defined moderate intensity (Telford et al., 2013).

Colley, Janssen and Tremblay recently recommended 12,000 steps/day based on objectively monitored data collected from Canadian children using an Actical accelerometer and unadjusted to a pedometer-based scale (Telford et al., 2013).

In contrast, Beets et al, (2009) reported that a minimum of 30 minutes of moderate to vigorous physical activity (MVPA) in children with suggested cut point's equivalent of threshold 4600 steps count. This previous study provides a policy that requires afterschool program which known as ASPs, 3 PM to 6 PM.

2.7 Axes Orientation in Accelerometer

One of the functions of Accelerometer GTX3+ is able to detect, record and store 3 different axes which are Axis 1, Axis 2 and Axis 3 during the activity movement. Each of the axis expressed different angle of movement in the form of total count or sum of counts for axis during scored time (ActiLife 6 User's Manual, 2012). Axis 1 represents movement of the vertical axis while Axis 2 represents movement in a horizontal axis and for the Axis 3 it represents movement of the lateral axis. Rowlands et al. (2006) reported that the three dimension of assessment offered by triaxial accelerometry (x = vertical, y = anterioposterior and z = mediolateral). In other study, accelerometers measure acceleration in one to three orthogonal planes which are vertical, mediolateral and anteroposterior (Rowlands and Eston (2007). Figure 2.1 shows different orientation of the 3 axis as below:

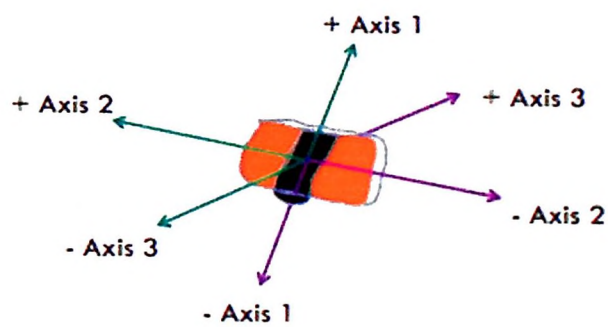

Figure 2.1 Different orientation of the 3 axis.