Assessment of Motor Proficiency Levels in Children in Saudi Arabia

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Assessment of Motor Proficiency Levels in Children in Saudi Arabia

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Submitted in fulfilment of the requirements
of the degree of Doctor of Education

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Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

(Signed)____________________________________

DEDICATION

This work is dedicated

With love

To my father whom I wish were alive and my mother and my brother, Sami

And

To my wife, Safiah, for her patience and support throughout all these years

And

To my children, Amr, Sulafah, and Sfanah

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I am really indebted to all my brothers and sisters for all kinds of support throughout my entire life.

Abstract

Assessing children's motor development is important for determining their developmental levels and needs in order to promote their motor skills. Differing environmental and cultural backgrounds can impact upon children's motor development, and thus need to be taken into account in motor assessments. This study aimed to provide a comprehensive overview of the motor development levels of children in Saudi Arabia using the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2). The investigation included both genders (males and females) at three school grade levels (1st, 3rd, 5th) from two residential areas (urban and rural). Moreover, the study investigated the effects of gender, grade, and residence on the performance of a sample of 188 Saudi children. These results were compared to BOT-2 norms from a United States sample. Furthermore, this study examined the possibility of using BOT-2 in Saudi society (objectivity, reliability, and validity).

A quantitative research paradigm was used in the study to achieve the study's objectives. One-sample-t-test was utilised to identify any significant differences between the study groups and BOT-2 norms in the subtest point scores. A three-way analysis of variance (ANOVA) was performed to determine any effect of the independent variables (gender, grade, and residential area) on the dependent variables (motor-area composite scores). Lastly, several statistical methods were used to examine the objectivity, reliability, and validity of using BOT-2 with Saudi children.

Major findings from the study demonstrated aspects of similarities and differences between the performance levels of the Saudi groups and the BOT-2 norms cross subtest point scores, with an exploration of the potential link between such variations and cultural differences between the Saudi groups and those comparing the BOT-2 norms providing insights into differential performance. Additionally, the motor-area composite scores were affected by the study's independent variables (residential area, gender, and grade). In conclusion, the BOT-2 complete form was deemed an appropriate instrument test to assess the motor development levels of Saudi children.

Contents

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Statement of the Problem

The significance of movement is often overlooked because it is such a natural part of human life. Movement, however, is essential for a child's physical activity and social development (Cools, Martelaer, Samaey, & Andries, 2009). Additionally, a child's mastery of fundamental motor skills is an important contribution towards a satisfying engagement with sports or any other physical activities (Bakhtiar, 2014; Gallahue & Donnelly, 2003; Gallahue & Ozmun, 2006; Pang & Fong, 2009). Historically, many educators believed that children inevitably developed motor skills as they matured, but now they recognise that environmental factors play a vital role in motor development (Gallahue & Ozmun, 2006). Therefore, children require encouragement, frequent opportunities to practise, and quality instruction in an ecologically sound environment in order to develop and refine their motor skills (Gallahue & Donnelly, 2003; Magill, 2011; Pang & Fong, 2009).

Cross-cultural research examines the extent to which culture affects a child's motor development (Gabbard, 2012). Although physical education studies indicate that children learn through observation and imitation (Jifri, 2003), numerous studies in motor development have reported significant cross-cultural differences (Chui, Ng, Fong, Lin, & Ng, 2007). The findings from these studies have led Vygotskiĭ and Cole (1978) to conclude that culture has a major role in child development. For example, youth in the United States are most likely to develop motor skills that are used in the sports that are most popular in that country (e.g., throwing, catching, and running). In contrast, youth in Saudi Arabia, and other nations where soccer is the primary sport, develop refined kicking skills (Jifri, 2003). In Asia, children develop superior fine motor skills because they use chopsticks (Chow, Henderson, & Barnett, 2001; Jifri, 2003). Further, culture sometimes restricts women's involvement in physical activities (Smith, 2010), since the cultural traditions of some ethnic groups do not allow females to participate in activities with males (Sleap, 1998).

Thomas (2000) suggested that one of the most common topics in studies of children's motor development is the influence of gender differences. For example, Goodway, Robinson, and Crowe (2010) indicate that males outperform females in motor skills, with the difference being minimal in early childhood but increasing through puberty. Gender differences are also noted with respect to balance abilities, such as walking forward on a balance beam; generally, males are better than females (Habib, 1997). Also, Junaid and Fellowes (2006) showed that there are significant differences between boys and girls in ball skills, for instance, boys performed better at throwing a bean bag into a box and bouncing a ball, while girls performed better on manual dexterity, measured by placing pegs in a peg board. These results support Cech and Martin's (2002) findings that males have a genetic advantage in some motor activities as they develop more muscle mass during puberty.

Gabbard (2012) and Payne and Isaacs (2011) defined a number of purposes for assessments of motor development. For example, assessment instruments help to identify the normal and abnormal in motor development through diagnosis and screening. Some testing protocols have been used to evaluate how programs affect children's motor skills and fitness development. Thus, motor assessment in children is valuable for a range of purposes (Venetsanou, Kambas, Aggeloussis, Fatouros, & Taxildaris, 2009). Moreover, using a reliable assessment tool is critical for both clinicians and researchers to diagnose movement problems and to ascertain the level of skills (Piek, 2006). Furthermore, assessment instruments are of value to motor development specialists, but only when they are valid, reliable, and objective (Gallahue & Ozmun, 2006). For these reasons, the Bruininks-Oseretsky test of motor proficiency (BOTMP, first edition, and BOT-2, second edition) is widely used to assess motor skills in different cultures (Cools et al., 2009; Düger, Bumin, Uyanik, Aki, & Kayihan, 1999; Kennedy, Brown, & Chien, 2012; Wuang, Lin, & Su, 2009).
In Saudi Arabia no motor development instrument is being used to provide comprehensive information on the motor development of children. However, the application of BOT-2 in this country may help to identify important features of motor development of Saudi children. In addition, the application of BOT-2 in Saudi Arabia would contribute to knowledge regarding cross-cultural differences in motor development between Saudi children and children from other countries.

Jifri (2003) provided a solid basis for future research, by confirming the appropriateness of using BOTMP in Saudi society. The current study built upon Jifri's (2003) foundational research in several ways. First, the current research used the new edition of the BOTMP, the BOT-2. This is an important distinction, as the additional subtest items in the BOT-2 are supposed to provide a more accurate assessment of children's motor abilities. Use of the BOT-2 allowed the current study to provide information about whether the revised tool is a suitable test instrument to use for Saudi children. Second, unlike Jifri (2003) research, which included only male participants, the current study collected data from male and female participants. This in in accordance with other studies that have examined the validity of the BOTMP in different societies (i.e., Habib, 1997; Hassan, 1991, 2001; Tabatabainia, 1995;

Venetsanou et al., 2009). Comparison of male and female Saudi participants is important because, unlike their male counterparts, female students do not receive Physical Education lessons in school. Because this study examined the motor proficiency of Saudi girls, findings from this study should make an important contribution to current debates in Saudi Arabia regarding the implementation of physical education classes in girls' schools. This aspect is important, as primary school physical education curriculum has the capacity to help children acquire movement skills and promote their physical activity and fitness (Gallahue & Donnelly, 2003).

Jifri (2003) provided a detailed portrayal of the motor proficiency of urban children in Saudi Arabia. Jifri's findings allow further research to compare urban children with children living in other areas of Saudi Arabia. A significant portion of Saudi Arabia's population live in rural areas, and the difference between Saudi urban and rural lifestyles and environments (Sonbol, Khatib, Metwally, & Abdel-Gawad, 2008) may provide different opportunities for children to engage in physical activities, thereby impacting on their levels of motor proficiency. For example, according to the Department of Physical Education in the Ministry of Education in Taif city (1990-2005), differences between urban and rural children in Taif city are evident in local sports competitions.

Jifri (2003) assessed the motor proficiency of children from five urban sites, representing eastern, western, northern, southern, and central Saudi Arabia. The findings showed that children who live in the southern part of the country had the best motor proficiency level. The majority of the population in southern Saudi Arabia live in small cities and villages, and different residential areas may affect the motor development of children (Pikora et al., 2002; Qndil, 1983). Further, research has shown that children's outdoor play is also related to environmental characteristics (Aarts, de Vries, Van Oers, & Schuit, 2012), with links between the built environment and physical activity (Handy, Boarnet, Ewing, & Killingsworth, 2002; Sallis, 2009). Wrotniak, Epstein, Dorn, Jones, and Kondilis (2006) suggested that the level of motor proficiency in children is positively associated with their physical activity. Accordingly, environmental factors, including educational experiences, cultural variations, and the characteristics of residential areas, may influence the motor proficiency of Saudi children.

1.2 Location and Education in Saudi Arabia

This study was conducted in rural and urban areas in and around Taif in Saudi Arabia. Saudi Arabia is the largest country in the Arabian Peninsula. It is located between the Red

Sea in the West and the Arabian Gulf in the East. Its land area is approximately 2,240,000 km^2 and is bordered to the north by Kuwait, Iraq, and Jordan, to the east by Qatar, Bahrain, the United Arab Emirates, and Oman, and to the south by Yemen (Al-Ghanem, 1999). Taif city is located in the south-west of Saudi Arabia as shown in Figure 1.

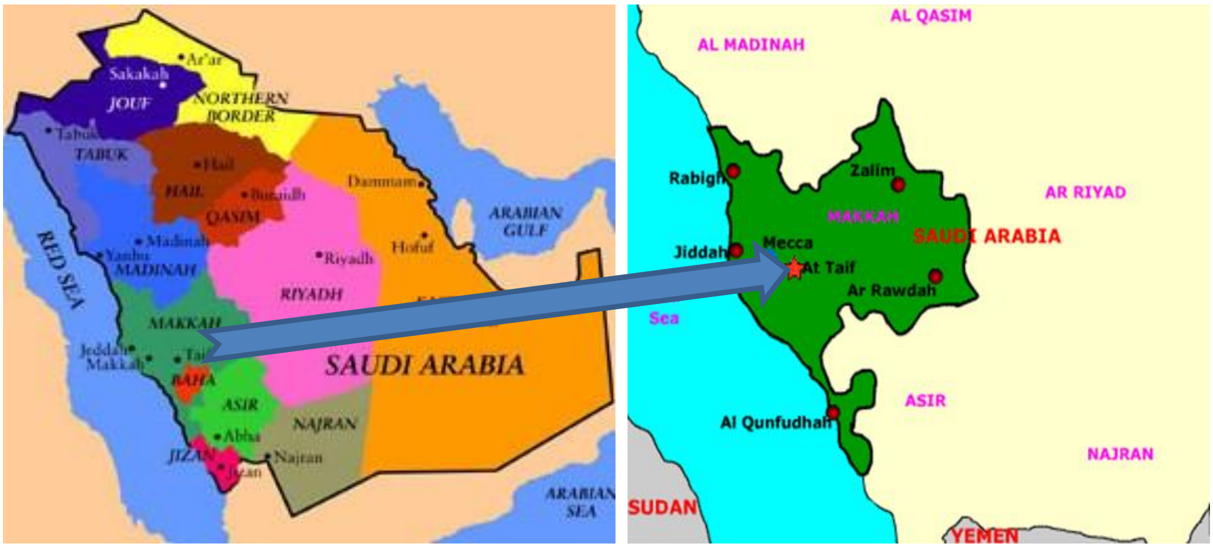

Figure 1. Study location. Left: the Saudi map divided by region. Right: location of Taif city.

In Saudi Arabia, there is clear contrast between coastal, mountainous and desert geographical areas (Sonbol et al., 2008), leading to a variety of lifestyles among the Saudi people. For example, people who live in rural areas usually work in the agriculture sector, and those who live in urban areas often work in various industries. Urban people usually use sophisticated tools and machines in everyday life (Sonbol et al., 2008). This variation in lifestyle due to geographic locations may also affect children's motor development (Bakhtiar, 2014). Taif Education District supervises schools in both urban and rural areas.

Saudi Arabia is one country that prescribes to the idea that education is the key to the future. As a result, free, high-quality programs are provided for all Saudi citizens at all levels of education. In addition, the education system in Saudi Arabia is guided on Islamic religious law, and, as such, aims to take advantage of human knowledge in light of the values and principles of Islam (Sonbol et al., 2008). The education sector has been one of the most significant drivers of development of the modern Kingdom of Saudi Arabia. In Saudi Arabia, males and females are segregated at all levels of education. Therefore, there are gender differences in the teaching of some school subjects. Physical education (PE) lessons are not provided for Saudi girls.

1.3 Purpose of the Study

The current study examined the potential use of BOT-2 in Saudi society to determine if it is an appropriate tool for use by Physical Education specialists and physical therapists. Because the normative data for the BOT-2 was collected in North America, this study also enabled comparison between the norms for North American and Saudi children. The sample of children who participated in this study was drawn from a single geographical region of Saudi Arabia, and, consequently, the data is not representative of all children living in Saudi Arabia. However, the study is the first to evaluate the motor proficiency of children living in different geographical locations (urban, rural). It is also the first study to investigate the motor development of Saudi girls to determine the possible impact of current education policies, which, to date, has denied them Physical Education lessons. In these ways, this Saudi study fills significant gaps in the motor development literature and enriches our knowledge of cross-cultural differences in children's motor development as measured by the BOT-2.

1.4 Research Questions

This study investigated the suitability of using BOT-2 in Saudi children, and the impact of living in urban and rural areas, on motor proficiency for both genders of Saudi children. To this end, the research addressed three questions:

1. What is the performance level of Saudi children compared to the BOT-2 norms?
2. Are there any differences between the Saudi groups according to gender, grade and residential area? Five areas were assessed:
    a. Fine manual control,
    b. Manual coordination,
    c. Body coordination,
    d. Strength and agility,
    e. Total motor composite.
3. Is BOT-2 appropriate for assessing Saudi children's motor proficiency?

1.5 Terms in BOT-2

The study instrument, BOT-2, contains 53 items grouped into four motor-area composites scores, with each comprising two subtest scores (see Table 1). The motor-area composite scores are summed to yield the total motor composite (motor proficiency). This score represents the individual's overall motor proficiency. A short form of BOT-2, BOT-2 SF, includes 14 items. Table 1 presents BOT-2's motor-area composites and their subtests in two forms (long form and short form).

Table 1
The BOT-2 Motor-Area Composites and Subtests

Motor-area composites	Subtest (long form)	Subtest (short form)
Fine Manual Control	Fine Motor Precision	FMP
	Fine Motor Integration	FMI
Manual Coordination	Manual Dexterity	MD
	Upper-Limb Coordination	ULC
Body Coordination	Bilateral Coordination	BC
	Balance	BAL
Strength and Agility	Running Speed and Agility	RSA
	Strength	STR

The BOT-2 includes norms from American children, allowing the researcher to compare the study sample with the American sample. This research will use BOT-2 norms instead of American norms when compare with Saudi groups.

1.6 Focus of the Study

The focus of the study was on primary schools in Saudi Arabia. Primary-school-aged children were sought for several reasons. First, the motor development and motor control of primary-school-aged children is affected by environmental factors, and, because children of this age have not yet reached puberty, their motor development has not been affected by maturation (Payne & Isaacs, 2011; Zelaznik, 1996). Second, ages 6 – 12 years involve a fundamental motor skills (FMS) period, which provides important information relating to children's early motor development. For example, there is evidence that, when they start school, some young children are delayed in their FMS (Gallahue & Ozmun, 2006; Pang & Fong, 2009). Therefore, assessing motor proficiency at this age helps to identify delays or impairment in children's motor development. Also, evaluation of motor proficiency in children aged 6 – 12 years provides evidence for speculating about future motor development. Importantly, if the children feel inadequate with regard to their FMS, they may be hesitant to participate in various leisure activities in adulthood (Gallahue & Ozmun, 2006;

Pangrazi & Beighle, 2013). Finally, due to difficulties in obtaining official approval to assess females from middle and high schools, due to culture issues, the focus on primary school aged children, facilitated the male female comparisons possible in this study.

1.7 Significance of the Study

As noted previously, this study was the first to employ BOT-2 in any Arab country. Therefore, the study aimed to provide evidence of the appropriateness of using the BOT-2 to assess the motor development of children in Arab-speaking countries. As the first study to measure motor proficiency among Saudi females, it also aimed to inform policies that currently exclude Saudi girls from participating in Physical Education in schools. Moreover, the results should help determine the extent to which Saudi females' motor proficiency will benefit from participation in Physical Education classes. Furthermore, the results should provide fresh insights into Saudi children's strengths and weakness in motor areas in comparison to North American children, from whom the BOT-2 test norms were derived. In this way, the findings will enrich the understanding of cross-cultural differences in children's motor development. Lastly, the study should provide greater understanding about the extent to which the environment (urban or rural) affects motor proficiency in Saudi children.

1.8 Thesis Structure

This thesis is presented using a conventional 5-chapter structure. Following this introductory chapter, Chapter 2 presents the literature review in five parts. Part 1 presents theories and principles of motor development**.** Part 2 reviews biological factors and environmental variables that are related to the current study. Part 3 provides an overview of assessment of fundamental motor skills. Part 4 provides information about the study tool (BOT-2). Finally, Part 5 reports on cross-cultural differences in motor development.

Chapter 3 outlines the method used to conduct the study. It includes sections overviewing the pilot study and the reliability of the tool used in the main study, the study's cross-sectional design, the study instrument and testing procedures, and procedures used for analysing the data. Chapter 4 presents the research findings relating to the performance level of Saudi children compared to the BOT-2 norms, the differences between the Saudi groups, and the appropriate of using BOT-2 in Saudi society. The final chapter (Chapter 5) discusses the key findings, describes the study's contributions to research and knowledge regarding motor development, identifies the limitations of this study, highlights the implications, and indicates directions for further research.

2 LITERATURE REVIEW

The aim of this chapter is to review the literature on motor development that provides the research base for the study, and to identify the significant gap in the literature that this study addressed. Chapter 1 provided an overview of the study and argued its significance. This chapter positions the study by locating it within the relevant literature on motor development and motor assessment. The chapter begins by overviewing frameworks and theories of motor development including relevant motor development principles underpinning the BOT-2. Part 1 presents a brief review of principles of motor development informing this study. The overview of relevant literature will be guided by Gallahue's (1982) model of motor development later revised by Gallahue and Ozmun (2006). Part 2 will use Gallahue and Ozmun's model as a guiding framework for discussing biological factors and environmental variables that have been found to influence motor development and that are relevant to this study. Part 3 extends on the previous section to overview the development and assessment of motor skills in children. Part 4 turns to the examination of BOT-2 including its development and issues related to its validity and reliability. Finally, Part 5 will overview previous studies that have used the BOTMP or BOT-2 in cross-cultural comparisons of children's motor development.

2.1 Part 1

2.1.1 Theories and principles of motor development

The primary aim of this section is to locate this study by reviewing frameworks and models that have been constructed for theorising motor development, including the multiple factors that influence it. Motor development has been defined as "change in motor behaviour resulting from the interaction of biological processes and the environment" (Gabbard, 2012, p. 4). Likewise, Clark (2007) emphasised that change in motor behaviour can be attributed to an individual's biological constraints and various environmental factors. These principles point to the idea that observable motor behaviour across the lifespan is the outcome of both the biological status of the organism at a given point in time, and environmental influences and experiences (Gabbard, 2012). The principles of motor development are synthesised in the work of various authors, including Gabbard (2012), Gallahue and Ozmun (2006), Payne and Isaacs (2011), and Thomas and Thomas (2008).

The authors listed above all point to the idea that motor development is both continuous and cumulative across the lifespan. For instance, ability to coordinate movement as locomotion and the manipulation of objects result from the contribution of multiple biological systems including hormonal, neural, and musculo-skeletal systems (Gabbard, 2012). Maturation influences human movement. Two processes in growth and movement maturation occur in different directions. Cephalocaudal development refers to the development of the human body from the head to the feet. For example, when children learn to walk, they can move and control their hip joints but they do not have a similar ability at the knee or ankle (early motor control starts with head control against gravity). The other direction in which development occurs is proximodistal: Development starts from the body's centre and progresses to the periphery of the body. For example, children can move and control their shoulder muscles before they control or move their wrist and fingers (Payne & Isaacs, 2011). However, although early motor development is broadly progressive, deterioration of motor performance is inevitable as a person ages (Gabbard, 2012; Payne & Isaacs, 2011).

Various frameworks of motor development tend to characterise human motor development as a process that involves several distinct stages, each with its own unique characteristics (Gabbard, 2012; Gallahue & Ozmun, 2006; Payne & Isaacs, 2011). According to Gallahue and Ozmun (2006), there are four main stages of motor development: reflexive movement phase, rudimentary motor phase, fundamental movement phase, and specialised movement phase. For example, the stage of fundamental motor skills occurs between the ages of 2 and 7 years, and involves a basic movement pattern of motor skills (Gabbard, 2012; Gallahue & Ozmun, 2006; Payne & Isaacs, 2011). Also, each phase of motor development forms the basis of the next phase. For example, fundamental motor skills are refined or combined with other movement skills during childhood to allow complex motor skills such as those used in sports (Gallahue & Ozmun, 2006).

Although motor development theories recognise general timelines for developmental stages, another principle acknowledges that each individual's pattern of motor development is unique. Children of the same age may differ in many development aspects such as height, strength, and motor skills, as heredity and environment play major roles in their development (Gabbard, 2012). Theorists also point to various similarities and differences between males and females in motor development. Gesell's early research (1928, 1954) in motor development distinguished between the motor abilities of boys and girls (Gallahue & Ozmun, 2006). For example, ten-year-old girls appear to have better balance than their male counterparts (Sandstrom, 1966). However, Thomas and Thomas (2008) noted that despite small performance differences between boys and girls, children generally show similar motor development trajectories.

Finally, most general frameworks categorise movement into two broad types. First, gross motor skills, such as walking, running, and skipping, are controlled and related by large muscles or muscle groups. Second, fine motor skills, such as those involved in drawing, sewing, and typing, are controlled by small muscles or muscle groups (Gallahue & Ozmun, 2006; Payne & Isaacs, 2011).

The design of the BOT-2 is underpinned by the principles described above. First, BOT-2 is consistent with motor development theories in terms of variations in test scores between age groups and genders (Kennedy et al., 2012). Based on Bruininks and Bruininks (2005), the long form of BOT-2 provides sex-specific norms due to the differences in performance between genders in some subtests. For example, females scored higher than males in fine motor precision. In addition, BOT-2 provides different norms for different ages. Second, BOT-2 classifies skills as either gross motor skills or fine motor skills. Finally, BOT-2 classifies movement according to the muscle groups and limbs involved. For example, the fine manual control composite tests the coordination of the hand and finger muscles used in writing and drawing. Thus, "the BOT-2 provides a comprehensive assessment of motor skills" (Bruininks & Bruininks, 2005, p. 8).

2.1.2 Models of motor development

Reviewing the development of theories of motor development is important for locating the focus of the current study. Contemporary theories of motor development have emerged based on investigations in the field of motor development over the past 100 years (Haywood, Roberton, & Getchell, 2012). Models have an important influence on the motor development field due to the vital role they play in helping investigators crystallise their thinking (Haywood et al., 2012).

Gabbard (2012) identifies four perspectives on motor development. These perspectives focus on, respectively, maturation, environmental systems, biological systems, and environmental/biological systems. Each view seeks to describe different patterns of motor behaviour and explain why those behaviours occur (Gabbard, 2012).

Several brief histories of motor development have been published over the years, such as those by Clark and Whitall (1989), Payne and Isaacs (2011), Gallahue and Ozmun (2006), Thelen (1995), and Thomas (2006). The study of motor development seems to have begun circa 1920–1930 by physicians who were interested in the developmental progress of infants (Payne & Isaacs, 2011). The study of maturation was the main focus from 1928 to 1946, with experimental and theoretical studies taking place in motor development (Clark & Whitall, 1989; Payne & Isaacs, 2011). Motor development research since World War II has clearly focused on understanding motor development over cognitive development (Clark & Whitall, 1989). During the 1960s, physical educators such as Espenschade, Glassow, and Rarick researched motor skills in school-aged children, focusing on the outcomes of motor development rather than the process (Clark & Whitall, 1989; Payne & Isaacs, 2011; Thomas, 2006). Since 1970, researchers have studied the process of development according to how children learn and control motor skills (Clark & Whitall, 1989; Thomas, 2006). The popular theory among developmentalists in this period has been dynamic systems, which reflects an integration of other theories and research (Cook & Cook, 2009; Gallahue & Ozmun, 2006). Dynamic systems theory attempts to address questions of movement control, coordination, and the process of development (Clark & Whitall, 1989; Gallahue & Ozmun, 2006).

Beckett and Taylor (2010) suggested that there are many different factors that contribute to unique developmental trajectories of individuals, including a range of biological and social factors. In general, motor development models historically have moved from a focus on either biological factors or environmental factors towards an understanding of motor development as a complex interaction between these sets of factors.

The current study aimed to investigate levels of motor proficiency of Saudi Arabian male and female children in different age groups. It also aimed to investigate the impact of living in urban or rural areas in Saudi Arabia on the relative motor proficiency of boys and girls. As such, this study was informed by a model of motor development that incorporated both biological and environment factors to explain children's motor development. The model of motor development proposed by Gallahue and Ozmun (2006) was chosen as a general framework for this study for several reasons. First, this model describes typical motor development patterns by age and gender. Second, the model accounts for both biological and environmental factors that impact on motor development. Third, Gallahue and Ozmun's model (2006) allows the researcher freedom to consider other factors, such as place of residence and educational experiences.

2.1.3 Gallahue and Ozmun's model (2006)

Generally, Gallahue and Ozmun's model (2006) is based on both descriptive and explanatory dimensions. For example, motor development study should begin from an understanding of the typical pattern of motor development exhibited by children at particular ages and the process that underpins these patterns (Gallahue & Ozmun, 2006). This model describes the characteristics of the study age groups. The summary of the entire model is presented in the next section as it points to motor processes that occur during infancy and early childhood that are critical building blocks for the motor competencies of children in the study age groups.

2.1.3.1 Introduction

Gallahue's (1982) model is divided into four phases of motor development comprising the reflexive, rudimentary, fundamental, and specialised phases as presented in Figure 2. The current information about Gallahue's model is derived from Gallahue and Ozmun (2006).

Reflexive movement phase (in utero to 1 year old). There are two reflexive movement behaviours that characterise this stage, *primitive reflexes* and *postural reflexes*:

- Primitive reflexes are automatic stimulus-response behaviours that are categorised according to their functions, including *information-gathering*, *nourishment-seeking*, and *protective responses*. The child would be unable to obtain nourishment of any kind without actions such as rooting and sucking reflexes.
- Postural reflexes are the second step of involuntary movements. These reflexes include reactions that are critical for upright balance and locomotion, such as body righting and head righting. For example, stepping reflexes are critical for walking behaviour.

Rudimentary movement phase (birth to 2 years). This stage incudes the first forms of voluntary movement. There are three types of movement in this phase:

- *Stability* is comprised of those movement skills that work "against the force of gravity to achieve and maintain an upright posture" (p. 142). Stability involves control of the head, neck, and trunk. Examples of stability movement skills are sitting and standing.
- *Locomotion* is those motor skills that allow an infant to move in order to explore his or her environment, such as crawling, creeping, and an upright gait.
- *Manipulation* includes the movement skills that allow an infant to make contact with objects through actions such as reaching, grasping, and releasing.

These types of skills do not develop independently; a child will not be able to move until the stability abilities are mastered. Also, the major factors that affect motor ability in this phase are the child's maturation and experiences. For example, the maturational process contribute to the rapidity and extent of development motor skills and control during this phase.

Fundamental movement phase (2 to 7 years). Children in this phase develop fundamental motor skills that are essential for a physically active lifestyle and for allowing children to interact with and explore their environment (Cools et al., 2009; Hardy, King, Farrell, Macniven, & Howlett, 2010; Siahkohian, Mahmoodi, & Salehi, 2011). These patterns are observed across cultures and most children as they begin to explore their movement capabilities. This phase, according to Gallahue and Ozmun (2006), is characterised by three types of basic skills patterns:

- Fundamental stability movements, such as rolling, dodging, one-foot balance, and beam-walking, allow individuals to maintain their relationship to the force of gravity.
- Fundamental locomotion movements involve the "projection of the body into external space by altering its location relative to fixed points on the surface" (p. 198). These skills include walking, running, jumping, hopping, galloping, and skipping.
- Fundamental manipulative movements include gross motor skills relative to an individual's relationship to objects, and are characterised by giving force to objects and receiving force from them. These skills are either propulsive, such as throwing and kicking, or absorptive, such as catching and trapping.

Fundamental motor patterns generally develop through three broadly defined stages: (1) the *initial stage*, which includes the primary patterns for a child's motor development; movement in this stage is characterised by poor rhythm and coordination; (2) the *elementary stage*, which involves greater control with better rhythmical coordination of fundamental movements; and (3) the *mature stage*, in which the child can perform fundamental motor skills with great success in terms of coordination and control. This stage may be attained by the child as early as age 5 or 6. However, this is dependent upon the complexity of the skill and sufficient practice for achieving proficiency.

Specialised movement phase (7 to 14 years). In this phase the child begins to apply fundamental motor skills he/she has mastered to sports skills, such as hopping and jumping for the triple jump in a track competition, and throwing actions adapted for baseball and water polo. Gallahue and Ozmun defined three stages of motor skill development: (1) the *transitional stage*, in which children combine fundamental movements and apply them to sports activities; (2) the *application stage*, in which the child begins to increase his or her cognitive sophistication and gains broadened experience through participation in a variety of movement tasks so as to apply them to specific types of sports; and (3) the *lifelong utilisation stage*, during which the individual continues to apply special skills throughout life in daily life or in sports-related activities. For example, an individual may progress from activity participation to professional levels of sports.

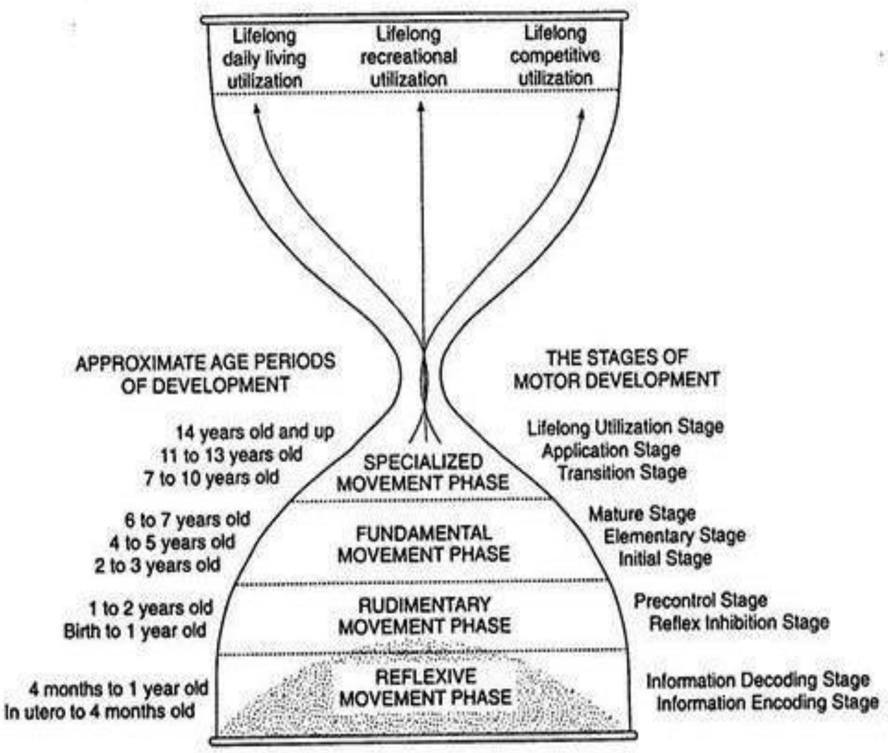

Figure 2. Gallahue and Ozmun's (2006, p. 49) model.

The current study focused on children aged 6 – 13 years. According to Gallahue and Ozmun's (2006) model, this age range includes two phases of motor development: the fundamental movement phase and the specialised phase. Most children in this age range are expected to have established fundamental motor skills such as running, jumping, hopping, skipping, throwing, catching, and kicking, and will move into the specialised movement phase where these skills will be applied to culturally specific games and sports. Motor skills in the specialised phase are strongly impacted by opportunities for practise, encouragement, and the ecological context of the environment (Gallahue & Ozmun, 2006).

Table 2 summarises the important characteristics of the age range examined in the current study, according to Gallahue and Ozmun's (2006) model. The table presents (a) features of motor development, (b) factors affecting motor development, and (c) gender differences.

Table 2

Stages of Motor Development Between 6 and 13 Years (Gallahue & Ozmun, 2006)

Developmental Stage	Features of Motor Development	Factors Affecting	Gender Differences
Mature (6 – 7 years old)	Fundamental motor skills is characterised by mechanical, coordinated, and controlled performances. Some skills are developed somewhat later such as catching, striking, and volleying. These skills require visual tracking and intercepting moving objects.	Some children achieve fundamental motor skills due to maturity, but the vast majority of children require opportunities for practise to move to the next phase.	Girls are better than boys at balance until age 8; abilities are similar between genders thereafter. From age 6 boys are superior in eye-hand and eye-foot coordination. In running speed boys and girls are similar until age 6 or 7; thereafter, boys are faster at all ages. Boys' and girls' agility improves; girls are stable at age 13 while boys continue to improve. In activities requiring strength, such as long jump, and distance throwing, boys are better than girls at all ages. Strength increases in boys from 7 – 17 years, but stops in girls at approximately age 15. Boys slightly outperform girls in muscular endurance but girls are better at approximately age 10 – 11. Some research suggests that girls are larger and stronger on average than boys because of their earlier entry into puberty.
Transitional (7 – 10 years old)	Fundamental motor skills become more accurate and controlled. Children combine a variety of movement patterns, allowing their movement abilities to expand.	Educational experiences play an important role in increasing children's motor control.	
Application (11 – 13 years old)	Children increase their cognitive sophistication and broaden their experience in motor skills if they apply their skills in elaborate games requiring coordination and agility.	Individual differences and environmental factors either enhance or inhibit motor skills development.	

2.1.4 Summary

The literature reviewed thus far indicates that BOT-2 long form is consistent with the general principles of human motor development. In addition, BOT-2 long form provides an exhaustive index of motor proficiency (Bruininks & Bruininks, 2005; Ruel et al., 2012). Gallahue and Ozmun's (2006) model is an appropriate theoretical model of motor development which provides both descriptive and explanatory information. According to this model, culture, society, and schooling may interact to affect child development (Cook & Cook, 2009). Although Gallahue and Ozmun's model describes patterns of motor development that are observed in most normally developing children and across most cultures, these authors suggest that a more comprehensive and nuanced understanding of motor development needs to take account of factors that influence those general patterns, including a range of hereditary and environmental factors. Specifically, it is suggested that to gain a more comprehensive understanding of the factors that influence the process of development, hereditary and environmental factors need to be added to this model. The following sections report on research that investigates the factors that impact on individuals' motor development and performance.

The previous sections also considered the fact that the BOT-2 was normed based on the motor performance of children from North America. One might expect that children in Saudi Arabia will score differently to North American children, as a result of differences in the movement environment, policies, and other cultural factors. The following section will focus on these factors.

Before discussing these factors, it is important to note that the above model proposes that there are general observable principles and patterns of motor development that are characteristic of development of most children. However, research has pointed to factors that explain variations in the patterns of motor development of population sub-groups and individuals.

2.2 Part 2

The following sections review previous research on the factors that influence motor development, including environmental variables such as educational experience and physical setting (i.e., urban or rural), and age and gender (e.g. Bakhtiar, 2014; Chui et al., 2007; Ericsson et al., 2012; Josman, Abdallah, & Engel-Yeger, 2006). Saudi Arabia is a diverse country in terms of its geography and socio-demographic factors. Therefore, studies that have investigated environmental influences on motor development are particularly significant for explaining potential variations of motor abilities between populations of Saudi children. These factors will be examined in this section. Also, the following section will include a brief overview of the diverse geography of Saudi Arabia and the context of its education system.

2.2.1 Age and gender influences

Many studies have focused on the differences between males and females in areas such as verbal ability, visual/spatial ability, mathematical reasoning, and activity levels (Dorfberger, Adi-Japha, & Karni, 2009; Shaffer, 2009). In middle childhood and adolescence (6 – 18 years), motor performance improves with age, and the improvement in several performance tasks is influenced by gender (Malina, Bouchard, & Bar-Or, 2004). According to Blakemore, Berenbaum, and Liben (2009) and Zosuls, Miller, Ruble, Martin, and Fabes

(2011), factors that have been found to influence gender-specific development relate to biology (nature) and socialisation (nurture). Gender differences in motor development have been documented in both Eastern and Western societies, and may be due to various factors, such as gender differences in skeletal structure and social acceptance (Chui et al., 2007).

For example, Düger et al. (1999) used some items from the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) to evaluate Turkish children aged 4 – 11 years, and found significant gender and age differences in some aspects of motor development. Scores on items measuring gross motor skills, such as running speed and agility, and standing broad jump, were higher in the older children, and it was suggested that this difference was due to differences in muscle growth. The growth of bones and muscles takes place from prenatal development until adolescence, but skeletal development occurs earlier in girls than in boys (Blakemore et al., 2009). However, boys performed better than girls on a fine motor task requiring speed, whereas girls were better at cutting out a circle using a preferred hand. Although both test items evaluated fine motor skills, boys performed better than girls on the test item that measured speed. Blakemore et al. (2009) suggested that these differences may be due to sociocultural influences, such as perceptions of appropriate behaviour for each sex, which encourage females to be more skilled at fine motor tasks than males.

Van Beurden, Zask, Barnett, and Dietrich (2002) assessed several fundamental motor skills in primary school children in Australia and found that boys performed overhand throwing skills better than girls, but girls were better in hopping and static balance skills. The investigators attributed these differences to the social environment and to physical education programs. Generally, boys tend to achieve proficiency in all the throwing patterns (overarm, sidearm, and underhand) earlier than girls (Gabbard, 2012). Also, Lippa (2005), Loovis and Butterfield (1993), and Payne and Isaacs (2011) found that boys' performance was better than girls' in throwing skills in general at all ages. However, according to Gesell's model, girls from 7 – 10 years tend be better than boys in balance and skipping skills (Sandstrom, 1966). Females are better than males at hopping, which requires balance and leg strength (Gabbard, 2012).

Chui et al. (2007) used the BOTMP to assess the motor proficiency of children aged from 6 – 10 years in Hong Kong. They found a significant gender effect in the majority of subtest scores. Boys scored more highly than girls in upper limb coordination, and on response speed subtest. On the other hand, girls demonstrated better visual-motor control than boys. These results are consistent with the results of the previous studies described above. For example, the upper limb coordination subtest includes catching and throwing a ball and evaluates both fine and gross motor skills (Bruininks, 1978). According to Chui et al. (2007), gender differences are persistent and are reflected in the standard scores provided for boys and girls in the BOTMP's manual.

Thomas and French (1985) conducted a meta-analysis study to understand gender differences in motor performance in individuals aged 3 – 20 years. They defined 20 tasks such as throwing, catching, running, and jumping in fundamental skills; and balance and fine eye-motor coordination in basic abilities. The results revealed significant gender differences in motor performance on 12 of the 20 tasks. Five tasks showed small differences favouring boys, and these differences increased with age from moderate in early childhood to large in adolescence. These tasks were the dash, sit-ups, long jump, grip strength, and shuttle run. During maturity, girls' improved performance tended to reduce the gender differences on the dash, grip strength, and the shuttle run, but not in long jump and sit-ups tasks. However, once the boys reached puberty, their performance in all their five tasks increased relative to the girls. Five tasks showed no gender difference before puberty, but a gender difference after puberty. For example, no gender differences were found with balance performance until the age of 10 – 13 years, after which the boys performed better than the girls. Finally, a large gender difference was found in throwing distance and throwing velocity; boys scored higher on these items than girls, and the gender difference increased with age. According to Malina et al. (2004), gender differences on the majority of tasks prior to puberty were environmentally induced, while some differences, such as in the throwing tasks, were a result of biological influences and opportunities for practise.

However, many studies have suggested that there is greater similarity than difference between the genders in terms of motor skills performance. For example, boys and girls showed small differences in performance in running, jumping, and swimming skills before puberty (Thomas & Thomas, 2008). In addition, Düger et al. (1999) found significant gender differences on only two of eight test items of motor proficiency: response speed and cutting out a circle with preferred hand. Also, Bakhtiar's (2014) results showed no gender differences in either locomotor or manipulation skills. Such results led Thomas and Thomas to suggest that most motor skills performance differences during primary school age children are greater within than between the genders (Thomas & Thomas, 2008).

In summary, some small differences in motor performance may be related to biological differences. According to motor performance curves in Malina et al. (2004), the gender differences in the majority of tasks begin to be more noticeable after 12 years of age. Clearly, puberty plays an important role in many motor tasks, especially because it increases muscle strength (Thomas & French, 1985). Prior to puberty, though, gender differences are more influenced by social and environmental factors than by biological factors (Garcia, 1994; Hardy et al., 2010; Junaid & Fellowes, 2006). For example, boys have been found to be more likely to engage in activities that require gross motor skills, while girls have been found to perform better than boys in fine motor coordination and flexibility, and these differences increase with age (Cook & Cook, 2009). The next two sections will review the environmental factors that influence children's motor development.

2.2.2 Educational experiences

Several studies suggest that motor proficiency is affected by educational experiences. For example, Al-Thumali (2005) conducted a study using the BOTMP to compare motor proficiency between two groups of Saudi Arabian students in the first grade in Taif city: those who had enrolled in kindergarten and those who had not. A significant difference in fine motor skills was found between the two groups, with those who had enrolled in kindergarten performing better in fine motor skills than those who remained at home. On the other hand, no significant difference in gross motor skills was found between the two groups. Therefore, Al-Thumali (2005) suggested that kindergarten programs were likely to influence fine motor skills because such programs usually include activities that help students to develop their fine motor skills, such as drawing, writing, and playing in the sand. Moreover, Saeki, Clark, and Azen (1985) compared the visual-motor skills of three groups: Japanese, Japanese-American, and American children. They found that both groups of Japanese-descent children performed better than the American group, with the Japan-born children performing the best of all the groups. Saeki et al. suggested that this may have been due to the Japanese cultural emphasis on fine motor skills which is acquired in Japanese pre-school programs. Finally, Chow et al. (2001) found that Hong Kong pre-schoolers performed better than American children in manual dexterity and dynamic balance. However, American children performed better in projection and in the reception of a moving object. The authors postulated that this might have been due to the different early practice during the pre-school period. Such research led Ericsson et al. (2012) to suggest that children who have a low degree of physical activity during physical education lessons do not adequately develop their motor skills. Also, Ericsson et al. (2012) suggested that including a daily Physical Education and Health (PEH) subject for one hour per week that involves motor skills training is a feasible way to improve children's motor skills. In sum, research suggests that physical education lessons, especially in primary schools, play an important role in developing children's motor skills (Department of Education, Victoria, 1996; Gallahue & Donnelly, 2003; Larzelere, 2009). This research is significant for the present study as it suggests that the absence of physical education lessons for Saudi Arabian females in schools may have an important, negative influence on their motor development. The current study will examine this influence.

2.2.3 Geographic location and education in Saudi Arabia

In Saudi Arabia, there is a clear contrast between geographical areas, which include coastal, mountainous, and desert areas (Sonbol et al., 2008), leading to a variety of lifestyles among the Saudi people. Furthermore, these areas within Saudi Arabia are characterised by distinctive socioeconomic conditions. For example, a large proportion of people who live in rural areas work in the agriculture sector, whereas those who live in urban areas often work in various manufacturing and service industries. In addition, urban people usually use sophisticated tools and machines in everyday life (Sonbol et al., 2008). These differences potentially impact on the physical activity levels of children in these areas and thus on aspects of their motor development (Bakhtiar, 2014). The current study was conducted in Taif city which is located in southwest Saudi Arabia. This study was conducted in selected rural and urban schools under the control of Taif Education District.

Taif city is one of cities of Hijaz region that is located in the west of Saudi Arabia (Qthami, 1997). Taif is located on a mountain chain about 1700m above sea level (Hanik, 1999). Also, Taif district includes many rural areas where most people work in the agricultural sector (Qthami, 1997). The rural areas are located around the city around 80 km from the Taif city centre (Hanik, 1999). Generally, rural areas in Taif district are characterised by sizeable distances between homes which may give the population greater opportunities for movement. Therefore, there is a variety of demographics in Taif district (Mongil, 2010).

The nature of life and environment in rural areas in Taif are more conducive for physical activity than urban areas. For example, the students in rural areas usually walk to school or use public transport instead of using cars. Also, it is very common in rural areas that children assist their families before and after school working on the land performing tasks associated with livestock production and agriculture. Thus, rural students typically spend a long time during the day in movement activity. This corresponds with Bakhtiar (2014), who confirmed that rural children have more opportunities for active movement than their peers in cities.

According to Alsalhe (2011), “Saudi Arabia is one of the international countries that believes education can determine the future of the country” (p. 24). As a result, free, high-quality programs are provided for all Saudi citizens at all levels of education. In addition, the education system in Saudi Arabia is based on Islamic religious law and, as such, aims to take advantage of human knowledge in light of the values and principles of Islam (Sonbol et al., 2008). The education sector in Saudi Arabia is considered as one of the key pillars in the development of the modern Kingdom of Saudi Arabia. One of the principles of the Saudi education system is that all females have the right to education (Sonbol et al., 2008). Males and females are segregated at all levels of education. Therefore, there are gender differences in the teaching of some school subjects. For example, currently physical education (PE) lessons are not provided for Saudi females. However, PE is a mandatory subject for Saudi male children. Differential access to PE lessons may increase the probability of differences between genders in motor skills performance.

2.2.4 Urban and rural influences

The influence of geographical location has been a focus of several studies on motor development. For example, Adawi (1991) compared perceptual motor skills among urban and rural children in Egypt using the Purdue Perceptual Motor Survey (Roach and Kephart 1966). In general, the results showed that there were no significant differences between urban and rural children in perceptual motor skills. However, an interaction was found between gender and urban/rural location; specifically, boys were better than girls in balancing items and walking on the beam, and girls were better in hopping and jumping skills. Adawi (1991) asserted that this was related to the similarity within the same gender in the types of play in which they engaged, regardless of whether they were from urban or rural areas. In another study, Qndil (1983) compared physical growth and fundamental skills in children from urban and rural areas in Egypt. In contrast to Adawi’s study, the results showed significant differences between the groups in some motor abilities, with the rural group performing better than the urban group in horizontal jumping. In the light of this, Qndil (1983) suggested the introduction of special programs in urban schools to develop children’s gross motor abilities.

Tsimeas, Tsiokanos, Koutedakis, Tsigilis, and Kellis (2005) conducted a study to examine the differences between urban and rural children in Greece on physical fitness tests, such as sit and reach, basketball throw, handgrip, vertical jump, 40m sprint, agility, 10 × 5m run, and 20m shuttle. The results revealed that boys who lived in urban areas scored significantly higher in the vertical jump test compared to their rural peers. Urban girls performed significantly better in the basketball throw test, whereas rural girls showed significantly higher scores on the handgrip test. However, the researchers found no statistically significant differences between the groups on the other tests in the study. On the basis of these findings the authors concluded that there were no clear significant differences in lifestyles between urban and rural children in Greece and that the national physical education (PE) programs were insufficient to improve physical fitness.

A relationship between motor proficiency level and physical activity was confirmed by Wrotniak et al. (2006). They examined 65 children aged 8 – 10 years in New York. The results showed that motor proficiency was positively associated with physical activity. Another study by Pikora et al. (2002) suggested that the physical environment, such as parks, playgrounds, and similar facilities, may play an important role in encouraging people to participate in physical activities. Both studies indicate that there can be a relationship between residential area and motor proficiency.

Bakhtiar (2014) stressed that the role of the rural environment can play a positive role in developing motor proficiency levels of primary school children, as children living in these areas are more physically active than their urban peers. For example, Bakhtiar found that children tended walk to school and play outdoors in rural areas, whereas their urban peers usually used vehicular transportation and engaged more frequently in sedentary kinds of entertainment, such as playing computer games or watching television. He examined 67 students from first grade primary school in Indonesia and found that children in rural areas scored higher on average in gross motor skills compared to children in urban areas. The gross motor skills tested involved locomotor skills such as running, galloping, hopping, leaping, and horizontal jump, and manipulative skills such as striking, stationary dribbling, catching, kicking, and overhand throwing.

The reviewed research indicates a clear contrast between urban and rural environments in Saudi Arabia, and this may influence children's motor development. Moreover, while urban and rural environment in Saudi Arabia are unique, the characteristics of those environments that potentially impact on motor development are such that differences in motor development may be similar to those noted in other countries. Thus, the study of the effect of residential area (urban, rural) on children's motor proficiency will give broader information about Saudi children's motor proficiency and how any differences compare with other nations.

2.2.5 Summary

A review of the literature suggested that while patterns of motor development of boys and girls are similar, there are differences in the motor development of boys and girls. These differences can be partly attributed to biological differences between boys and girls, however research suggests that different social expectations relating to the motor competencies of boys and girls may also be a significant influence. As Gabbard and Krebs (2012) have stated, “In order to truly understand the complex nature of human motor development, environmental determinants should be considered” (p. 137). Studies have confirmed that environmental variables such as educational experiences and residential setting (urban or rural) can influence children's motor development. Also, the impact of environmental factors on children’s development has been discussed in several theories, such as Bronfenbrenner’s theory (Gabbard, 2012; Gallahue & Ozmun, 2006). Bronfenbrenner's ecological theory is useful for understanding how children’s motor development can be influenced by factors operating at different social levels. This theory proposes that development occurs as a result of interactions between the child and his or her environment (Cook & Cook, 2009; Gabbard, 2012; Gabbard & Krebs, 2012). Figure 3 adapts Bronfenbrenner's ecological model of development to represent the hypothesised relationships between the major factors that may influence the motor development of Saudi children. The next section, Part 3, will discuss the importance of fundamental motor skills in childhood.

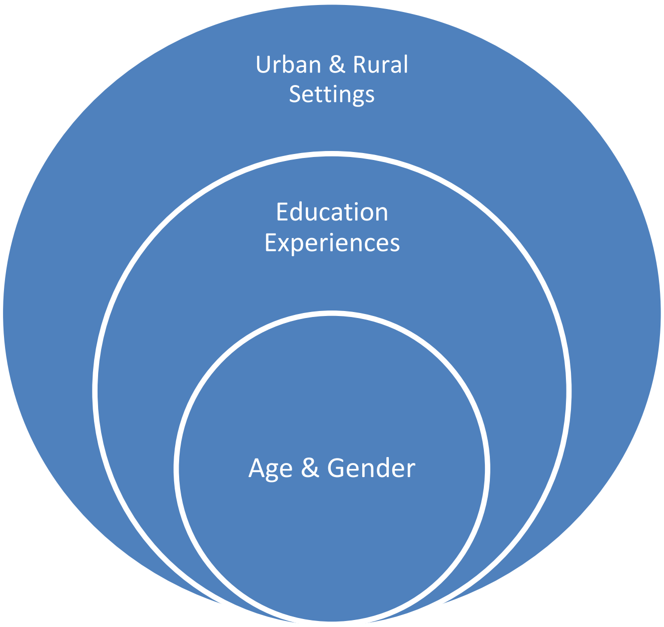

Figure 3. The relationships between factors influencing motor development. Adapted from "Studying Environmental Influence on Motor Development in Children," by A. Gabbard and Krebs, 2012, Physical Educator, 69, p. 138. Copyright 2012 by ProQuest.

2.3 Part 3

2.3.1 Fundamental motor skills

Fundamental motor skills are considered to be the building blocks for future movement skills (Lemos, Avigo, & Barela, 2012; Payne & Isaacs, 2011). Therefore, these skills are the topic of much research in the motor development field (Gabbard, 2012; Gallahue & Ozmun, 2006). Gabbard (2012) has defined fundamental motor skills (FMS) as "common motor activities (e.g., walk, run, jump, and throw) that have specific movement patterns" (p. 283). FMS are developed in early childhood and are essential in encouraging a physically active lifestyle (Cools et al., 2009). Mastering these skills allows children to interact and explore their environment (Cools et al., 2009; Hardy et al., 2010; Siahkohian et al., 2011). FMS are classified into the three major groups: locomotor skills, such as walking, running, and skipping; non-locomotor skills, such as bending, stretching, and pushing; and manipulative skills, such as throwing and catching (Gallahue & Ozmun, 2006; Malina et al., 2004; Pangrazi & Beighle, 2013).

Clark (2007), Payne and Isaacs (2011), and Clark and Metcalfe (2002) conceptualised human motor development as a pyramid comprising six periods: the reflexive, preadapted, fundamental patterns, context-specific, skillful, and compensation periods (see Figure 4). The model proposes that the fundamental motor period is the foundation for the development of motor skills in advanced periods. Thus, if the child acquires fundamental motor patterns, he or she is able to cross the proficiency barrier to learn more advanced motor skills (Barela, 2013; Clark, 2007; Goodway, Crowe, & Ward, 2003; Pang & Fong, 2009). This is supported by Haynes and Miller (2014) who concluded that the lack of FMS proficiency can restrict the learning of more advanced sport-specific skills. During the period of FMS development, there is parallel development of fine motor skills and coordination of muscle groups (Payne & Isaacs, 2011).

Although many children master FMS by the age of six years (Clark, 2007; Gabbard, 2012; Gallahue & Ozmun, 2006), there is evidence that some young children are delayed in their development of FMS at the start of school (Gallahue & Ozmun, 2006; Siahkohian et al., 2011). For example, Ericsson (2008) indicates that Danish and Swedish studies show that 10-15% of all the children who start school have not mastered FMS. Also, around 6-10% of children aged 7-10 years have motor skills coordination problems.

The development of FMS is dependent not only on maturation but also on environmental factors and life experiences (Clark, 2007; Gallahue & Ozmun, 2006). For example, Jalal and Allawi (1978) suggested that there is a difference between rural and urban children in the mastering of jumping skills, whereby rural children were often found to be better than urban children due, supposedly, to environmental conditions. Furthermore, many studies have confirmed that FMS proficiency can be enhanced by practice opportunities and early physical education programs (Barela, 2013; Lemos et al., 2012; Robinson, 2011). Therefore, Gallahue and Donnelly (2003), Goodway et al. (2003), Clark (2007), and Malina et al. (2004) have all emphasised that children need to be taught to develop FMS, which supports the view that FMS are significantly influenced by environmental factors. Figure 4 presents a graphical depiction of human motor development as proposed by Clark and Metcalfe (2002).

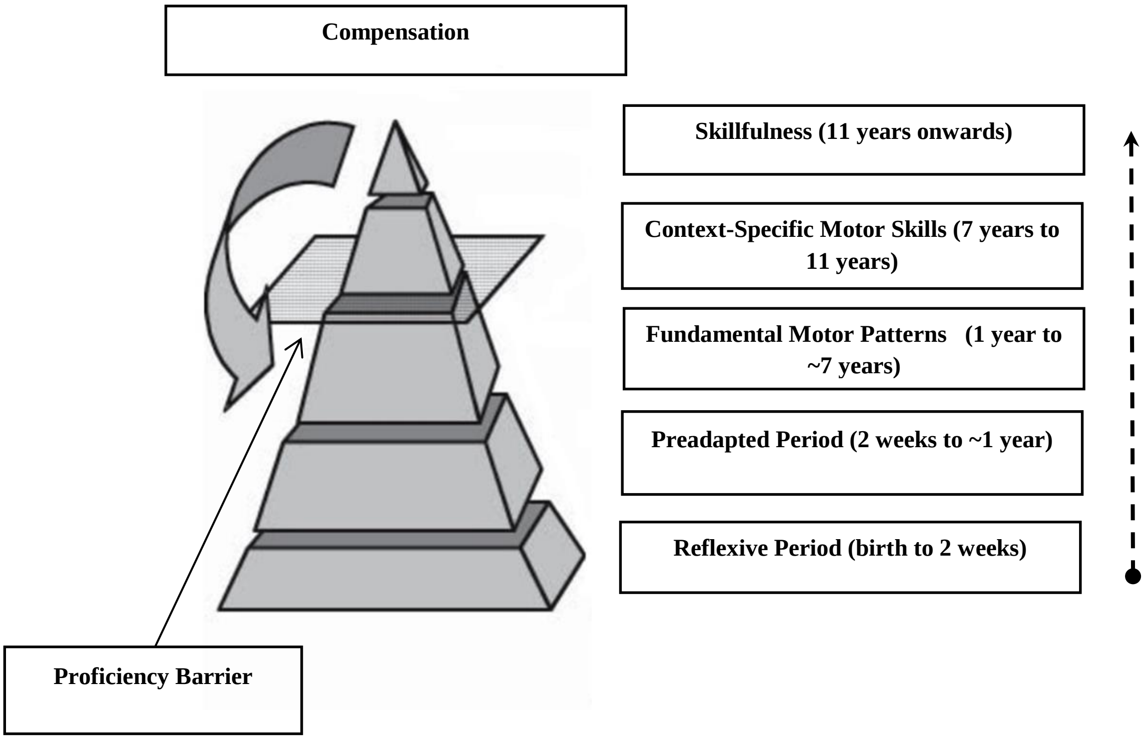

Figure 4. Clark and Metcalf's mountain of motor development. Adapted from "On the Problem of Motor Skill Development," by A. Clark, 2007, Physical Education, Recreation & Dance, 78, p. 41. Copyright 2007 by ProQuest.

The fundamental movement phase, occurring between two and six years of age, has been found to be a significant and foundational period for motor development. However, there is disparity in the age that FMS are mastered by children as they are influenced by environmental factors. Exploring the impact of biological factors (gender and age) and environment factors (educational experience and residential area) requires a suitable tool to assess motor performance. The next section will describe several tools that assess fundamental motor skills.

2.3.2 Assessment of fundamental motor skills

There are number of motor skills assessment instruments that have been used to measure motor skills, such as the Movement Assessment Battery for Children Movement (ABC), Test of Gross Motor Development-2 (TGMD-2), and the Bruininks-Oseretsky test of Motor Proficiency-2 (BOT-2) (Cools et al., 2009; Gabbard, 2012; Gallahue & Ozmun, 2006; Payne & Isaacs, 2011; Piek, Hands, & Licari, 2012). Generally, assessment tools in motor skills are classified as product-oriented assessment or process-oriented assessment (Gabbard, 2012; Gallahue & Ozmun, 2006; Malina et al., 2004; Payne & Isaacs, 2011). According to authors such as Payne and Isaacs (2011), the product-oriented instruments provide quantitative measurement of a particular performance, such as throwing distance and jump distance, whereas process-oriented instruments focus on the qualitative description of specific performance or technique in terms of its components, such as hip rotation and arm action in throwing. However, Malina et al. (2004) have noted that good performance on product instruments is offset by good performance in process instruments and vice versa.

In addition, there are some assessment tools that combine both quantitative and qualitative assessment such as Movement Assessment Battery for Children (Movement ABC) and McCarron Assessment of Neuromuscular Development (MAND) (Cools et al., 2009; Hands, Larkin, & Rose, 2013). Similarly, BOT-2 provides quantitative and qualitative assessment (Bruininks & Bruininks, 2005). Although Movement ABC and MAND have separated gross and fine motor scores (Gallahue & Ozmun, 2006; Piek, Hands, & Licari, 2012), the BOT-2 has a wider range of composite standard scores (Bruininks & Bruininks, 2005; Piek, Hands, & Licari, 2012). Therefore, BOT-2 provides a comprehensive assessment for motor performance (Bruininks & Bruininks, 2005).

Process-oriented instruments, such as TGMD-2, are most often used for evaluating FMS (Gabbard, 2012; Mazzardo, 2008). However, according to Mazzardo (2008), the majority of tools are valid but they evaluate a limited number of motor skills. Accordingly, many studies that have used TGMD or TGMD-2 to investigate children’s motor performance, such as those by Bakhtiar, (2014), Goodway and Branta, (2003), Goodway et al., (2010), Hardy et al., (2010), Lemos et al., (2012), Pang and Fong, (2009), Robinson, (2011), and Siahkohian et al.,(2011). These studies have focused only on gross motor skills, especially the locomotor and manipulative skills of the FMS. In contrast, the BOT-2 includes test items relating to a wide range of motor competencies including balance, and gross and fine motor skills. In addition, whereas process instruments may be appropriate for assessing motor skills in preschool-age children, product instruments are more suitable for advanced ages (Gallahue & Ozmun, 2006). For this reason, there are some advantages to applying product-oriented assessments such as BOT-2 to assess FMS. For the purpose of this research study, the investigator applied the BOT-2 so as to obtain a comprehensive assessment of motor proficiency for the study sample.

2.3.3 Summary

The fundamental movement phase is the foundational period for motor development. The FMS are classified into three groups: locomotor skills such as walking, running, and skipping; non-locomotor skills such as bending, stretching, and pushing; and manipulative skills such as throwing and catching. These groups of skills are important because they are necessary for children's usual movements. BOT-2 is the appropriate motor assessment tool for use in this research study.

2.4 Part 4

2.4.1 History of and general information about the BOTMP

The BOTMP has had long history since its development in 1923 in Russia by Oseretsky after extensive observation of children (Hattie & Edwards, 1987). Oseretsky first used the motor test to compare the motor development of children suffering from movement disorders and mental retardation with that of normally developing children (Burton & Miller, 1998; Düger et al., 1999; Wuang et al., 2009). Following its development, the test was used in Russia and other European countries and was translated into English by Doll in 1946 (Burton & Miller, 1998; Hassan, 1991; Hattie & Edwards, 1987). In 1978 the test was adapted and redeveloped as the BOTMP to emphasise proficiency of movement and motor performance (Cools et al., 2009; Gallahue & Ozmun, 2006; Hattie & Edwards, 1987). In 2005 Bruininks and Bruininks published the second edition of BOTMP, the BOT-2 (Bruininks & Bruininks, 2005). The BOT-2 is widely used to evaluate motor skills for both clinical and research purposes (Cools et al., 2009; Lucas et al., 2013; Wuang et al., 2009). BOT-2 evaluates the movement proficiency of individuals aged between 4 and 21 years. The test provides a complete overview of movement proficiency; it measures skills that depend upon gross muscles or fine muscles separately. Since publication of the BOTMP in 1978, the BOTMP and BOT-2 have been widely used to explore the nature and degree of impairment in motor skills (Bruininks & Bruininks, 2005). According to Bruininks and Bruininks (2005), the BOTMP divided subtests into composites, gross and fine motor skills but in BOT-2 the authors also added limbs involved in movement tasks. According to Cools et al. (2009), validity of the BOT-2 has been proven, and content and factor analysis correlation coefficients support its theoretical structure. In addition, there is a strong relationship between the BOT-2 and other tests, such as the Peabody Development Scales second edition (PDMS-2) and the BOTMP (Cools et al., 2009; Deitz, Kartin, & Kopp, 2007). Test-retest reliability and inter-rater reliability of the BOT-2 has been demonstrated (Cools et al., 2009; Deitz et al., 2007).

2.4.2 The differences between BOTMP and BOT-2

It is important to first provide a brief description of the first version of the BOTMP to lay a clear foundation for evaluating the BOT-2 in terms of its appropriateness for this study. BOTMP has been applied in studies in countries including United States, United Arab Emirates, Iran, Pakistan, Iceland, Greece, Palestine, Israel, Taiwan, and Saudi Arabia. The

BOTMP was developed for therapists and educators as an instrument for evaluating motor dysfunctions and developmental handicaps that may hinder a child's normal development (Bruininks, 1978). Düger et al. (1999) revealed that the BOTMP can also be convenient for investigating unexplored aspects of motor development such as the relationship between motor development and demographic characteristics (age, sex, and geographic region). According to Bruininks and Bruininks (2005), six goals underpinned the revision of the BOTMP to derive the BOT-2. These included: (a) improving functional relevance of test content, (b) expanding coverage of fine motor and gross motor skills, (c) improving measurement among 4- and 5-year-olds, (d) extending norms through age 21, (e) improving item presentation, and (f) improving the quality of the kit equipment.

There are some significant differences between BOT-2 and BOTMP as shown in Table 3. The first important difference is improvement in the functional relevance of the test. The BOTMP contains two composite subtests, gross and fine motor skills, which are classified on the basis of groups of muscles used in movement. However, the BOT-2 utilises a composite structure that considers muscle groups and limbs used for specific movements. For example, the BOT-2 has four motor-area composite scores: (a) fine manual control that encompasses control and coordination of the distal musculature of the hands and fingers, (b) manual coordination involving control and coordination of the arms and hands, (c) body coordination including control and coordination of large musculature that aids in maintaining posture and balance, and (d) strength and agility involving control and coordination of the large musculature included in locomotion (Baine, 2008; Bruininks & Bruininks, 2005; Myrelid et al., 2010). Each motor composite includes two subtests, as presented in Table 3. The short form of the BOT-2 comprises 14 test items, selected proportionately from the complete form subtests, and requires approximately 15 to 20 minutes to administer. The complete form includes 53 test items and requires approximately 40 to 60 minutes to administer (Baine, 2008; Bruininks & Bruininks, 2005; Deitz et al., 2007; Gabbard, 2012; Kennedy et al., 2012; Payne & Isaacs, 2011). A second important difference between the BOT-2 and the BOTMP concerns item presentation. The BOT-2 provides examiners with greater flexibility for presenting activities by using verbal directions, physical demonstration, and photographs (Bruininks & Bruininks, 2005). Photographs showing the administration of tests are a new design feature in BOT-2 to make it more user-friendly (Bruininks & Bruininks, 2005). This feature may make the BOT-2 an appropriate test for use across different cultures as the administration procedures are clear for both examiner and examinee, as confirmed by Lucas et al. (2013) and Ruel et al. (2012). A third difference is that some items in the BOTMP were replaced with higher quality materials in the BOT-2 in order to improve the overall quality of the test kit. For instance, the new balance beam is made from a solid material, on the basis of BOTMP users' feedback (Bruininks & Bruininks, 2005).

The BOT-2 long form was considered appropriate for use in the present study for two reasons. First, the BOT-2 long form is suitable for use in schools, as suggested by Deitz et al., (2007), Hassan (1991), Jifri (2003), and Tabatabainia (1995). Second, the application of the long form of the BOT-2 provides a comprehensive measure of motor proficiency involving four separate motor-area composite scores, as well as a total motor proficiency score. On the other hand, the short form provides only a single score of overall motor proficiency (Bruininks & Bruininks, 2005), and is mainly used as a screening tool (Gabbard, 2012). Table 3 provides a comparison between BOTMP and BOT-2 in terms of composite scores, subtests, and test items.

Table 3

A Comparison Between BOT-2 and BOTMP in Terms of Test Items, Subtest Scores, and Composite Scores

BOT-2					BOTMP				
Subtest	Items	New Items	Composite Scores	Total Score	Subtest	Items	Dropped	Composite Scores	Total Score
Fine Motor Precision	7	4	Fine Motor Control	Motor Proficiency	Response Speed	1	1	Fine Motor Skills	Motor Proficiency
Fine Motor Integration	8	4			Visual-Motor Control	8	1		
Manual Dexterity	5	0	Manual Coordination		Upper-Limb Speed and Dexterity	8	3		
Upper-Limb Coordination	7	2			Upper-Limb Coordination	9	2	Both	
Bilateral Coordination	7	1	Body Coordination		Running Speed and Agility	1	0	Gross Motor Skills	
Balance	9	4			Balance	8	3		
Running Speed and Agility	5	4	Strength and Agility		Bilateral Coordination	8	4		
Strength	5	2			Strength	3	0		
Total	53	21	4	1		46	14	2	1

2.4.3 BOT-2 as an international tool

As noted in Chapter 1, many international studies have used BOTMP, and several have used BOT-2. Given the importance of these studies to this project, several studies that have used BOT-2 will be discussed in detail. Chowdhury, Wrotniak, and Ghosh (2010) conducted a study to examine the impact of nutritional and socioeconomic factors on motor development among 427 boys and 414 girls aged 5-12 years in India, using the BOT-2 Short Form. Results showed that the nutritional and socioeconomic status of the children had a significant impact on their total BOT-2 scores. Children with lower socioeconomic and poorer nutritional status were found to have lower motor proficiency levels compared to those of children with a higher socioeconomic and nutritional status. Also, Kennedy et al. (2012) used the long form of the BOT-2 to determine the strength of the relationship between motor proficiency, scores on the Physical Self-Description Questionnaire (child report), and scores on the Movement Assessment Battery for Children 2nd Edition Checklist (parent report) in a sample of 38 children aged between 8 and 12 years in Victoria, Australia. The results revealed a moderate to large association between strength and agility composite scores and children's physical self-description. The authors suggested this association may have been influenced by gender because boys usually focus on gross motor skills performance in physical activities while girls prefer more fine motor skills. Also, they found moderate to large associations between all BOT-2 composite scores and parents' reports, except for fine motor control. According to the researchers, parents focused on their children's fine motor performance as academic tasks so it was possible that parents placed their children's fine motor performance relative to other motor areas. Finally, according to the children's reports, real-life locations, such as the home, classroom, and playground were important sources of their physical activities.

Significantly, several studies have focused on the validity and reliability of BOT-2. For example, Lucas et al. (2013) examined the inter-rater and test-retest reliability of BOT-2 Short Form in Australian Aboriginal communities. They found excellent reliability, particularly with respect to inter-rater reliability. Thus, they suggested that BOT-2 short form has acceptable reliability when used in Australian Aboriginal communities. Also, Wuang and Su (2009) conducted a study to evaluate the reliability of using BOT-2 in Taiwan. The sample was 100 children aged 4 – 12 years. The researchers found that BOT-2 had good internal consistency and excellent test-retest reliability. Kegel et al. (2012) used the balance subtest of BOT-2 to establish a new balance tool in Belgium. They found moderate to high correlation between the balance subtest in the BOT-2 and the new test. These studies represent an extension of previous studies that examined the validity and reliability of BOTMP in different societies, such as studies by Hassan (2001) and Venetsanou et al. (2009).

Other international studies have used BOT-2 to understand the impact of certain medical conditions on motor development. For example, Jafari and Asad Malayeri (2011) conducted a study to define the relationship between static balance ability and profound sensorineural hearing loss among Iranian children. They found a significant correlation between hearing impairment and static balance. Myrelid et al. (2010) conducted a study among young children with Down syndrome (DS) in Sweden, to investigate the impact of growth hormone (GH) treatment on motor performance. The results showed that the motor performance of children with DS could benefit from early GH treatment. Ruel et al. (2012) examined motor proficiency among Human Immunodeficiency Virus (HIV)-infected children in Uganda. The most important results were that the HIV-infected children had significantly lower motor proficiency scores on BOT-2 than HIV-negative children.

2.4.4 Summary

The BOTMP and BOT-2 tests are valid and reliable tools. Many international studies have used these tests for a range of purposes. It is important to note that there are some differences between BOTMP and BOT-2 in terms of test items and subtests. The current study will be the first study to apply BOT-2 to Saudi children. The last part of this chapter will examine research dealing with influences on children's motor development.

2.5 Part 5

2.5.1 Cross-cultural perspectives on BOTMP

Motor development is traditionally studied in cross-cultural research; it also provides an important domain for evaluating cultural challenges within general behavioural science (Karasik, Adolph, Tamis-Lemonda, & Bornstein, 2010). In human development, the critical developmental period, in most cultures, ranges from approximately age 2 to 12 years, which is the time when children gradually start to enter the social world outside of the family (Gielen & Roopnarine, 2004). However, most cross-cultural studies of child development that claim universal relevance of their findings tend to reflect Western development theories, as the studies are undertaken with Western children (Gielen & Roopnarine, 2004). Nevertheless, cross-cultural variations in motor development do exist (Cintas, 1989). Therefore, the current study focuses on two important cross-cultural dimensions. First, it provides motor development data enabling a comparison of motor performance of primary school-aged Saudi children with that of children from North America. Significantly, this study is the first study to evaluate the motor development of Saudi female children. Second, this study is also the first time BOT-2 has been applied in Saudi Arabia, or in any Arab country. Therefore, a significant contribution of this study will be to provide data as to the suitability of using the BOT-2 as an evaluative tool in Saudi Arabia.

Hassan (1991) conducted a BOTMP study in the UAE community. The study compared the performance of 281 pupils aged 6 to 14 years in UAE with North American norms. The results revealed superior performance among North American participants for both genders, at all age levels, and on all subtests, especially the gross motor subtests. The results appeared to be related to customs and social expectations. For example, UAE females typically have less freedom and fewer opportunities to be physically active and to participate in sporting activities, compared to North American females. In another study, Tabatabainia (1995) used the BOTMP with 170 Iranian children, aged 4.5 and 6.5 years. The Iranian children scored higher than North American children on some subtests, such as visual-motor control and strength. On the other hand, the North American children performed better on running speed and agility, and response speed.

Habib’s (1997) study of the evolution of dynamic balance in 180 Pakistani children aged 5 – 13 years verified the impact on motor development of gender, and economic and social status. Habib used the running speed and agility, and balance subtests of BOTMP to evaluate the children’s performance. The results indicated that the Pakistani children performed less well than the North American children on the both subtests. These results suggested that environment and social experiences can impact on motor proficiency of children belonging to different cultures. Jifri (2003) used the BOTMP to examine motor performance in 155 Saudi boys aged 10 and 12 years. The Saudi boys scored significantly lower than North American children in the running speed and agility, balance, upper-limp coordination, and upper-limb speed and dexterity subtests. In contrast, Saudi groups scored significantly higher than North American children on the response speed and visual-motor control subtests. However, no significant differences were identified between groups in the bilateral coordination and strength subtests. Finally, Chui et al. (2007) conducted a study to examine the differences in fine motor proficiency between children in Hong Kong and the United States, using the BOTMP. The study sample was 264 children aged 6 – 10 years. No significant differences in upper-limb coordination or response speed were found between the two groups of children. However, on the visual-motor control and the upper limb speed and dexterity subtests the children from Hong Kong scored significantly higher than their American counterparts.

2.5.2 Summary

The above review of literature reveals some similarities and differences between countries and societies in terms of motor proficiency. Therefore, further comparison of motor development between children from different societies will provide important information for cross-cultural studies. The current study will contribute to such information by comparing Saudi children's motor proficiency, as measured by the BOT-2, with North American norms on the BOT-2.

2.6 Inference of this Literature Review

The current study's aim was to provide a comprehensive picture of the motor proficiency of Saudi children, and to investigate the appropriateness of using BOT-2 for assessing Saudi children's motor performance. The literature review justifies the study and its approach in several ways.

First, the literature suggests that environmental factors may play an important role in children's motor development; and the current study may contribute to this body of literature by revealing differences and similarities in motor proficiency between Saudi children and North American children. Moreover, the literature suggests that children's motor performance may vary according to residential area and educational experiences within Saudi Arabia; and this possibility will be examined in the current study.

Second, the literature reveals both similarities and differences in motor development between boys and girls. The current study will further the literature on gender differences by comparing motor development in boys and girls across three age groups. Importantly, this is the first study that has evaluated the motor development of Saudi girls.

Third, the study addressed the development of fundamental motor skills, an essential phase in children's motor development. Although the fundamental movement phase occurs between 2 and 6 years of age, many studies have assessed fundamental motor skills in older children. The BOT-2 includes test items that evaluate a variety of FMS, such as walking, running balance, and throwing, in addition to motor control. For example, van Beurden et al. (2002) assessed fundamental motor skills among children in grades three and four, while Pang and Fong (2009) evaluated the fundamental motor skills of children aged six to nine.

Finally, the literature review examined issues of validity and reliability of the BOT-2 and argued its appropriateness for use in this study. Differences between the BOTMP and BOT-2 were examined. The literature points to the BOT-2 as being a useful tool for investigating a number of unexplored aspects of motor development, such as the effect of demographic characteristics (like gender and geographic region) on motor development (Düger et al., 1999), as is the case in this study.

In light of Gallahue and Ozmun's (2006) model, the current study explored the influence of age and gender, educational experiences, and urban and rural setting on Saudi children's motor proficiency. This was achieved by using several concepts and assessments, such as FMS, BOT-2, and cross-cultural perspectives (see Figure 5).

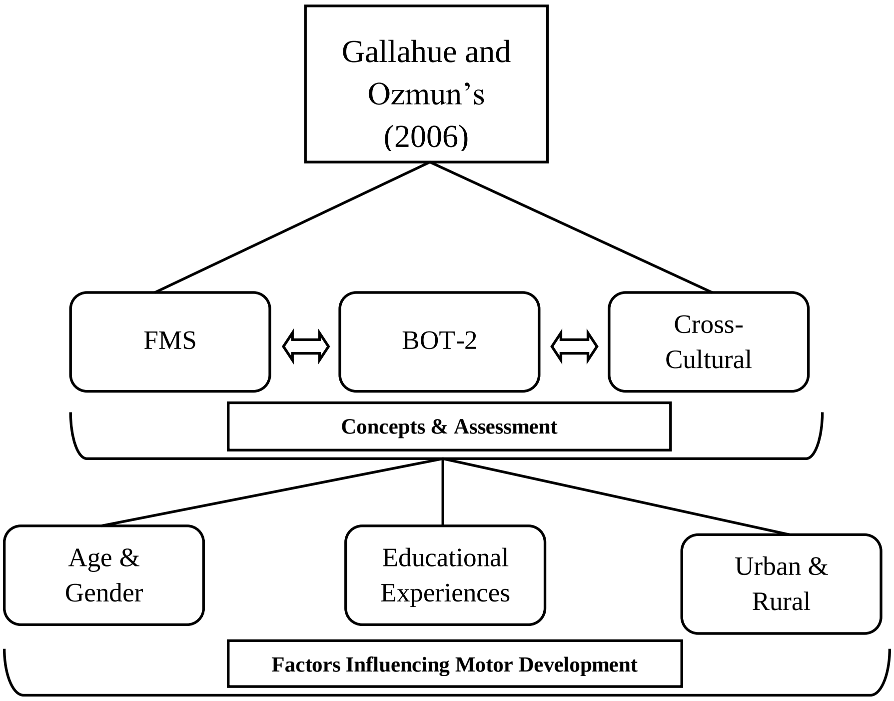

Figure 5. The study's theoretical framework.

3 METHOD

This study sought to address the issue of the motor development of young Saudi children, through an assessment of:

- The performance level of Saudi children compared to the BOT-2 norms;
- Identified differences within the Saudi groups on five areas of motor performance according to gender, residential area, and grades; and
- The overall appropriateness of the BOT-2 as a tool for assessing Saudi children's motor proficiency.

This chapter overviews the methods used to conduct the study. Part 1 presents the research methodology, followed by an explanation of the cross-sectional research design (Part 2) and a discussion of the research basis for the instrument selection (Part 3). Part 4 then describes a pilot study highlighting the reliability aspects with respect to the main study. Finally, Part 5 explains the procedures used for analysing the data.

3.1 Methodology

A quantitative research design was used to determine the motor proficiency levels of the study sample. Two reasons supported this approach. First, the study's instrument, BOT-2, provided numerical assessments of the motor proficiency level, providing the capacity to objectively assess performance of groups. Many internationally published quantitative studies (e.g., Chui et al., 2007; Hassan, 2001; Josman et al., 2006; Venetsanou et al., 2009;; Wuang et al., 2009), in the field of motor development have used either the BOT-2 or the earlier test, the BOTMP, to measure motor proficiency. Second, the nature of the research required numeric data collection to enable comparisons to be made between the Saudi children and the corresponding BOT-2 norms, specifically in relation to the similarities and differences in motor proficiency between urban and rural children in Saudi primary schools. Therefore, a quantitative research approach was deemed the most appropriate for the current study, as it included narrow focused questions (Creswell, 2012; Thomas, Nelson, & Silverman, 2011). Figure 6 illustrates the relationship between the research questions.

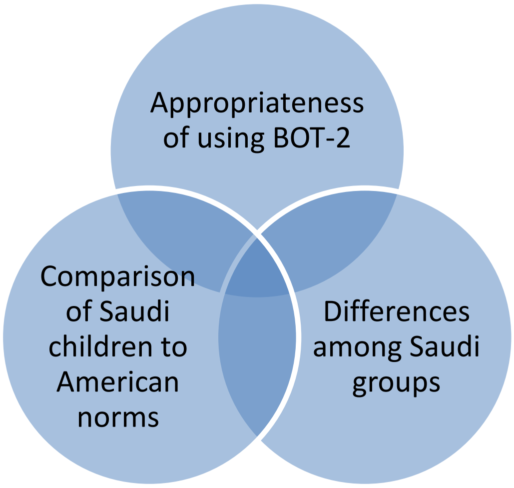

Figure 6. Link between research questions.

The following section discusses the various dimensions of the research design.

3.2 Cross-sectional Research Design

Two major strategies (the longitudinal method and the cross-sectional method) were considered for the examination of the motor development of Saudi children (Gallahue, 1982; Gallahue & Ozmun, 2006; Thomas et al., 2011). Both designs aim to control the conditions of the study at one moment in time (Flick, 2011). Thomas et al. (2011) explain that: "The major distinction between the two basic approaches in developmental studies is whether researchers follow the same participants over time (longitudinal designs) or select different participants at each age level (cross-sectional design)" (p. 291).

For the current study, a cross-sectional design was selected over the longitudinal method for four reasons. First, this method allowed for a comparison to be made within the study group; for example, it enabled the determination of different fine motor control scores between two age groups within the female sample. Second, this approach enabled the study to verify the validity of BOT-2 for use with children at various ages (Saudi children aged between 6 and 12 years). For example, the score results of the groups of males in the different age groupings were computed in five ways: (a) for each item with its subtest scores; (b) each subtest with its motor-area composite; (c) between each subtest and total motor composite scores; (d) between the fine manual control, manual coordination, body coordination, and strength and agility scores, as well as the total motor composite scores; and (e) total motor composite scores and BOT-2 Short Form (BOT-2 SF) scores. Third, the cross-sectional design was deemed appropriate because of the nature of the BOT-2 test instrument. That is, as the norms are divided by age, the study was able to easily make comparisons between the participant groups and the BOT-2 norms.

Fourth, many motor development studies (e.g., Hassan, 1991; Habib, 1997; Venetsanou et al., 2009) have used BOTMP to confirm the suitability of using a cross-sectional design. The vast majority of motor development research has used a cross-sectional approach because it is a more direct and easily applicable technique (Gallahue, 1982). Perhaps the major advantage of this method is that researchers can study motor development, in a short time period of time, for a wide range of age levels (Haywood et al., 2012).

3.3 Instrument Selection

Instrument selection is an important part of the research process. “Assessment is a way of understanding a child in order to make informed decisions about the child” (Sattler, 2008, p. 4). Gabbard (2012), and Payne and Isaacs (2011) have suggested four questions which can help the researcher select the most appropriate test for the assessment of motor skills, namely:

1. Is the test valid, reliable, and objective?
2. Are the test’s norms established on populations similar to that which the researcher plans to assess?
3. Is the test applicable to administer?
4. Does the researcher have the expertise to administer the test?

These questions guided the researcher to determine the appropriate instrument to use for conducting the study. Chapter Two provided some information about the validity and reliability of the BOT-2, and following sections detail further the validity, reliability, and objectivity (inter-rater reliability) of the measure.

The BOTMP and BOT-2 are examples of a norm-referenced test, the data for which were gathered from subjects in the BOT-2 population (Burton & Miller, 1998). Many international studies that have evaluated motor development and control of children in different cultures have used the BOTMP or the BOT-2 (see Table 4). Therefore, BOT-2 is widely considered to be a valid and reliable instrument for measuring motor performance, with many researchers, such as Hassan (1991), Jifri (2003), and Tabatabainia (1995) having adopted the test for use in cross-cultural studies. Further, similar studies have confirmed the potential use of BOTMP’s long form during a school’s administration time. Finally, for the current study, the researcher had previous experience using the BOTMP (Al-Thumali, 2005) to investigate differences in the motor performance between two groups of Saudi students in the first grade, namely, those who had enrolled in kindergarten, and those who had not. For these reasons, the BOT-2 was chosen for use in the current study. Table 4 summarises the application of BOTMP and BOT-2 in different societies.

Table 4
International Studies Using Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)

Nation	Reference	Purpose of study
United Arab Emeritus (UAE)	Hassan (1991, 2001)	To assess motor proficiency in children in the UAE.
Iran	Tabatabainia (1995)	To evaluate Iranian children’s motor proficiency.
Pakistan	Habib (1997)	To test the balance skills of Pakistani children.
Turkey	Düger et al. (1999)	To examine the relationship between motor abilities and age and gender in Turkish children.
Saudi Arabia	Jifri (2003)	To evaluate Saudi children’s motor proficiency.
Palestine & Israel	Josman et al. (2006)	To compare the visual-perceptual and motor skills of Palestinian and Israeli children.
Costa Rica	Shafir, Angulo-Barroso, Calatroni, Jimenez, and Lozoff (2006)	To examine the effects of iron deficiency in infancy on motor development over time.
Hong Kong	Chui et al. (2007)	To compare the motor proficiency of children in Hong Kong and the US.
Greece	Venetsanou et al. (2009)	To examine the validity of the Bruininks-Oseretsky test of motor proficiency: short form (BOTMP-SF).
Taiwan	Wuang and Su (2009)	To assess motor skills and intellectual disabilities in Taiwanese children.
India	Chowdhury et al. (2010)	To examine the impact of nutritional and socioeconomic factors on motor development.
Sweden	Myrelid et al. (2010)	To investigate the impact of growth hormone treatment on motor performance.
Iran	Jafari and Asad Malayeri (2011)	To define the relationship between static balance ability and profound sensorineural hearing loss.
Australia	Kennedy et al. (2012)	To examine the correlations between BOT-2 scores, child-report, and parent-report.
Belgium	Kegel et al. (2012)	To establish a new balance assessment tool.
Uganda	Ruel et al. (2012)	To determine whether HIV-positive children have impairment of neurocognitive ability or impairment of motor development.
Australia	Lucas et al. (2013)	To examine the reliability of the BOT-2 SF for children living in remote Australian Aboriginal communities.

3.3.1 Reliability and validity of BOT-2

The Bruininks-Oseretsky test of motor proficiency, second edition (BOT-2) was used in the current study. The BOT-2 is a widely used instrument with well documented reliability and validity, as summarised below. It has the capacity to assess children's motor performance, and also provide information that helps to distinguish between normal and abnormal motor behaviour (Cools et al., 2009; Deitz et al., 2007; Wuang et al., 2009).

3.3.1.1 Reliability

The internal consistency reliability, test-retest reliability, and inter-rater reliability of the BOT-2 has been confirmed. Internal consistency reliability gauges the consistency of scores across the test items within each subtest and composite (Bruininks & Bruininks, 2005). This reliability is used for normative samples whose "internal consistency…[are] examined using the stratified alpha method for each composite and the split-half method for each subtest" (Deitz et al., 2007, p. 94). The total motor composite in these subtests reported a high alpha of $\geq .93$ for all age groups (Bruininks & Bruininks, 2005; Deitz et al., 2007). Test-retest reliability refers to the stability of an individual's score over a short period of time (between two and four weeks). Each examinee was tested by the same examiner twice (Bruininks & Bruininks, 2005). The mean subtest correlation coefficient ranged between 0.69 and 0.70, and the mean composite correlation coefficients ranged between 0.77 and 0.80 (Bruininks & Bruininks, 2005; Cools et al., 2009). The last reliability method, inter-rater reliability, requires different examiners to assess the performance of the same examinee. The correlation coefficient results were very high for all the complete form subtests and composites (Bruininks & Bruininks, 2005; Deitz et al., 2007).

3.3.1.2 Validity

Four types of validity (content validity, internal structure, ability to distinguish between groups, and scores on BOT-2 correlated with scores on other measures of motor performance) are reported for the BOT-2, by Bruininks and Bruininks (2005), and Deitz et al. (2007). The content validity for BOT-2 was based on multiple stages achieved by: (a) identifying the least effective items from BOTMP and the new test items by using surveys and focus groups, and (b) analysing both the new items and the retained items from the BOTMP by pilot, national trial, and standardisation for the new items test. A factor analysis was used to examine the subtest structure for BOT-2, and feedback from participants was used to retain, revise, or delete certain test items.

Then, the internal structure of BOT-2 was developed by distinguishing motor skills on the basis of the limbs and musculature involved, and how these skills relate to specific activities of motor behaviour, such as postural control, locomotion, and object manipulation. This internal structure was validated in two ways: (a) an examination of the correlations among the subtest scale scores and the motor-area composite scores in three age groups (4 – 7, 8 – 11, and 12 – 21 years); and (b) a confirmatory factor analysis to determine motor-area composites which are used to evaluate a performance on BOT-2.

Finally, clinical groups were compared with a non-clinical population to examine the ability of the BOT-2 to distinguish between the groups. There were three clinical groups, each consisting of children with a condition associated with motor performance deficits: developmental coordination disorder, mild to moderate mental retardation, and high-functioning autism/Asperger's disorder. All three clinical groups recorded significantly lower scores than non-clinical population scores ($p < .001$). Finally, the relationships between the BOT-2 scores and other measures of motor performance were investigated. The BOT-2 scores were compared with scores yielded by three instruments: Bruininks-Oseresky Test of Motor Proficiency (BOTMP); Peabody Developmental Motor Scales, Second Edition (PDMS-2); and Test of Visual-Motor Skills-Revised (TVMS-R). All three comparisons demonstrated that the children's scores on BOT-2 were correlated with their scores on other measures of motor performance.

3.4 Pilot Study to Establish Validity of BOT-2 for use in Saudi Arabia

An initial pilot study was undertaken prior to the main study, to provide an overview of the validity of using BOT-2 for Saudi children. The pilot study was a necessary part of this research for two reasons. First, the pilot study was the first investigation to apply BOT-2 in Saudi Arabia and any Arab country. Therefore, it was important to ensure the BOT-2 instructions' translation and test administration were appropriate with respect to the cultural conditions prevailing in Saudi Arabia. Second, as the participants' examiners included eight teachers and the researcher, the pilot study became an essential step in the training of the teacher examiners in their application of BOT-2. The following sections describe how the pilot study was undertaken.

3.4.1 Translation of the BOT-2's instructions

As noted above, the current study was the first time that the BOT-2 was applied in Saudi Arabia. Thus, having a robust translation of the instrument's protocol was important for both the examiners and the examinees. To ensure that the instructions for BOT-2 were well understood, they were translated from English into Arabic by the researcher, being adapted to fit the local dialect of Saudi Arabia. To this end, the researcher established an advisory committee of volunteers from the Taif University (a PhD staff member from the Department of English; two PhD staff members, both of whom had graduated from Western universities, from the Department of Physical Education; and two physical education (PE) primary school teachers from the city of Taif, Saudi Arabia). The researcher arranged a meeting with the reference group and provided them with a copy of the proposed translation so they could provide any comments about the tool. Also, during this meeting the researcher gave a full explanation about the study's tool, how it worked, and how the previous studies translated the tool.

The final agreement about the robustness of the translation relied on several principles. First, the Arabic translation of the instructions for individual test items for BOT-2 was a "procedural translation", meaning that the original instructions for the test's administration needed to retain its Arabic translation to ensure the correct application of the BOT-2 testing procedures. Second, given the similarities between the BOTMP and BOT-2, the translation of the BOT-2, undertaken for this study, was able to take advantage of previous translations of the BOTMP by Hassan (1991) and Jifri (2003). They had previously applied the BOTMP in their investigations into motor development in Arab countries. Also, the translation into Arabic had to reflect a level of language that would be understood by primary school-aged children. The specific focus was to ensure that the terminology used in the testing was: (a) age appropriate; and (b) clear and unambiguous with respect to the aims, procedures, and instructions for conducting specific tests (see the example given in Table 5). The examiners taught the task to the examinees by describing the aim of the task and procedures. The instructions were notes provided by the examiner to the examinee (see Appendix C). Lucas et al. (2013) and Ruel et al. (2012) asserted that the BOT-2 was an appropriate tool for testing children from different cultures. Finally, the committee reviewed the final version of translation.

Table 5
Example of Translation of Procedures for Individual Test Item: Filling in Shapes-Circle

Aim of test	Fill the Circle - shape (see p. 2 in examinee booklet).	أن يملأ المفحوص شكل دائري (انظر كراسة الاختبار ص ٢).	الهدف
Procedures	• Color in the circle and try to stay inside the lines. • Take your time. • Ready? Begin.	• لون الدائرة مع محاولة بقائك داخل الحدود الشكل. • خذ من الوقت ما تشاء. • مستعد؟ إبدا.	الاجراء
Instructions	• Hold the pencil in preferred hand. • Pointing to the circle.	• خذ القلم الاحمر بيدك (اليمنى/ اليسرى) • أشر إلى الشكل الدائري.	تعليمات للفاحص

Note. The first two columns are the English translation; the second two columns are the Arabic translation.

3.4.2 Training examiners

As noted earlier, the researcher has had previous experience with the study tool's administration through the use of the BOTMP (Al-Thumali, 2005). However, the data collection within the schools required a team of teachers to undertake the assessments in the different locations. Therefore, there was a need to conduct a training workshop for the volunteer examiners; such training was aimed at ensuring the consistent application of the translated BOT-2 used to assess the children's motor proficiency and reducing potential measurement errors in the testing (Kimberlin & Winterstein, 2008). The four male PE teacher examiners and four female preschool teacher examiners were volunteers from eight schools. The researcher was also part of the team of examiners. Both sets of teachers were familiar with, and taught, subject areas that involved their students learning motor skills. As the schools in Saudi Arabia are divided by gender, the examiners were divided into two groups (males and females). The examiners' details are presented in Table 6.

The training workshop involved theoretical and practical aspects. During the workshop, the participants were encouraged to discuss issues related to the test's administration in an attempt to resolve any potential difficulties in gathering the data. The BOT-2 training video by Bruininks and Bruininks (2007) was used to demonstrate the administration of each test item, enhancing the reliability of the study. During the workshop the researcher was able to readily learn the individual test procedures. The chief investigator trained the assessors in administering each aspect of the tests in BOT-2. The assessors administered the test, and the researcher observed and recorded the scores on independent record forms. The assessors' scores generally corresponded with the scores given by the researcher.

Table 6
Examiners' School Location and Gender

Examiners' Identification Number	School Location	Gender
Teacher 1	Urban	Female
Teacher 2	Urban	Female
Teacher 3	Rural	Female
Teacher 4	Rural	Female
Teacher 5	Urban	Male
Teacher 6	Urban	Male
Teacher 7	Rural	Male
Teacher 8	Rural	Male
Researcher (9)	Unattached	Male

3.4.3 Reliability and administration procedures used to conduct the pilot study

As noted above, the practical phase in training the examiners, the examiners tested 15 children (8 males, 7 females); each examiner tested two children, except for one examiner, who tested just one child. The children, aged between 6 and 10 years, were volunteer participants in the examiner training study, who had obtained the consent of their parents. These children were not part of the main or pilot study sample. This phase was a prelude to the reliability of the pilot study.

For the pilot study, 28 male and female pupils (15 and 13, respectively), aged 6 to 11.4 years, from primary schools in different (urban and rural) residential areas were tested. The school student participants were all under the administration of the District of Education, Taif city. Taif is located in the south-west of the Kingdom of Saudi Arabia. The pilot study was conducted after school hours. Table 7 outlines the participants' grades, genders, and school locations.

Table 7
Grades, Genders, and Locations of Pilot Study Participants

Grade	Urban		Rural		Total
	Males	Females	Males	Females	
1	4	3	3	2	12
3	3	3	2	2	10
5	2	1	1	2	6
Total	9	7	6	6	28

The teachers were only required to record, on their forms, the raw scores for each test administered. The researcher aggregated all item scores to derive the final test scores**.** As noted previously, the reliability study was undertaken in primary schools in the urban and rural areas of the city of Taif.

The aim of the pilot study was to establish the reliability of BOT-2. This piloting was important as the main study needed the examiners to understand the test administration process, as well as the test instructions. According to Drost (2011) and Shultz and Whitney (2005), there are four estimates of the BOT-2 reliability: the test-retest reliability; the alternate forms reliability; the split-half alpha; and the inter-rater reliability. The researcher decided to use the test-retest and the inter-rater reliability measures for the study as the procedure was applied in similar studies conducted by Bruininks and Bruininks (2005), Lam (2011), and Lucas et al. (2013). As with the current study, these studies involved the BOT-2 and the use of multiple examiners. Also, the scores' stability (test-retest) and raters' consistency (inter-rater reliability) were considered to be valid measures by a number of authors (Huck, 2008; Kimberlin & Winterstein, 2008; Shultz & Whitney, 2005). Together, the two methods demonstrate both the reliability and the objectivity of the scoring (Sattler, 2008). The sections below present an overview of the outcomes of the reliability measures used for the pilot study. The results of the pilot study are reported in Chapter 4.

3.4.3.1 Procedures used to establish inter-rater reliability

After conducting the training examiners' workshop, the researcher asked the examiners to evaluate a number of pupils in their schools. With the agreement of the examiners, this process was undertaken in one male and one female school. (All schools in Taif city fall within the purview of the District of Education, and are separated according to student gender.) Each pupil (examinee) was evaluated by two teachers using a form to separately record the student's item raw scores. At a single sitting, one teacher conducted the test while the other teacher observed the examinee's performance as suggested by Bruininks and Bruininks (2005). Table 8 lists the roles of the teacher examiners in relation to the examinees. As noted previously, each examiner evaluated two pupils. The researcher was satisfied that this number of examinees was suitable as the teachers' loads were high and they could not leave their school during school hours. Therefore, the testing to establish the inter-rater reliability was conducted during the weekend (Thursday 11/4/2013 for the females, and Friday 12/4/2013 for the males: the weekend equivalent in Saudi Arabia occurs on Thursdays and Fridays). The results of this study are reported in Chapter 4.

Table 8
Distribution of Examinees to Teacher Examiners and Teachers Observing in Inter-Rater Reliability

Gender	Examinees	Teacher Examiners	Teacher Observing
Female	1	1	2
	2	2	1
	3	3	4
	4	4	3
Male	1	5	6
	2	6	5
	3	7	8
	4	8	7
	5	5	Researcher
	6	Researcher	5
Total	10	9	9

The examiners recorded all the raw scores, except for the subtest item scores of the FMP and FMI, as the examinee performs the tasks of the FMP and FMI subtests in their booklet. Then these test items are corrected manually according to the scoring guideline instructions. This process of scoring requires a great understanding of the scoring guideline instructions. Hence, the researcher scored the raw scores of the FMP and FMI subtest scores, the scale scores, and the standard scores for all the composite motor-areas. Additionally, because the student sample was small in number, the percentage (exact) agreement was computed by the researcher, using the statistical method confirmed by Habib (1997).

3.4.3.2 Procedures used to establish test-retest reliability

Next, the examiner team calculated the test-retest reliability of the measure. Each examiner assessed two pupils in his/her school on two occasions. The researcher (a male) undertook the evaluation in a male school during the weekend, after agreement with the school's principal and pupils' parents. Although small, the sample size was acceptable, for two reasons. First, all the examiners used one BOT-2 kit to assess the examinees (thus, it was difficult for each examiner to evaluate more than two examinees on one day). Each testing occasion took between 45 minutes and 1 hour. Also, the distances between schools are such that it was difficult to provide a study tool (BOT-2) in two schools on the same day. Second, the main study needed a reasonable time for completion. Thus, it was important not to spend much time on this stage to avoid a clash between the timing of the study and the school holidays. Table 9 lists the dates of the tests, and the distribution of the examinees to the examiners. The results are reported in Chapter 4.

Table 9
Test-Retest Reliability Schedules

Sample Gender	Examinees	Date of First Testing # 2013	Date of Second Testing 2013	Teacher Examiner	Residence
Female	1	13-Apr	27-Apr	1	Urban
	2	13-Apr	27-Apr		
	3	14-Apr	25-Apr	2	
	4	14-Apr	25-Apr		
	5	20-Apr	01-May	3	Rural
	6	20-Apr	01-May		
	7	22-Apr	04-May	4	
	8	22-Apr	04-May		
	9	18-Apr	02-May	Researcher	
Male	10	16-Apr	26-Apr	5	Urban
	11	16-Apr	26-Apr		
	12	18-Apr	30-Apr	6	
	13	18-Apr	30-Apr		
	14	23-Apr	05-May	7	Rural
	15	23-Apr	05-May		
	16	21-Apr	06-May	8	
	17	21-Apr	06-May		
	18	18-Apr	02-May	Researcher	

Note. # The average time between first and second testing was from 10 to 15 days.

3.4.4 Summary of pilot study procedures

It took approximately two months to undertake the pilot study to ensure that the reliability of the measure was suitable for the main study. One important task in confirming the reliability of the measure was ensuring that the translated instructions for the test items were clear for both the examiners and examinees. This was achieved by the use of a translation committee, from the Taif University, comprising specialists in the English language and Physical Education. Also, during the training session the researcher and examiners discussed the relevance and significance of each point in every test item. The second task was to train the examiner teachers to assess the examinees' (students') performance in motor proficiency. The workshop included two sections: the test administration procedures, and the recording of the raw scores. The third task involved examining the inter-rater reliability and the test-retest reliability. Although the sample size was small, reliability can be increase by using more reliable and robust research methods (Brennan, 2006). Overall, the study sample in the reliability study was representative of the main study target population.

3.5 Procedure and Data Analysis

The study sought to determine the appropriateness of using the long form of the BOT-2 within Saudi society; it achieved this outcome by examining validity, reliability, and objectivity. Additionally, the study sought to determine if there were significant differences between the male and female students, and between the students in rural and urban residential areas. Moreover, the study sought to achieve a cross-cultural comparison of the motor proficiency of children. All the study's steps and procedures were in accordance with those used in the most relevant previous studies (e.g. Habib, 1997; Jifri, 2003; Tabtabainia, 1995) and were appropriate for addressing the research questions. Furthermore, the sample size for this study, of 188 students (92 male and 96 female) represents a major sample considered more than adequate to investigate this issue, particularly given the extensive information collected from each subject. This sample size is similar to that used in other studies. However, certain practical considerations were important for implementing the study. These included time for the training of examiners, sourcing enough volunteer teacher/assessors, and securing an adequate number of student participants. The next section describes the research methods and data analysis used in the main study, and outlines the results.

3.5.1 Sample

The total number of examinee participants in the main study was 188 pupils (92 males and 96 females) from eight (government building) primary schools in urban and rural areas of Taif city. Taif's education District oversees one of the largest educational zones in Saudi Arabia; it encompasses both urban and rural locations. The urban schools were located in the west and east of the city, and the rural schools were located in the north and south. Classification of schools into these districts was determined by the Taif Education District. The pupils studying in the urban schools lived within the limits of the city, and the pupils studying in the rural schools lived in small villages. The schools participating in the study were selected by the education department and in accordance with the research requirements. For example, the research required an indoor playground located within the school, with enough space for the application of several test items, such as shuttle runs. Approximately 15 participants came from one class in each of three grades (years 1, 3, and 5) from each school. The school administration identified the students for participation. The study sample was partly determined by parental consent so, to this end, letters were sent to all parents in selected grade levels seeking permission for their child to be involved in the study. The researcher excluded any pupil who had repeated the grade or who lived outside the school's catchment. The sample did not include any child with an intellectual or physical disability. Sample characteristics are summarised in Table 10.

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Table 10
Mean Age in Years and Standard Deviation of all Groups by Gender, School Location, and Grade Group

Gender	School Location	Grade 1			Grade 3			Grade 5			N
		N	M	SD	N	M	SD	N	M	SD	
Male	Urban	15	7.51	.23	15	9.92	.27	15	12.16	.46	45
	Rural	17	7.38	.29	15	9.65	.30	15	12.44	.36	47
	Total	32	7.44	.26	30	9.78	.28	30	12.30	.41	92
Female	Urban	17	7.62	.32	16	9.97	.31	15	11.74	.33	48
	Rural	16	7.59	.33	15	9.79	.31	17	11.61	.29	48
	Total	33	7.60	.32	31	9.88	.31	32	11.67	.31	96

Previously published research (e.g., Cohen, Manion & Morrison, 2011; Creswell, 2012), identified in the literature review, was significant in determining the best sample size. International quantitative studies in the same field also confirmed that the size of the research sample was appropriate to the aims of the study. For example, Hassan (2001) had 194 participants, Habib (1997) had 180, Josman et al. (2006) had 226, and Jifri (2003) had 155. Consequently, the current study's sample size (188) fell within the range of sample sizes used in other studies.

3.5.2 Contact with Saudi Department of Education and ethical clearance

Ethics approval was gained through Griffith University (EDN/B1/12/HREC). Additional approval was also sought through the Taif Education District. The Taif Educational District, supported the research, and provided the researcher with the official letters for eight public schools to conduct the study. Details of all approvals is provided in Appendix A.

After considering all the test items and the test administration, the department asked the researcher to not require females to undertake full push-ups; the department concluded it was sufficient for the females to undertake the knee push-up item. As a result, the examiners assessed the female participants' strength using the knee push-ups subtest. In contrast, the male participants' strength was assessed using the full push-up subtest. In the current study, in contrast to the strength subtest as described by Bruininks and Bruininks (2005), the examinee could choose either the knee push-ups or the full push-ups.

3.5.3 Scoring procedures

Generally, BOT-2 provides two types of the subtest scores: the point score and the scale score. In the current study, the investigator used the scale scores; however, for the study comparing the current sample's scores with the BOT-2 norms the investigator used the point score. This approach was confirmed by Hassan (1991), Jifri (2003), and Tabatabainia (1995). Also, in the correlation validity between each item score and its subtest the researcher used the point score, as suggested by Hassan (1991).

As mentioned earlier in relation to training the examiners (in the Training Examiners section), the teacher examiners recorded the raw scores on the record forms. This process was followed for the Manual Dexterity (MD), Upper-Limb Coordination (ULC), Bilateral Coordination (BC), Balance (BAL), Running Speed and Agility (RSA), and Strength (STR) subtests. Examinees completed the Fine Motor Precision (FMP) and Fine Motor Integration (FMI) subtests in booklets provided in the BOT-2 test kit. As the scoring of the FMP and FMI subtests require great familiarity and experience with the BOT-2 scoring guidelines, the research recorded the raw scores for these subtests. In addition, the researcher recorded the entire scale scores and the standard scores for the composite motor-areas. Overall, the scoring of the test items and the administration followed the standardised instructions in the BOT-2 manual and the adminstration of easel book (Bruininks & Bruininks, 2005).

As noted in Chapter 2, many studies have compared the differences between genders in motor skills and motor development. Some of the earlier (e.g., Baine, 2008; Hassan, 1991; Tabatabainia, 1995) used either BOTMP or BOT-2 to compare the male and the female participants. Such studies used point scores; however, the point score was unable to provide the four motor-area composite scores or total motor proficiency scores. These results were shown to be of great value in the current study, especially with regard to the results for the Saudi female children. Moreover, scale scores was used by Wrotniak et al. (2006) when they compared the genders on the overall BOTMP score. Also, Shafir et al. (2006) posited the appropriateness of using this type of scoring in different societies. Thus, the scale scores were deemed more reliable.

Finally, the comparison between the current sample's scores and the BOT-2 test norms used the point score for each subtest. The Saudi participants were grouped by age. Age groups were identified according to the average age in each grade; for example, the mean age for the 1st-grade males was 7.4 years, so this group was compared with the 7-year-old male BOT-2 norm sample (see Hassan, 1991; Jifri 2003; Tabatabainia, 1995).

3.5.4 Testing

Testing in the current study was conducted over two months. Testing occurred for both males and females in urban and rural locations, as outlined in Table 11.

Table 11
Participants' Testing Schedules

Gender	School Location	Date
Female	Urban	4/5/ 2013 – 20/5/2013
	Rural	8/6/2013 – 23/6/2013
Males	Urban	22/5/2013 – 5/6/2013
	Rural	25/6/2013- 10/7/2013

For the purpose of testing, the participants were asked to wear uniforms that would be comfortable to wear when performing moderate physical activity. All the test items were conducted within the schools' indoor playground areas. Each participant was assessed individually, during one session, by either one of the volunteer assessors or the researcher. Participants (pupils) and teacher examiners all belonged to the same schools. The method of using teachers for the data collection had several benefits. First, it helped the examinee to feel more comfortable and relaxed during the test, as they already had a pre-existing relationship with their examiner. For example, the teacher was able to encourage his or her students to relax and not be concerned about failing, especially as the test was not an academic exam.

Second, as the BOT-2 test usually takes quite a long time to administer, the teacher could easily arrange a suitable time during which the students could complete the test. For example, usually primary schools make time for free activities once a week; some teachers assessed the pupils during this time. Third, as the male and female students attend separate schools in the Saudi education system, the male teachers assessed the male students and the female teachers assessed the female students. To ensure that the study had a minimal impact on normal school routines, the researcher evaluated the majority of students (a little over half of the participants) in the afternoons after school. When the testing occurred outside of school hours, parents also attended the test with their children. Figure 7 shows the number of pupils, by gender, assessed by each of the examiners, including the researcher.

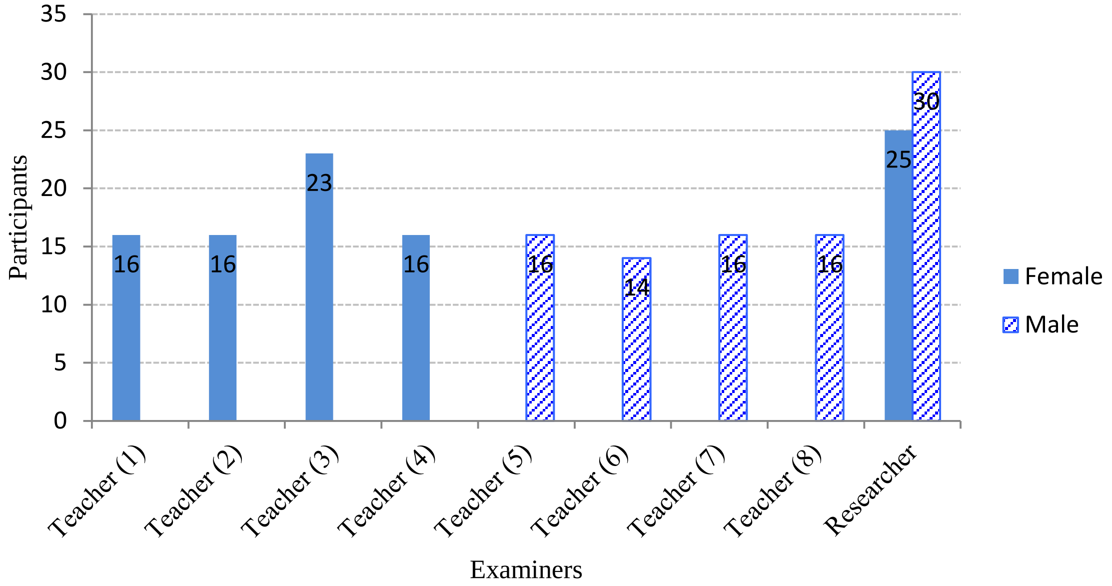

Figure 7. Distribution of participants on examiners.

3.5.5 Data analysis

Independent variables were residential area, gender, and grade; dependent variables were total motor composite score, fine manual control, manual coordination, body coordination, and strength and agility. A review of the relevant international studies which applied either BOTMP or BOT-2 indentified the work of Baine (2008), Chui et al. (2007) Hassan (1991), Jifri (2003), Josman et al. (2006), Habib (1997), Tabatabainia (1995), and Venetsanou et al. (2009). From this review, the researcher determined the most appropriate statistical treatment to best address the research questions. The following paragraphs describe the statistical methods used for each question.

Research Question 1 aimed to define the differences between the Saudi children and the BOT-2 norm sample. Applying one-sample t-test, the researcher used the statistical procedure used by Chui et al. (2007), Hassan (1991), Jifri (2003), and Tabatabainia (1995).

Research Question 2 sought to identify the effect of the independent variables on the dependent variables. The investigator applied a three-way analysis of variance (ANOVA). This statistical treatment was congruent with several studies and recommendations (e.g., Jifri, 2003; Thomas et al., 2011). Also, the researcher used Fisher's LSD post-hoc test, as recommended by Corty (2007).

Research Question 3 sought to identify the potential of applying BOT-2 on Saudi society by examining three features. The first feature was the objectivity of BOT-2. Similar previous studies have included multiple examiners and applied either the BOTMP or the BOT-2 (e.g., Kegel et al., 2012; Lucas et al., 2013; Mercer, Hankins, Spinks, & Tedder, 2009; Roeber, Tober, Bolt, & Pollak, 2012). The common element across those studies was that they used two raters, except for Kegel et al. (2012) who used three raters. Also, the studies used the intraclass correlation coefficient (ICC) to evaluate the inter-rater reliability. In addition, some test items were used from BOTMP or BOT-2.

The current study involved nine examiners and all of the BOT-2 items. Therefore, applying the ICC was deemed as not appropriate because of the small sample size. Thus, the investigator established the inter-rater reliability by having two raters examine two participants; then, the percentage agreement and average difference between both raters were identified. This approach was congruent with the approach used by Bruininks and Bruininks (2005).

The second feature related to the test-retest reliability of the BOT-2. A number of previous studies (e.g., Kegel et al., 2012; Lucas et al., 2013; Mercer et al., 2009; Wuang & Su, 2009) examined test-retest reliability using the ICC statistical approach. However, the Bruininks and Bruininks (2005) manual applies the test-retest reliability with the Pearson correlation coefficient. The current study used both statistical methods to establish test-retest reliability of the measure.

The final feature was the validity of the BOT-2, as indicated by internal consistency. This method was used by a number of international studies (e.g., Hassan 1991; Jifri, 2003; Tabatabainia, 1995) to determine the validity of the BOTMP. Also, the model was applied by Bruininks and Bruininks (2005).

Table 12 summarises the statistical methods for each question. SPSS v22 was used for all data analysis, and Excel was used to prepare graphics. The following convention was used throughout the dissertation to indicate levels of significance (* < .05, ** < .01, and *** < .001).

Table 12
Statistical Analyses for Research Questions

Research Question	Data Collection	Analysis Approach	Outcomes
RQ 1	Comparison between Saudi study groups and North American norms by gender and age.	One-sample t-test.	Differences between Saudi participants' scores and BOT-2 norms.
RQ 2	Differences among the study groups in terms of fine manual control, manual coordination, body coordination, strength and agility, and total motor composite, to find any statistical differences among the three independent variables.	A 2 x 2 x 3 (residential areas x gender x grade) three-way ANOVA with a Fisher's LSD post-hoc test. Also, independent t-test was applied to discover any significant interactions.	Effect of independent variables on the dependent variables.
RQ 3	Inter-rater reliability between two examiners.	Percentage agreement Average difference.	Objectivity of the BOT-2.
	Test-retest reliability between first and second evaluation.	Pearson product-moment Intra-class correlation coefficient with a two-way mixed effect.	Reliability of the BOT-2.
	Computation of correlation between: • Each item point score and its subtest point score. • Each subtest scale score and its motor-area composite. • Each subtest and total motor composite scores. • Fine manual control, manual coordination, body coordination, strength and agility, and the total motor composite scores. • Total motor composite scores and short form scores.	Pearson product-moment (internal consistency).	Validity of the BOT-2.

3.6 Conclusion

This chapter has reviewed the methods and procedures adopted for the study, including the procedures related to the pilot study, and the selection of participants, testing, data collection, and data analysis for the main study. It provides an overview of the research methods selected to achieve the aims of the current study. The chapter argues that a quantitative research approach was the appropriate paradigm for examining the validity, objectively, and reliability of using BOT-2 in Saudi society. This aim was addressed in two parts: the pilot study and main study. Additionally, a cross-sectional research approach was deemed as the design most conducive to comparisons among the study groups and between the Saudi groups and the BOT-2 norms. Various statistical analyses were used, namely Pearson product-moment correlation, intra-class correlation coefficient, a one-sample t-test, an independent t-test, and a three-way ANOVA. The next chapter presents the results of the study.

4 RESULTS

This study explores the development of motor proficiency in Saudi children, with a focus on difference according to gender, age, and urban/rural location. Also, this study includes comparisons between the study sample and BOT-2 norms. Finally, this study examines the possibility of using BOT-2 in Saudi society.

This chapter presents the results from the data collection process documented in the previous chapter in order to answer the study’s three research questions:

1. What is the performance level of Saudi children compared to the BOT-2 norms?
2. Are there any differences between the Saudi groups according to gender, residential area, and age? Five areas of motor proficiency were assessed:
    a. Fine manual control
    b. Manual coordination
    c. Body coordination
    d. Strength and agility
    e. Total motor composite
3. Is BOT-2 appropriate for assessing Saudi children’s motor proficiency?

4.1 Respondents

The sample of 188 students (92 males and 96 females), tested on the BOT-2, was selected from the primary grades 1, 3, and 5, from eight schools (the details are summarised in Table 13).

Table 13
The Study Sample by Gender, School, and Grade

Gender	Location	Grade 1	Grade 3	Grade 5	N
Male	Urban	6	7	5	18
		9	8	10	27
	Rural	8	8	9	25
		9	7	6	22
	Total Male	32	30	30	92
Female	Urban	5	7	6	18
		12	9	9	30
	Rural	7	6	10	23
		9	9	7	25
	Total Female	33	31	32	96
Total		65	61	62	188

The findings from this study are presented in three major sections, in parallel with the research questions: (a) comparison of Saudi children's performance to BOT-2 norms, (b) the differences among the Saudi groups, and (c) the appropriateness of using BOT-2 in Saudi society. As detailed in Chapter 3, for the comparative analysis between the Saudi data and the BOT-2 norms, the data point scores are used, as the normed data is based on point scores. For the detailed comparison of results from Saudi children provided for each of the subtests (Sections (b) and (c)), data scale scores were calculated from the individual measures, and are presented and used in the analysis, in line with the standard approach to this analysis (e.g., Jifri 2003).

4.2 What is the Performance Level of Saudi Children Compared to the BOT-2 Norms?

Before examining in depth the results from this study, it is useful to provide a comparison of the mean point scores found on each of the eight subtests for the Saudi sample and the normed BOT-2 values as shown (Figures 8 to 11).

The following graphs are presented by gender and subtest scores. Figure 8 and 9 compare the performance of Saudi males with BOT-2 males' norms on BOT-2 subtests. Overall, there are strong similarities in the performance subtest scores between Saudi groups and BOT-2 norms across gender and age. For instance, on most subtests, 9-year-old Saudi males' scores were similar to, but slightly lower than, the BOT-2 norms for 9-year-old males.

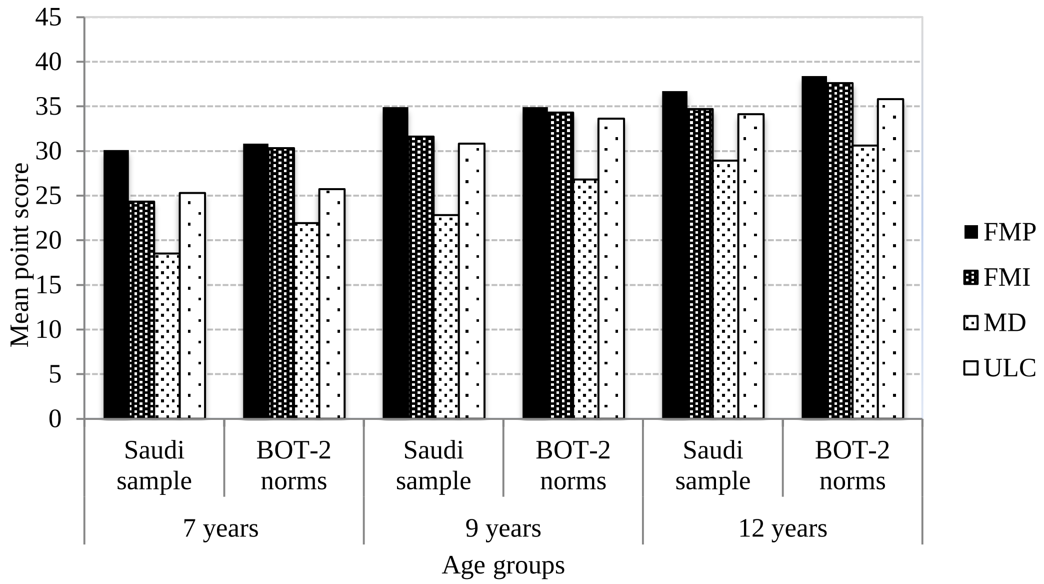

Figure 8. Saudi males' mean point scores on FMP, FMI, MD, and ULC subtests, and BOT-2 males' norms, by age.

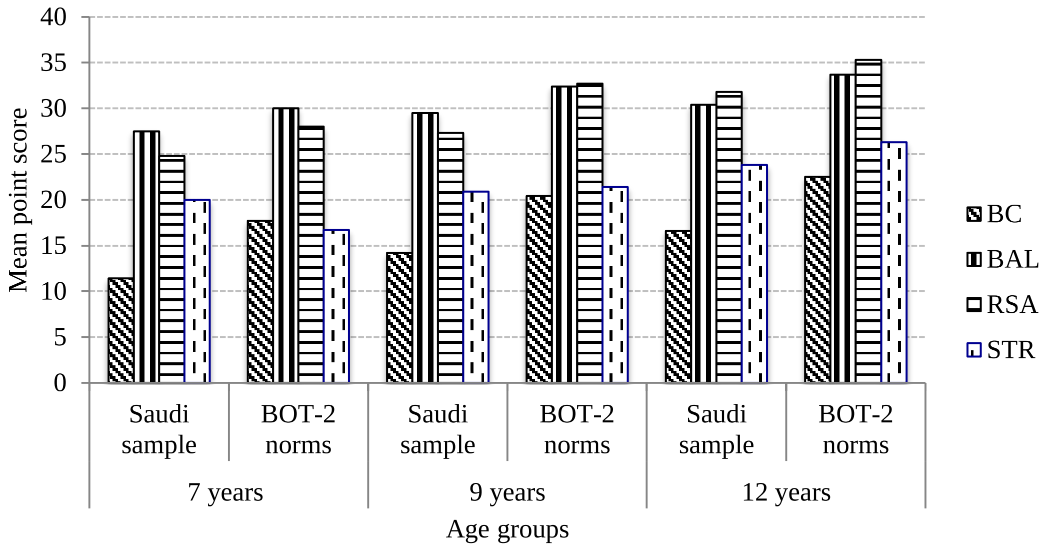

Figure 9. Saudi males' mean point scores on BC, BAL, RSA, and STR subtests, and BOT-2 males' norms, by age.

Similar patterns are also seen for Saudi females. Overall, Saudi females' scores on the BOT-2 subtests were similar to the BOT-2 females' norms, as shown in Figure 10 and 11. However, Saudi females scored lower than the BOT-2 norms in some subtests, such as MD, ULC, and BC. In contrast, Saudi females in all age groups scored higher than the BOT-2 norms on the FMP subtest.

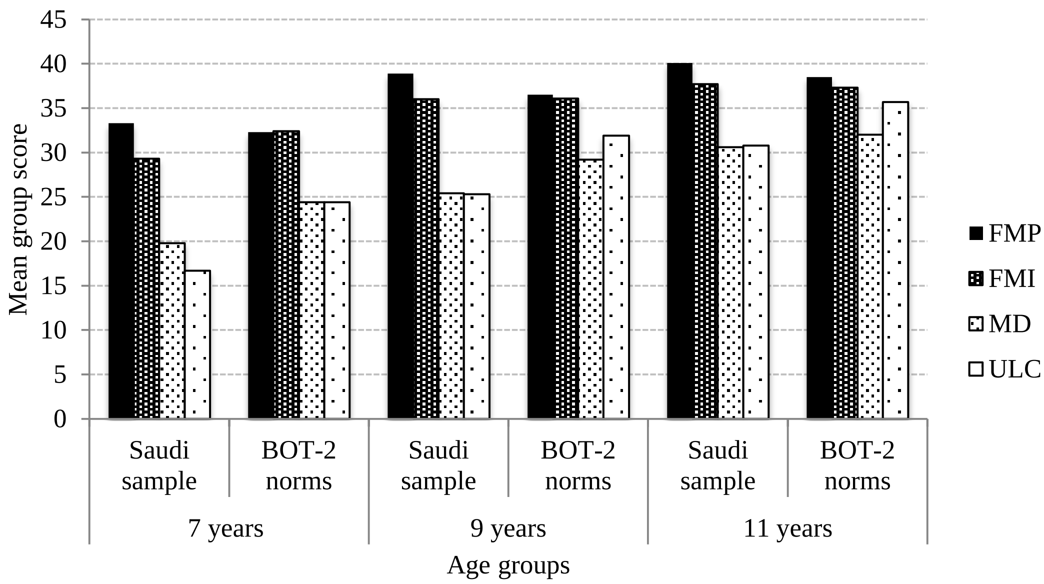

Figure 10. Saudi females' mean point scores on FMP, FMI, MD, and ULC subtests, and BOT-2 females' norms, by age.

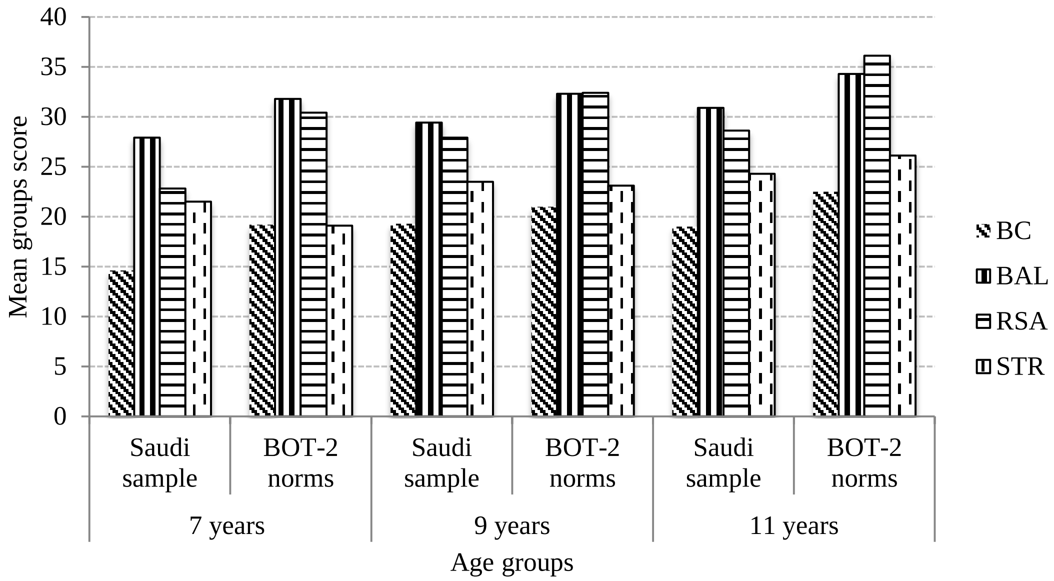

Figure 11. Saudi females' mean point scores on BC, BAL, RSA, and STR subtests, and BOT-2 females' norms, by age.

The results indicate that there are age and gender differences across the eight subtests. This raises the questions of why might these occur. The differences, and the potential reasons for these differences, will be the focus of detailed examination in the following section, which compares Saudi results by grade, gender, and residential area.

4.2.1 Detailed results of subtests by gender and age against BOT-2 norms

The following section presents the results of the three age groups, by gender, showing their performance against the BOT-2 subtest norms. These differences are all assessed using 2-sided t-tests. The discussion thus focusses on whether the Saudi participants' scores differ significantly from the norms, and whether they are higher or lower.

4.2.1.1 First grade (males and females)

A comparison between the Saudi 1st-grade males and the BOT-2 norms is presented in Table 14. From this table it is apparent that there are both areas of similarities and differences between the performance levels of the Saudi males and the normed values across the eight subtests of the BOT-2. Notably, for five of the six subtests on which there was a significant difference from the norms (namely, FMI, MD, BC, BAL, and RSA), the Saudi sample showed significantly lower development than the BOT-2 norms; in contrast, the Saudi sample scored significnatly higher than the BOT-2 norm on the strength subtest.

Table 14
Means and Standard Deviations of 7-Year-old Saudi Males and 7-Year-old BOT-2 Males, and t-tests Comparing the Samples

Subtests	Saudi 1st Grade (*n* = 32)		BOT-2 Norm # (*n* = 53)		One Sample t-test		
	M	SD	M	SD	t	df	p
Fine Motor Precision (FMP)	30.1	4.0	30.8	7.1	-0.84	31	ns
Fine Motor Integration (FMI)	24.3	4.5	30.3	7.7	-7.46	31	***
Manual Dexterity (MD)	18.5	2.9	21.9	5.5	-6.30	31	***
Upper-Limp Coordination (ULC)	25.3	5.0	25.7	9.5	-0.36	31	ns
Bilateral Coordination (BC)	11.4	3.8	17.7	5.1	-9.23	31	***
Balance (BAL)	27.5	3.3	30.0	6.6	-4.08	31	***
Running Speed and Agility (RSA)	24.8	4.5	28.0	7.6	-3.88	31	**
Strength with full push-up (STR)	20.0	5.4	16.7	6.8	3.48	31	**

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency* (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

Two subtests measure fine manual control. On one subtest, FMP, the Saudi males' mean score did not differ significantly from the BOT-2 norm. On the other subtest, FMI, the Saudi males scored significantly lower (24.3) than the BOT-2 norm (30.3; t = -7.46, df = 31, $p < .000$). Notably, for both subtests (BC, BAL) related to the body coordination area, the Saudi 1st-grade males recorded scores that were significantly lower than the BOT-2 norms.

However, on the strength and agility subtest (RSA), the BOT-2 norm was significantly higher than the mean for the Saudi group. In contrast, the Saudi group scored higher than the BOT-2 norm on the strength subtest (STR; t = 3.48, df = 31, $p = .001$). This result indicates that, at this young age, Saudi boys perform better than the BOT-2 norms on those test items related to gross motor skills, such as long jumps, full push-ups, and sit-ups.

A similar comparison of performance for the females is presented in Table 15. The pattern of differences between the female participants' scores and the norms was similar to the pattern of differences between the male participants' scores and the norms. Like the male participants, the Saudi female participants scored higher than the BOT-2 norm on the strength subtest (t = 2.99, df = 32, p = .005); however, they scored significantly lower than the BOT-2 norms on all other subtests, except on the FMP subtest, on which there was no difference.

Table 15
Means and Standard Deviations of 7-year-old Saudi Females and 7-year-old BOT-2 Females, and t-tests Comparing the Samples

Subtests	Saudi 1st Grade (n = 33)		BOT-2 Norm # (n = 57)		One Sample t-test		
	M	SD	M	SD	t	df	p
Fine Motor Precision (FMP)	33.3	3.6	32.3	4.8	1.55	32	ns
Fine Motor Integration (FMI)	29.3	5.1	32.4	6.2	-3.40	32	**
Manual Dexterity (MD)	19.8	3.1	24.4	5.0	-8.41	32	***
Upper-Limp Coordination (ULC)	16.7	7.1	24.4	7.1	-6.17	32	***
Bilateral Coordination (BC)	14.6	3.7	19.2	4.2	-6.96	32	***
Balance (BAL)	27.9	4.3	31.8	4.4	-5.10	32	***
Running Speed and Agility (RSA)	22.8	3.8	30.4	5.9	-11.15	32	***
Strength with knee push-up (STR)	21.5	4.6	19.1	5.7	2.99	32	**

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency* (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

In summary, the Saudi female group were significantly lower than the BOT-2 norms in all subtests, except for the Fine Motor Precision (FMP) subtest, where no significant difference was seen, and for the Strength (STR) subtest, on which the Saudi females scored significantly higher than the BOT-2 norm.

4.2.1.2 Third grade (males and females)

Table 16 compares the performance of the 3rd grade Saudi males with the BOT-2 norms. There were areas of similarities and differences between the Saudi participants' scores and the BOT-2 norms. There were no significant differences between the two groups on the

FMP and STR subtests. However, the Saudi group scored significantly lower than the BOT-2 norms on the other subtests.

Table 16

Means and Standard Deviations of 9-year-old Saudi Males and 9-year-old BOT-2 Males, and t-tests Comparing the Samples

Subtests	Saudi 3rd Grade (*n* = 30)		BOT-2 Norm # (*n* = 55)		One Sample t-test		
	M	SD	M	SD	t	df	p
Fine Motor Precision (FMP)	34.9	4.6	34.9	4.4	0.00	29	ns
Fine Motor Integration (FMI)	31.6	5.5	34.3	4.6	-2.59	29	*
Manual Dexterity (MD)	22.8	3.1	26.8	4.5	-6.93	29	***
Upper-Limp Coordination (ULC)	30.8	3.7	33.6	4.9	-4.02	29	***
Bilateral Coordination (BC)	14.2	3.9	20.4	4.1	-8.49	29	***
Balance (BAL)	29.5	4.0	32.4	3.6	-3.89	29	**
Running Speed and Agility (RSA)	27.3	4.1	32.7	5.9	-6.97	29	***
Strength with full push-up (STR)	20.9	5.2	21.4	6.2	0.55	29	ns

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency*. (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

On the Fine Motor Precision (FMP) subtest, the Saudi group's mean score was no different to the norm (M=34.9), and there was no significant differnce between the Saudi participants' mean score and the norm on the STR subtest. On all other subtests, the Saudi participants scored significantly lower than the BOT-2 norms. For example, on the Bilateral Coordination (BC) subtest, the Saudi sample mean was 14.2, and the BOT-2 norm was 20.4.

Table 17 shows the comparison between the Saudi 3rd grade females and the BOT-2 norms. No significant differences were found between the Saudi mean scores and the BOT-2 norms on the FMI or STR subtests. However, the mean for the Saudi sample was significantly higher than the BOT-2 norm on the FMP subtest (t = 6.67, df = 30, $p < .000$). In contrast, the Saudi participants' mean scores were significantly lower than the BOT-2 norms on all other subtests.

Table 17
Means and Standard Deviations of 9-Year-old Saudi Females and 9-Year-old BOT-2 Females, and t-tests Comparing the Samples

Subtests	Saudi 3rd Grade (*n* = 31)		BOT-2 Norm # (*n* = 55)		One Sample t-test		
	M	SD	M	SD	t	df	p
Fine Motor Precision (FMP)	38.9	2.0	36.5	4.2	6.67	30	***
Fine Motor Integration (FMI)	36.0	2.8	36.1	3.3	-0.19	30	ns
Manual Dexterity (MD)	25.4	3.7	29.2	4.8	-5.55	30	***
Upper-Limp Coordination (ULC)	25.3	6.2	31.9	4.5	-5.89	30	***
Bilateral Coordination (BC)	19.3	3.3	21.0	4.1	-2.81	30	**
Balance (BAL)	29.4	4.3	32.3	3.8	-3.63	30	**
Running Speed and Agility (RSA)	27.9	4.0	32.4	5.9	-6.16	30	***
Strength with knee push-up (STR)	23.5	4.5	23.1	5.7	0.59	30	ns

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency*. (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

The results indicated that the performances by the 3rd grade male and female Saudi participants were consistent with the BOT-2 norms on some subtests. For example, on the STR subtest, there was no difference between Saudi participants and the BOT-2 norms. However, the Saudi females' mean score exceeded the BOT-2 females' norm in the FMP subtest. This would suggest that the Saudi females have higher levels of motor proficiency in some movement tasks, such as folding paper and cutting out with scissors.

4.2.1.3 Fifth grade (males and females)

The results of the comparison between the 5th grade Saudi males and the BOT-2 norms are shown in Table 18. The comparison between the male groups showed that the Saudi sample scored below the norms on all subtests.

Table 18

Means and Standard Deviations of 12-Year-old Saudi Males and 12-year-old BOT-2 Males, and t-tests Comparing the Samples

Subtests	Saudi 5th Grade (*n* = 30)		BOT-2 Norm # (*n* = 52)		One Sample t-test		
	M	SD	M	SD	t	df	*p*
Fine Motor Precision (FMP)	36.7	3.8	38.4	3.8	-2.34	29	*
Fine Motor Integration (FMI)	34.7	4.9	37.6	2.3	-3.23	29	**
Manual Dexterity (MD)	28.9	3.1	30.6	4.4	-2.96	29	**
Upper-Limp Coordination (ULC)	34.1	3.4	35.8	3.7	-2.70	29	*
Bilateral Coordination (BC)	16.6	4.4	22.5	2.4	-7.32	29	***
Balance (BAL)	30.4	4.1	33.7	2.6	-4.25	29	***
Running Speed and Agility (RSA)	31.8	5.3	35.3	7.7	-3.60	29	**
Strength with full push-up (STR)	23.8	4.9	26.3	7.5	-2.74	29	*

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency*. (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

The differences were clear, particularly on the BC and BAL subtests, which relate to body coordination (BC: t = -7.32, df = 29, p < .000; BAL: t = -4.25, df = 29, p < .000). These results revealed that the Saudi group performed significantly below the norm values on movement tasks that require body control and balance ability.

The comparisons between the female groups are shown in Table 19. No significant difference was identified between the Saudi girls' mean and the BOT-2 norm on the FMI subtest. However, the Saudi females scored significantly higher than the BOT-2 norm on the FMP subtest (t = 7.45, df = 31, p < .000). In contrast, the Saudi sample scored significantly lower than the BOT-2 norms on the six other subtests.

Table 19
Means and Standard Deviations of 11-Year-old Saudi Females and 11-year-old BOT-2 Females, and t-tests Comparing the Samples

Subtests	Saudi 5th Grade (*n* = 32)		BOT-2 Norm # (*n* = 53)		One Sample t-test		
	M	SD	M	SD	t	df	*p*
Fine Motor Precision (FMP)	40.1	1.2	38.5	3.0	7.45	31	***
Fine Motor Integration (FMI)	37.7	2.7	37.3	2.9	0.92	31	ns
Manual Dexterity (MD)	30.6	3.6	32.0	4.4	-2.04	31	*
Upper-Limp Coordination (ULC)	30.8	5.7	35.7	3.3	-4.75	31	***
Bilateral Coordination (BC)	19.0	3.2	22.5	1.8	-5.92	31	***
Balance (BAL)	30.9	2.6	34.3	2.5	-6.47	31	***
Running Speed and Agility (RSA)	28.6	4.0	36.1	5.4	-10.22	31	***
Strength with knee push-up (STR)	24.3	4.5	26.1	6.1	-2.16	31	*

Note. # From *Bruininks-Oseretsky Test of Motor Proficiency*. (2nd ed.). Minneapolis, MN: Pearson Assessments, by Bruininks & Bruininks, 2005, p. 60.

Like the Saudi 5th-grade males, the Saudi 5th-grade females scored significantly lower than the BOT-2 norms on the BC and BAL subtests, which measure body coordination. However, the Saudi group recorded high differences from the BOT-2 norms in the movement tasks (FMP and FMI) that require the precise control of fingers and hands, such as drawing lines through paths.

4.2.1.4 *Age-related patterns*

This section provides a summary (see Table 20) of the overall patterns by age and gender from the results presented above, and clarifies the differences between the sudy sample's motor proficiency scores and the BOT-2 norms. The Saudi results were significantly lower than the BOT-2 norms on the majority of subtests across all grades. However, on some subtests, such as the MD for both genders, and the FMI for the female groups, this difference diminished with the increased age of the sample group. Also, on the

Fine Motor Precision (FMP) subtest, the 3rd grade and 5th grade Saudi females' mean scores were significantly higher than the BOT-2 norms. Interestingly, although the 1st-grade male and female Saudi participants scored higher than the BOT-2 norm on the Strength (STR) subtest, 5th grade Saudi participants scored significantly lower than the BOT-2 norms on this subtest.

Table 20

Summary of Comparisons Between the Saudi Groups' Scores and the BOT-2 Norms

Composite	Subtest	Male			Females		
		Grade			Grade		
		1	3	5	1	3	5
Fine manual control	FMP	ns	ns	* ↓	ns	*** ↑	*** ↑
	FMI	*** ↓	* ↓	** ↓	** ↓	ns	ns
Manual coordination	MD	*** ↓	*** ↓	** ↓	*** ↓	*** ↓	* ↓
	ULC	ns	*** ↓	* ↓	*** ↓	*** ↓	*** ↓
Body coordination	BC	*** ↓	*** ↓	*** ↓	*** ↓	** ↓	*** ↓
	BAL	*** ↓	** ↓	*** ↓	*** ↓	** ↓	*** ↓
Strength and Agility	RSA	** ↓	*** ↓	** ↓	*** ↓	*** ↓	*** ↓
	STR	** ↑	ns	* ↓	** ↑	ns	* ↓

Note. ↑ = Saudi group higher than BOT-2 norm. ↓ = Saudi group lower than BOT-2 norm.

In the fine manual control motor-area there are areas of similarities and differences between the Saudi males' and females' scores and the BOT-2 norms. For example, on the FMP subtest, 1st grade male and female Saudi children's scores were not significantly different from the BOT-2 norms. However, in the later age levels the male groups recorded lower scores than the BOT-2 norms, and the females recorded scores that were significantly higher the norms. Also, on the FMI subtest, the Saudi male groups scored lower than the BOT-2 norms at all age levels; yet the Saudi female groups started lower and became higher at later age levels. These results suggest that, with increasing age, different social factors might be influencing skill development.

Generally, in the manual coordination motor-area, assessed by the MD and ULC subtests, both Saudi gender groups recorded significantly lower than the BOT-2 norms. The most interesting result was that the Saudi females at all age levels scored significantly lower on the Upper-Limb Coordination (ULC) subtest; thus, the Saudi female groups scored lower than the BOT-2 norms on the test items that require coordination between arms and hands, such as catching and dribbling a ball.

The most marked differences between the Saudi study groups and the BOT-2 norms were in the body coordination motor-area. In both genders, and at all age levels, the Saudi groups scored lower than the BOT-2 norms in both (BC and BAL) subtest scores. This means that, for all the movement skills that require body control and coordination between the upper and lower limbs, as well as balance skills (such as stability, stasis, and dynamic), the Saudi groups recorded performances significantly lower the BOT-2 norms.

Finally, in the strength and agility area, a clear difference in performance on strength and agility was seen. For the Running Speed and Agility measure (RSA) both the Saudi gender groups recorded significantly lower scores than the BOT-2 norms. However, in the Strength (STR) subtest, both the Saudi boys and girls were initially stronger (Grade 1); then there was no difference (Grade 3); and then they scored weaker (Grade 5). This means that the rate of increase in the strength ability of the Saudi sample fell behind the increase in the BOT-2 norms. Hence, the Saudi groups did not maintain their progress at these tasks. In conclusion, the cultural differences appear to influence the majority of the motor development areas.

4.3 Are There any Differences Between the Saudi Groups According to Gender, Residential area, and Grade?

Given the clear variation in the physical achievement in the different age samples, it was deemed valuable to explore whether such differences can, to some degree, be explained by factors such as gender or residential area. The items were assessed in terms of:

a. Fine manual control,
b. Manual coordination,
c. Body coordination,
d. Strength and agility,
e. Total motor composite.

Before discussing the answers to the question, the descriptive statistics are addressed according to the subtest scores for the study groups. As noted in Chapter 3, and earlier in this chapter, the subtest scores used here relied on the scale score from Bruininks and Bruininks (2005).

This type of score may show that the younger participants recorded higher score than the older participants. This is expected because the point scores are not adjusted for age and gender.

4.3.1 Subtest scores

The Saudi children's motor proficiency was explored in relation to the different locations (rural and urban) and gender. This section is divided into these major descriptive statistics.

4.3.1.1 Implications by residential area

The descriptive statistics from the BOT-2 and results from the independent t-test for males and females, who live in different locations (urban and rural), are shown in Tables 21 and 22.

Table 21 indicates the impact of school location on the subtest scores of the male participants. In all grades, the urban pupils scored higher on average than the rural pupils on the subtests Fine Motor Precision (FMP) (15.6 – 18.6), Upper-Limb Coordination (ULC) (13.4 – 18.1), and Bilateral Coordination (BC) (10 -12.6). The differences in scores on the FMP subtest were significant in the 3rd and 5th grade students, but not in the 1st grade students. With regard to the Upper-Limb Coordination (ULC) subtest, the only significant difference was for those in the 3rd grade. None of the differences on the BC subtest were significant.

Table 21

The BOT-2 Subtest Scale Scores for Male Groups by Grade and Location (n=92), Assessing for Each Grade Significant Differences by School Location

BOT-2 subtest	School location	Grade 1			Grade 3			Grade 5		
		M	SD	*p*	M	SD	*p*	M	SD	*p*
Fine Motor Precision (FMP)	Urban	18.4	3.3	ns	18.6	4.0	***	15.6	4.0	**
	Rural	17.6	5.2		12.6	3.8		11.2	4.1	
Fine Motor Integration (FMI)	Urban	13.0	1.6	ns	14.2	4.2	*	14.9	4.2	**
	Rural	13.2	3.6		11.2	3.3		9.7	3.6	
Manual Dexterity (MD)	Urban	14.3	3.2	ns	12.5	3.4	ns	13.4	3.0	ns
	Rural	15.2	3.4		10.7	2.8		12.3	3.7	
Upper-Limp Coordination (ULC)	Urban	18.1	3.2	ns	14.5	3.4	*	13.4	4.0	ns
	Rural	16.0	2.5		12.2	2.1		11.7	3.4	
Bilateral Coordination (BC)	Urban	12.6	2.7	ns	10.0	3.4	ns	10.3	5.0	ns
	Rural	12.3	3.8		8.5	1.9		7.7	2.0	
Balance (BAL)	Urban	12.8	3.1	ns	11.2	3.6	ns	13.0	4.6	ns
	Rural	14.7	3.3		12.4	3.1		10.2	3.2	
Running Speed and Agility (RSA)	Urban	12.6	2.6	***	9.4	1.8	***	11.1	3.9	ns
	Rural	18.2	2.5		13.0	2.5		13.0	2.8	
Strength with full push-up (STR)	Urban	15.6	3.6	***	13.0	3.4	***	12.3	4.0	ns
	Rural	21.6	2.6		18.2	3.4		14.6	3.0	

In contrast, the rural pupils scored higher than the urban students on the Running Speed and Agility (RSA) (13 -18.2) and Strength (STR) (14.6 – 21.6) subtests. For example, the means for the Grade 1 boys on the STR subtest were 15.6 for the urban boys and 21.6 for the rural boys. On the Fine Motor Integration (FMI) subtest, the 1st grade pupils in the rural schools scored slightly higher than 1st grade students from urban schools. However, among 3rd and 5th grade male students, those from urban schools significantly higher than those in rural schools. Similarly, on the Manual Dexterity (MD) subtest, 1st grade rural students scored higher than 1st grade urban students; in contrast, among 3rd and 5th grade students, urban students scored higher than rural students. On the Balance (BAL) subtest, the 1st and

3rd grade rural pupils' scores (M = 14.7, SD = 3.3, and M = 12.4, SD = 3.1, respectively) were higher than then urban pupils' scores, whereas, amongst the 5th grade students, the urban pupils' scores were higher than the rural pupils' scores.

In summary, the urban pupils had better scores in the fine manual control motor area (FMP, FMI), while the rural pupils recorded better scores in the strength and agility motor area (RSA, STR). However, there was no consistent pattern in both study groups in the manual coordination motor-area (MD, ULC) and the body coordination motor-area (BC, BAL).

Table 22 shows the effect of the place of residence on the performance of the female study groups. Compared to the urban students, the rural female pupils obtained better scores in the Balance (BAL) and Strength (STR) subtests in all grades, on average; however, the only significant difference was for 1st grade students on the STR subtest. In contrast, the urban pupils recorded higher scores than the rural groups on the FMI, MD, and ULC subtests. Only the differences on the MD subtest were significant; these differences were significant in all grades. There was a disparity between the means of the other subtest scores for the female groups, by school grade.

Table 22

The BOT-2 Subtest Scale Scores for Female Groups by Grade and Location (n = 96), Assessing for Each Grade Significant Differences by School Location

BOT-2 subtest	School location	Grade 1			Grade 3			Grade 5		
		M	SD	*p*	M	SD	*p*	M	SD	*p*
Fine Motor Precision (FMP)	Urban	17.3	2.9	ns	18.4	4.5	ns	20.6	2.7	ns
	Rural	17.4	4.5		20.0	3.8		18.6	3.4	
Fine Motor Integration (FMI)	Urban	14.5	4.2	ns	15.3	3.7	ns	18.1	4.0	*
	Rural	13.4	4.3		14.6	4.4		14.6	4.3	
Manual Dexterity (MD)	Urban	13.5	3.8	*	14.1	3.5	*	16.4	3.2	**
	Rural	11.0	3.1		11.2	3.6		12.3	3.8	
Upper-Limp Coordination (ULC)	Urban	11.7	6.1	ns	12.4	3.2	ns	12.8	4.3	ns
	Rural	11.3	6.0		10.0	4.2		11.1	5.0	
Bilateral Coordination (BC)	Urban	10.6	3.7	ns	10.8	4.1	ns	10.0	10.5	ns
	Rural	11.7	3.1		13.5	3.6		9.1	3.8	
Balance (BAL)	Urban	10.4	3.4	ns	10.3	4.0	ns	10.1	3.5	ns
	Rural	12.5	4.4		10.8	3.9		10.8	5.1	
Running Speed and Agility (RSA)	Urban	10.2	2.9	*	11.1	3.0	ns	11.4	1.9	ns
	Rural	12.3	2.4		12.6	2.3		10.8	3.3	
Strength with knee push-up (STR)	Urban	17.2	4.5	***	15.0	4.2	ns	13.8	2.5	ns
	Rural	22.0	2.0		17.0	4.0		15.4	4.2	

In general, the results were substantially similar to the results for the males. For example, the urban groups recorded higher average scores in the fine manual control motor–area than the rural groups, especially on the FMI subtest. In addition, the urban groups recorded better scores than the rural groups on both subtests (MD and ULC) measuring manual coordination. However, the rural groups obtained higher scores than the urban groups in the strength and agility motor-area, especially on the STR subtest.

4.3.1.2 Implications by gender

The disparities in the performance of the male and female pupils on the BOT-2 subtests are given in Table 23. Generally, there were no large differences between the genders on most of the subtests. However, the male pupils in all grades excelled on the LUC subtest (range 12.5 – 17), and the BAL subtest (range 11.6 – 13.8). Among students in 1st and 3rd grades, the males' average score on the ULC subtest was significantly higher than the females' average score. Among students in 1st grade, the males' average score on the BAL subtest was significantly higher than the females' average score. However, among students in 3rd and 5th grades, the female pupils scored significantly higher than the males on the FMI subtest (females' range 14 – 16.2). Females in all grades also scored higher than males on the STR subtest (females' range 14.7 – 19.5), but this difference was not significant. Although the 1st grade male pupils achieved higher scores than the 1st grade female pupils in the FMP, MD, BC, and RSA subtests, the 3rd grade female pupils obtained better scores than the 3rd grade males on the same subtests.

Table 23
The BOT-2 Subtest Scale Scores for Male and Female Groups by Grade in Both Locations (N = 188)

BOT-2 subtest	Gender	Grade 1			Grade 3			Grade 5		
		M	SD	*p*	M	SD	*p*	M	SD	*p*
Fine Motor Precision (FMP)	M	18.0	4.3	ns	15.6	4.9	**	13.4	4.5	***
	F	17.3	3.7		19.1	4.2		19.5	3.2	
Fine Motor Integration (FMI)	M	13.1	2.8	ns	12.7	4.0	*	12.3	4.7	**
	F	14.0	4.2		15.0	4.0		16.2	4.5	
Manual Dexterity (MD)	M	14.8	3.3	**	11.6	3.2	ns	12.8	3.3	ns
	F	12.3	3.7		12.7	3.8		14.2	4.0	
Upper-Limp Coordination (ULC)	M	17.0	3.0	***	13.3	3.0	*	12.5	3.7	ns
	F	11.5	6.0		11.2	3.8		11.9	4.7	
Bilateral Coordination (BC)	M	12.4	3.3	ns	9.26	2.8	**	9.0	4.0	ns
	F	11.1	3.4		12.1	4.1		9.56	3.5	
Balance (BAL)	M	13.8	3.3	*	11.8	3.4	ns	11.6	4.2	ns
	F	11.4	4.0		10.6	3.9		10.5	4.3	
Running Speed and Agility (RSA)	M	15.5	3.8	***	11.2	2.8	ns	12.1	3.5	ns
	F	11.2	2.9		11.8	2.8		11.0	2.7	
Strength with knee push-up (STR)	M	18.8	4.3	ns	15.6	4.3	ns	13.4	3.6	ns
	F	19.5	4.2		15.9	4.2		14.7	3.5	

In general, no gender dominated. However, some scores were higher in the female groups for the fine manual control, and strength and agility composite scores. In addition, as shown in Table 23, some of the male groups scored higher than the females on the BC and BAL subtests, which constitute the body coordination composite.

In conclusion, the differing residential locations (urban, rural) and gender (male, female) appear to have an effect on most of the subtest scores for BOT-2. Next, the differences in composite motor scores are described.

4.3.2 The differences in composite motor scores

In this section the results are divided into five parts addressing the four motor areas – fine manual control, manual coordination, body coordination, and strength and agility – and the total motor composite, which is an aggregation of all four motor-areas. As shown in Figure 12, the differences in each of these dependent variables were firstly examined by a three-way ANOVA. Post hoc tests examined interactions involving individuals' grades. T-tests were than used to examine results for gender and residential location – variables with only two levels, and thus not considered by the post hoc tests. Finally, summary graphs, presented by gender, show the patterns by resident area and grade for each of the motor-area composite scores.

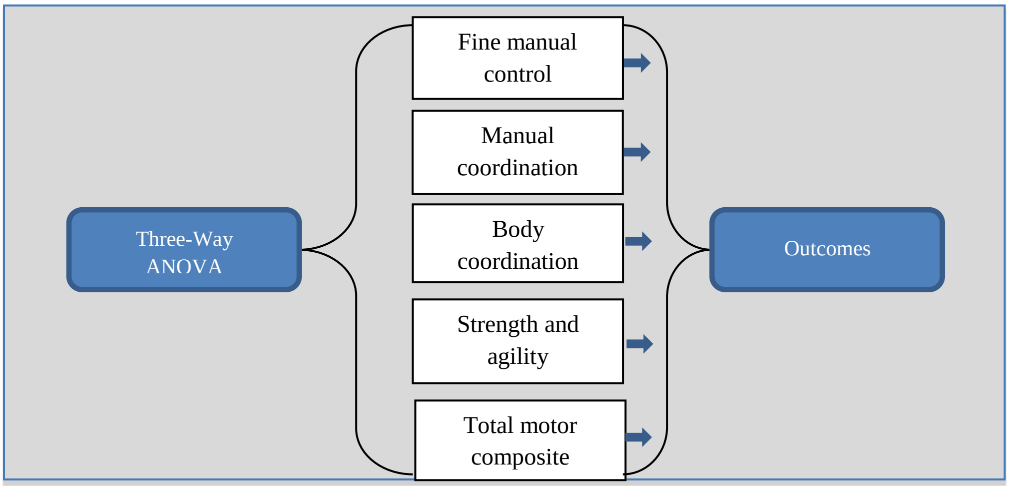

Figure 12. Examination of the differences in four motor areas and the total motor composite.

4.3.2.1 Fine manual control

A three-way ANOVA was applied to the fine manual control composite scores (as shown in Table 24). The results showed two significant main effects of gender ($F(1, 176) = 27.34$, $p < .000$) and residential area ($F(1, 176) = 17.19$, $p < .000$). The female participants recorded significantly higher mean scores than the males ($M = 54.1$, $SD = 8.5$; $M = 48.3$, $SD = 8.9$, respectively); and urban students scored significantly higher than rural students ($M = 53.6$, $SD = 8.3$; $M = 49.0$, $SD = 9.4$, respectively).

Table 24
The ANOVA (2×2×3) Conducted on the Fine Manual Control Composite

Source	df	SS	MS	F	*p*
Gender	1	1672.1	1672.1	27.34	***
Grade	2	52.4	26.2	0.42	ns
Residential area	1	1051.0	1051.0	17.19	***
Gender × Grade	2	1228.9	614.4	10.05	***
Gender × Residential area	1	345.5	345.5	5.65	*
Grade × Residential area	2	685.4	342.7	5.60	**
Gender × Grade × Residential area	2	207.7	103.5	1.69	ns
Error	176	10761.3	61.1		
Total	188	511023.0			

Additionally, the results revealed three significant interactions between the independent variables, namely, gender × grade ($F(2, 176) = 10.05$, $p < .000$), gender × residential area ($F(1, 176) = 5.65$, $p = .019$), and grade × residential area ($F(2, 176) = 5.60$, $p = .004$). However, there was no interaction between gender × grade × residential area, as shown in Table 24.

No significant interactions were found on the post hoc tests with regard to grade levels.

The series of independent t-tests, conducted to uncover any significant relationships, found three interesting results:

(a) The six independent sample t-tests, employed to identify the significant effects between gender and grade, showed that the male 1st graders recorded significantly higher scores than the males in the 5th grades ($t = 3.03$, $df = 60$, $p = .004$); this response was unexpected as the development of motor skills increases with age. Also, among the female students, there were significant differences between the 1st and 3rd graders, and between the 1st and 5th graders ($t = -2.13$, $df = 62$, $p = < .037$) and ($t = -2.70$, $df = 63$, $p = .009$) respectively; as expected, students in the higher grades scored higher than those in the lower grades.

(b) The two independent t-tests assessing the fine manual control composite showed that the male pupils in the urban areas scored significantly higher than those from the rural areas (t = 4.20, df = 90, *p* = <.000). Among the female groups there was no significant difference between urban and rural students.

(c) The three independent t-tests showed that the urban pupils in the 3rd and 5th grades scored significantly higher than their rural peers, (t = 2.21, df = 59, p = .031) and (t = 3.56, df = 60, p = .001) respectively.

Figure 13 presents the direction of performance of fine manual control motor area for the study groups divided by gender. There were clear differences in both genders between urban and rural participants. For example, both males groups performed similarly at 1st grade, but the urban group showed higher scores at 3rd grade, followed by a reduction in scores at 5th grade. However, the rural males' scores dropped from 1st grade to 5th grade. There were no significant differences in the final manual control scores between urban and rural females in 1st grade and 3rd grade, but the 5th-grade urban group scored higher than the 5th-grade rural group.

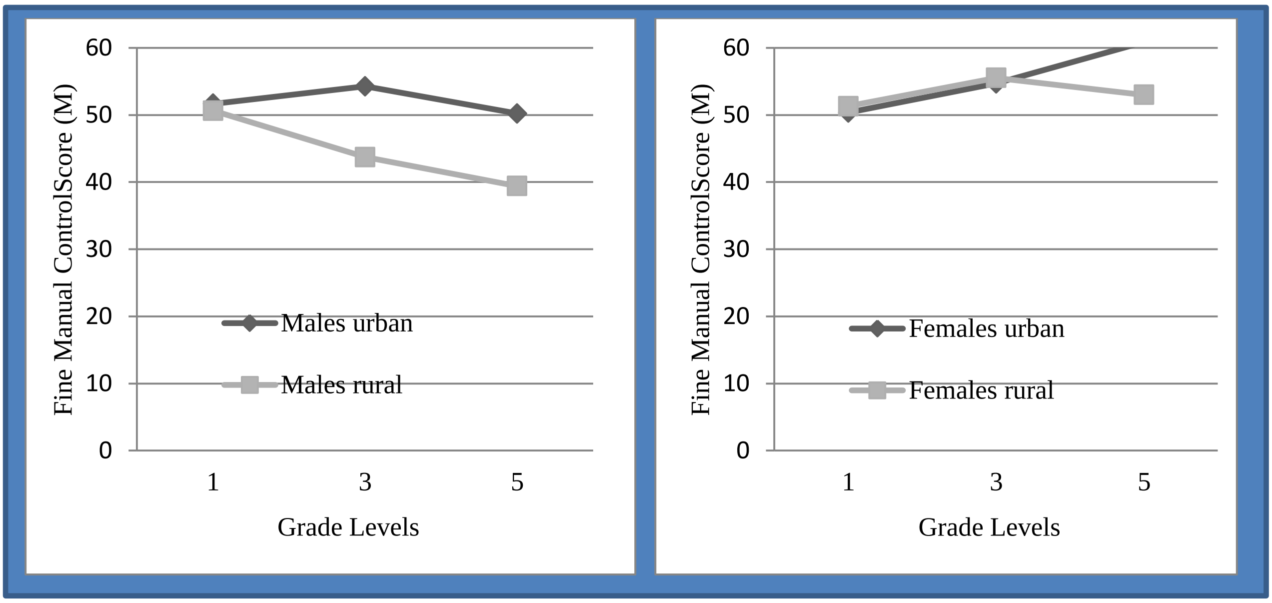

Figure 13. The mean fine manual control composite scores for both residential areas (urban and rural) by gender.

4.3.2.2 Manual coordination

The second three-way ANOVA was employed to find any significant differences between groups on the manual coordination composite. Three significant main effects and one interaction effect were found (as shown in Table 25). In terms of gender, the main significant effect saw higher scores for the male pupils compared to female pupils (F(1, 176) = 7.12, p = .008; M = 46.2, SD = 7.7; M = 43.4, SD = 7.9, respectively). Also, with respect to grade, a significant effect was recorded ($F(2, 176) = 4.43$, $p = .013$). The last main effect was of residential area ($F(1, 176) = 15.09$, $p < .000$), with the urban pupils' mean being 46 ($SD = 7.2$), and the rural mean being 42.7 ($SD = 8.2$). All the main and interaction effects are presented in Table 25.

Table 25
The ANOVA (2×2×3) Conducted on the Manual Coordination Composite

Source	df	SS	MS	F	*p*
Gender	1	369.0	369.0	7.12	**
Grade	2	459.3	229.6	4.43	*
Resident	1	781.4	781.4	15.09	***
Gender × Grade	2	1071.4	535.7	10.34	***
Gender × Residential area	1	37.9	37.9	0.73	ns
Grade × Residential area	2	154.1	77.0	1.48	ns
Gender × Grade × Residential area	2	23.3	11.6	0.22	ns
Error	176	9112.9	51.7		
Total	188	389454.0			

In relation to the grade variable, the post hoc LSD test revealed that the 1st graders recorded significantly higher results than did the 3rd and 5th graders ($p < .05$). However, there was no difference between the 3rd and 5th graders in manual coordination.

Several t-tests were conducted to define the significant differences between gender and grade. The results show that the 1st grade males recorded significantly higher scores than the 3rd- and 5th-grade males, ($t = 4.65$, $df = 60$, $p < .000$ and $t = 5.10$, $df = 60$, $p < .000$ respectively). In contrast, the female students' scores did not differ according to grade.

Figure 14 reports the mean scores of the study sample in the manual coordination motor-area. Generally, opposite patterns of results were evident for males and females. The male groups' scores decreased between 1st grade and 5th grade, and urban males performed better than rural males. In contrast, female students' scores increased between 1st grade and 5th grade (although rural female students' scores fell between 1st and 3rd grades).

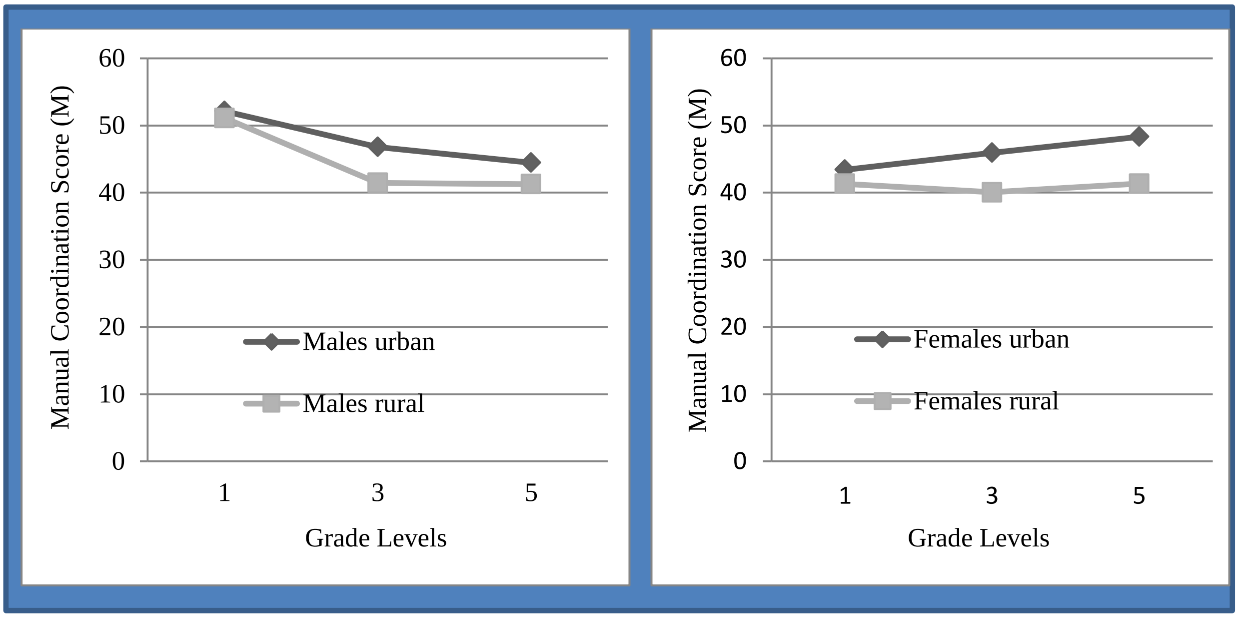

Figure 14. The mean manual coordination composite scores for both residential areas (urban and rural) by gender.

4.3.2.3 Body coordination

The results of the three-way ANOVA conducted on the body coordination composite showed one significant effect of grade ($F(2, 176) = 8.98$, $p < .000$), with only one significant interaction between gender × grade ($F(2, 176) = 3.87$, $p = .023$); the details are presented in Table 26.

Table 26

The ANOVA (2×2×3) Conducted on the Body Coordination Composite

Source	df	SS	MS	F	*p*
Gender	1	65.5	65.5	1.46	ns
Grade	2	806.0	403.0	8.98	***
Resident	1	3.6	3.6	0.08	ns
Gender × Grade	2	347.2	173.6	3.87	*
Gender × Residential area	1	175.0	175.0	3.90	ns
Grade × Residential area	2	287.3	143.6	3.20	ns
Gender × Grade × Residential area	2	75.3	37.6	0.84	ns
Error	176	7891.0	44.8		
Total	188	311337.0			

The results from the post hoc LSD test produced results similar to the results relating to the dependent variable manual coordination. The performance of the 1st graders was better than that of the 3rd and 5th graders ($p < .05$, and $p < .001$, respectively).

The 1st -grade males recorded significant differences in the t-test, while no statistical differences were found with the 3rd and 5th grade males (namely $t = 3.94$, $df = 60$, $p < .000$ and $t = 3.68$, $df = 60$, $p < .000$ respectively). No significant interactions were identified for the female pupils.

In summary, Figure 15 shows the changing of mean scores on the body coordination composite across grade levels for males and females in both urban and rural area. Among male participants, those in rural areas and those in urban areas performed at similar levels, except for the 5th -grade male participants, among whom the urban participants performed better than the rural participants. Rural females scored better than urban females in all grades, but the performance dropped sharply from 3rd grade to 5th grade for both groups.

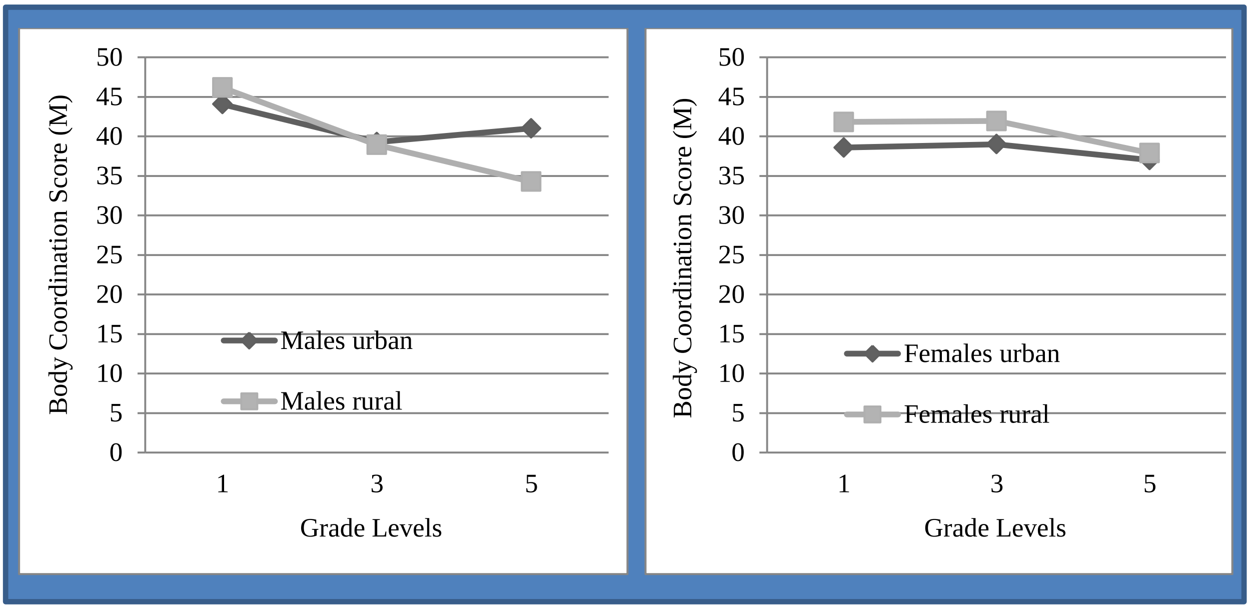

Figure 15. The mean body coordination composite scores for both residential areas (urban and rural) by gender.

4.3.2.4 Strength and agility

The ANOVA conducted on the strength and agility composite revealed significant differences among all the dependent variables. The results revealed three significant main effects, as well as three interaction effects (as seen in Table 27).

There was a main effect of gender ($F(1, 176) = 4.22$, $p = .041$). The male pupils ($M = 49.2$, $SD = 8.9$) scored higher than the female pupils ($M = 47.0$, $SD = 7.4$). There was also a main effect of grade ($F(2, 176) = 24.67$, $p < .000$). Finally, there was a main effect of residential location ($F(1, 176) = 56.14$, $p < .000$): The rural pupils recorded higher mean scores than did the urban participants ($M = 51.4$, $SD = 8.2$; $M = 44.5$, $SD = 6.7$ respectively).

Table 27
The ANOVA (2×2×3) Conducted on the Strength and Agility Composite

Source	df	SS	MS	F	*p*
Gender	1	169.7	169.7	4.22	*
Grade	2	1981.4	990.7	24.67	***
Resident	1	2254.6	2254.6	56.14	***
Gender × Grade	2	254.3	127.1	3.16	*
Gender × Residential area	1	285.1	285.1	7.10	**
Grade × Residential area	2	585.1	292.9	7.29	**
Gender × Grade × Residential area	2	8.0	4.0	0.10	ns
Error	176	7068.0	40.1		
Total	188	44769.0			

The post hoc LSD revealed that the 1st graders' scores were significantly different from the 3rd and 5th graders' scores ($p < .001$ for both comparisons).

A significant gender × grade interaction was found ($F(2, 176) = 3.16$, $p = .045$). T-tests revealed that 1st grade males performed better than 3rd- and 5th-grade males ($p < .001$ for both comparisons). In addition, the 1st -grade females scored significantly better than the 5th grade females ($t = 3.50$, $df = 63$, $p = .001$).

A significant gender × residential area interaction was found ($F(1, 176) = 7.10$, $p = .008$). Results from t-tests showed that rural participants performed better than urban participants: males ($t = -6.17$, $df = 90$, $p < .000$) and females ($t = -2.96$, $df = 94$, $p = .004$).

Finally, a significant grade × residential area interaction was found ($F(2, 176) = 7.29$, $p = .001$). In the 1st- and 3rd-grade students, but not in the 5th-grade students, rural participants scored higher than urban participants.

In summary, Figure 16 shows the mean scores recorded for both males and females in the strength and agility motor-area. Generally, the rural groups (males and females) scored higher than their peers in urban schools. Additionally, the scores dropped from 1st grade to 5th grade in all groups; this decrease was especially marked in rural groups (males and females).

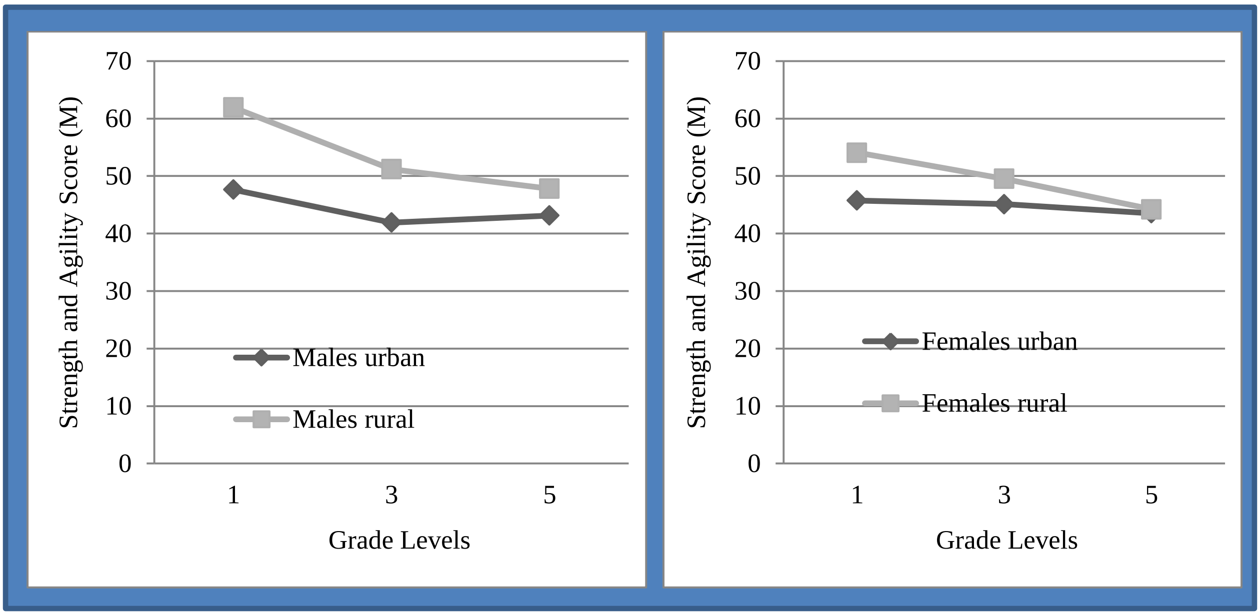

Figure 16. The mean strength and agility composite scores for both residential areas (urban and rural) by gender.

4.3.2.5 Total motor composite

The last three-way ANOVA examined the effects of the independent variables on the total motor composite. Table 28 outlines the existence of one statistical main effect and two significant interactions. The main effect was found between the grade groups ($F(2, 176) = 11.57$, $p < .000$).

Table 28
The ANOVA (2×2×3) Conducted on the Total Motor Composite

Source	df	SS	MS	F	*p*
Gender	1	0.5	0.5	0.02	ns
Grade	2	1003.3	501.6	11.57	***
Residential area	1	10.0	10.0	0.23	ns
Gender × Grade	2	962.8	481.4	11.10	***
Gender × Residential area	1	0.1	0.1	0.00	ns
Grade × Residential area	2	474.0	237.0	5.46	**
Gender × Grade × Residential area	2	41.6	20.8	0.48	ns
Error	176	7629.9	43.3		
Total	188	10139.4			

Further analysis using the post hoc LSD test showed that the 1st graders' scores were higher than the 3rd and 5th graders' scores, $p < .01$ and $p < .001$, respectively. However, the post hoc LSD results revealed no significant difference between the 3rd and 5th graders in overall motor proficiency.

The t-test investigating the gender × grade interaction showed that the 1st -grade male pupils scored higher than did their 3rd- and 5th-grade peers on the total motor composite ($t = 4.94$, $df = 60$, $p = < .000$ and $t = 5.60$, $df = 60$, $p < .000$ respectively). On the other hand, there were no significant differences among the female grade samples. Moreover, the t-test investigating the grade × residential area interaction revealed that 1st grade rural children performed better than 1st-grade urban children ($t = 2.07$, $df = 63$, $p = 0.42$). In contrast, among 5th grade students, urban children performed better than rural children ($t = 2.07$, $df = 60$, $p = .042$).

In summary, Figure 17 presents the total motor composite scores. In all grades, urban males performed similarly to rural males. However, females' scores varied according to residential location. Specifically, among 1st grade students, rural students performed better than urban students. Urban females' scores increased rapidly between 3rd grade and 5th grade. In contrast, the rural females' scores dropped between 3rd and 5th grades.

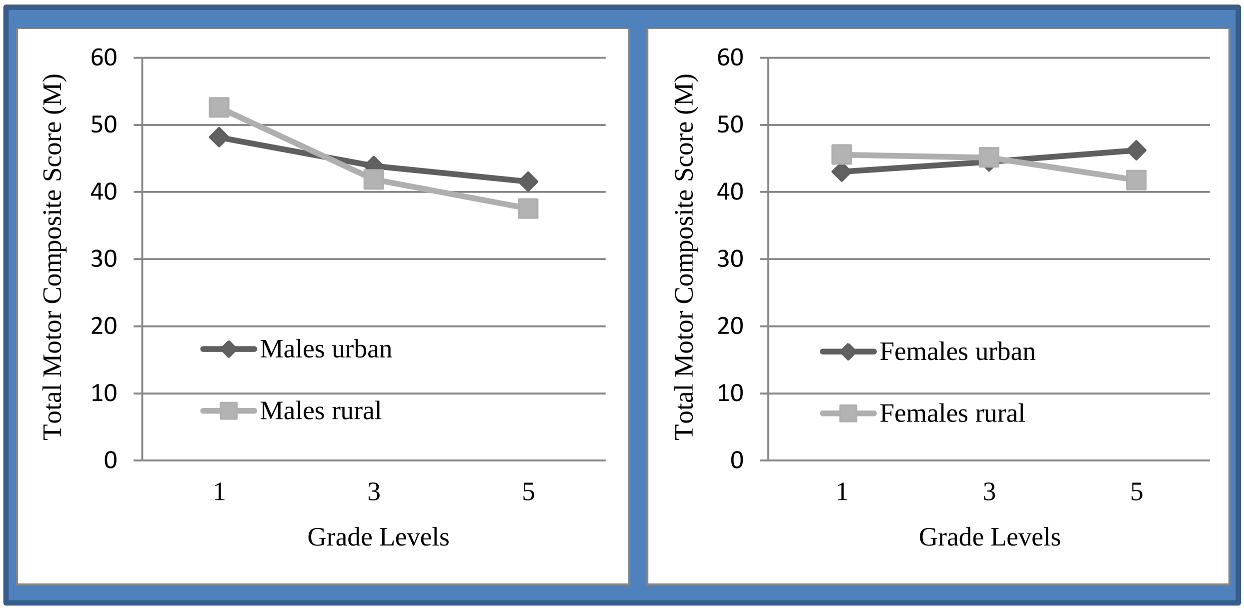

Figure 17. The mean total composite scores for both residential areas (urban and rural) by gender.

4.4 Is BOT-2 appropriate for assessing Saudi children's motor proficiency?

This section will answer Research Question 3, which addresses the appropriateness of using BOT-2 in Saudi society. The results addressing this question were divided into three parts: objectivity, reliability, and validity (as shown in Figure 18).

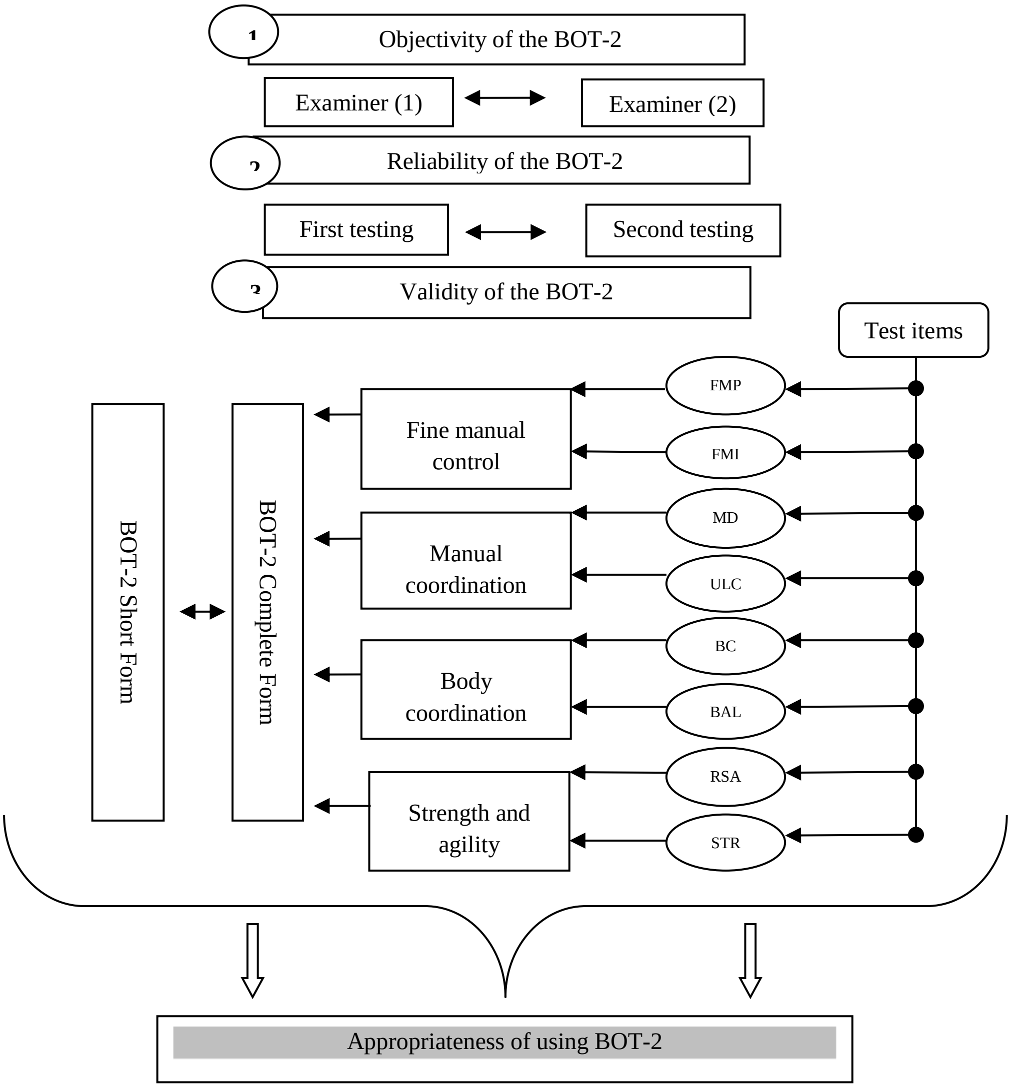

Figure 18. Overview of Research Question 3.

A key consideration in this discussion relates to the quality of the data. This section explores the results with regard to the reliability of data coding between different examiners. Tables 29 and 30 present the inter-rater reliability between the examiners. The average agreement among the male and female raters was generally very high, ranging between 100 and 80, and 100 and 85, respectively. The lowest levels of agreement observed for female raters were noted on the ULC (85%), RSA (85%), and STR (85%) subtests. For male raters, ULC had the lowest level of agreement at 80%. From this we can conclude that there was great matching between examiners who evaluated students' performances on the BOT-2 tool.

Table 29

Inter-Rater Reliability for BOT-2 Subtests, Composites, and Short Form for Female Examiners

	Female Examiners											
	Group 1						Group 2					
BOT-2 Subtest, Composite, and Short Form	1		2				3		4			
	M#	SD	M	SD	AD##	PCA### %	M	SD	M	SD	AD	PCA %
Fine Motor Precision (FMP)	19.5	0.7	19.5	0.7	0.0	100	18.5	0.7	18.5	0.7	0.0	100
Fine Motor Integration (FMI)	20.5	0.7	20.5	0.7	0.0	100	16.0	5.6	16.0	5.6	0.0	100
Fine Manual Control	62.0	1.4	62.0	1.4	0.0	100	61.5	3.5	61.5	3.5	0.0	100
Manual Dexterity (MD)	9.5	2.1	10.5	2.1	1.0	90	12.0	2.8	12.0	2.8	0.0	100
Upper-Limp Coordination (ULC)	18.0	8.4	16.5	7.7	1.5	85	13.0	4.9	14.0	4.2	1.0	90
Manual Coordination	44.5	2.1	44.5	3.5	0.0	100	48.5	9.1	49.0	8.4	0.5	95
Bilateral Coordination (BC)	14.5	2.1	13.5	0.7	1.0	90	11.5	3.5	11.0	2.8	0.5	95
Balance (BAL)	9.5	6.3	10.5	6.3	1.0	90	8.0	0.0	9.0	1.4	1.0	90
Body Coordination	39.0	1.4	39.5	0.7	0.5	95	40.0	5.6	41.0	5.6	1.0	90
Running Speed and Agility (RSA)	11.5	4.9	11.5	3.5	0.0	100	12.5	0.7	11.0	1.4	1.5	85
Strength with knee push-up (STR)	23.5	2.1	22.5	3.5	1.0	90	16.0	4.2	17.5	4.9	1.5	85
Strength and Agility	48.0	11.3	47.5	7.7	0.5	95	53.0	5.6	54.5	6.3	1.5	85
Total Motor Proficiency	51.0	1.4	52.0	3.5	1.0	90	47.5	1.4	48.0	4.9	0.5	95
Short Form	46.5	0.7	47.0	4.2	0.5	95	47.0	0.0	46.5	2.1	0.5	95

Note. # Scale and standard scores, ## Average difference, ### Percentage close agreement %

Table 30

Inter-Rater Reliability for BOT-2 Subtests, Composites, and Short Form for Male Examiners

BOT-2 Subtest, Composite, and Short Form	Male Examiners																	
	Group 1						Group 2						Group 3					
	5		6				7		8				5		9			
	M#	SD	M	SD	AD##	PCA### %	M	SD	M	SD	AD	PCA %	M	SD	M	SD	AD	PCA %
Fine Motor Precision (FMP)	18.0	5.6	18.0	5.6	0.0	100	14.0	1.4	14.0	1.4	0.0	100	21.5	0.7	21.5	0.7	0.0	100
Fine Motor Integration (FMI)	13.0	1.4	13.0	1.4	0.0	100	14.5	0.7	14.5	0.7	0.0	100	14.5	2.1	14.5	2.1	0.0	100
Fine Manual Control	51.5	10.6	51.5	10.6	0.0	100	47.0	0.0	47.0	0.0	0.0	100	56.5	2.1	56.5	2.1	0.0	100
Manual Dexterity (MD)	14.5	4.9	14.0	5.6	0.5	95	16.5	2.1	17.0	2.8	0.5	95	14.5	4.9	15.5	4.9	1.0	90
Upper-Limp Coordination (ULC)	16.5	3.5	16.5	2.1	0.0	100	23.0	0.0	21.0	1.4	2.0	80	19.5	2.1	18.5	2.1	1.0	90
Manual Coordination	53.5	12.0	53.5	13.4	0.0	100	56.5	9.1	55.5	8.4	1.0	90	54.0	4.2	53.0	2.8	1.0	90
Bilateral Coordination (BC)	11.5	0.7	12.5	0.7	1.0	90	12.0	0.0	11.5	0.7	0.5	95	14.0	0.0	15.0	0.0	1.0	90
Balance (BAL)	11.5	0.7	12.0	1.4	0.5	95	12.5	2.1	12.5	2.1	0.0	100	16.5	4.9	16.0	5.6	0.5	95
Body Coordination	41.0	2.8	43.0	4.2	2.0	90	42.0	1.4	41.5	2.1	0.5	95	50.0	5.6	50.5	6.3	0.5	95
Running Speed and Agility (RSA)	10.0	2.8	9.0	2.8	1.0	90	14.0	1.4	14.5	0.7	0.5	95	13.5	0.7	13.5	0.7	0.0	100
Strength with full push-up (STR)	13.5	2.1	13.0	0.0	0.5	95	13.0	1.4	13.5	0.7	0.5	95	16.0	2.8	16.5	3.5	0.5	95
Strength and Agility	43.5	3.5	42.0	2.8	1.5	85	47.0	1.4	47.0	1.4	0.0	100	48.5	2.1	49.0	2.8	0.5	95
Total Motor Proficiency	44.0	7.0	45.5	7.7	0.5	90	48.5	0.7	48.0	0.0	0.5	95	52.0	1.4	51.0	1.4	1.0	90
Short Form	41.0	1.4	41.5	0.7	0.5	95	45.0	1.4	44.5	3.5	0.5	95	54.5	2.1	54.0	2.8	0.5	95

Note. # Scale and standard scores, ## Average difference, ### Percentage close agreement %

Generally, the percentage close agreement increased was higher on the subtest scores which do not need high concentration from examiners. For example, as shown in Table 29, the percentage close agreement on the Manual Dexterity (MD) subtest reached 100% among group 2. The MD subtest includes tasks that are easy to observe, such as transferring pennies and stringing blocks. In contrast, the percentage close agreement decreased on the subtests which require greater focus on the performance. For instance, group 2 of the female examiners (Table 29) and group 1 of the male examiners (Table 30) recorded a low level of agreement on the strength and agility motor area composite scores. This motor area includes some test items which require high levels of observation, such as one-legged side hop and push-ups.

4.4.1 Reliability of the BOT-2

This section examined the stability of scores over a brief span of time. Table 31 presents the Pearson product-moment correlation and intraclass correlation coefficient (ICC) between the first and second evaluation for the male and female pupils.

Table 31

Test-Retest Reliability for BOT-2 Subtest, Composites, and Short Form by Gender (n = 18)

BOT-2 Subtest, Composite, and Short Form	Male (n = 9)						Female (n = 9)					
	First Testing		Second Testing				First Testing		Second Testing			
	M #	SD	M	SD	r	ICC	M	SD	M	SD	r	ICC
Fine Motor Precision (FMP)	17.1	5.3	17.8	3.8	.86	.90	18.8	3.8	19.8	3.8	.89	.93
Fine Motor Integration (FMI)	12.3	3.6	13.2	3.6	.77	.86	12.4	2.8	15.5	3.6	.92	.76
Fine Manual Control	49.7	9.0	51.6	8.1	.92	.95	51.3	5.1	56.4	6.8	.87	.77
Manual Dexterity (MD)	13.2	4.0	12.7	4.0	.76	.87	13.7	4.0	13.3	4.4	.89	.94
Upper-Limp Coordination (ULC)	13.6	2.8	12.7	3.5	.76	.85	10.6	1.6	11.8	3.3	.44	.50
Manual Coordination	45.5	6.8	43.6	8.4	.85	.90	43.3	4.8	44.1	6.0	.81	.89
Bilateral Coordination (BC)	9.6	2.0	11.1	2.5	.85	.82	11.1	2.8	13.2	3.5	.79	.78
Balance (BAL)	13.6	2.7	13.1	3.8	.40	.58	11.8	5.4	14.0	3.8	.73	.78
Body Coordination	41.5	5.2	42.2	5.6	.68	.82	40.3	5.4	43.4	5.4	.43	.56
Running Speed and Agility (RSA)	13.5	3.3	12.2	3.2	.78	.85	11.7	1.8	11.5	1.8	.86	.92
Strength with knee push-up (STR)	15.7	4.4	17.5	4.3	.89	.91	16.7	5.0	17.1	4.3	.96	.97
Strength and Agility	49.5	8.8	51.3	8.2	.77	.87	46.8	5.2	47.1	4.1	.93	.95
Total Motor Proficiency	45.0	6.2	45.4	6.3	.86	.93	43.0	3.2	46.3	3.8	.59	.58
Short Form	46.3	3.3	45.7	4.5	.73	.83	42.6	4.3	44.5	4.9	.93	.92

Note. # Scale and standard scores.

The Pearson correlations ranged from r = .40 – .92 for males and r = .43 – .93 for females. The ICC ranged from .58 – .95 for males and from .50 – .97 for females. Correlations for BAL and ULC subtests were notably lower than the correlations for other subtests. The STR subtest had the highest correlation in both gender groups (male and female).

Overall, strong correlations were found for subtests which related to fine manual control (FMP and FMI) for both groups (males and females). These subtests contain drawing and copying tasks, which are common activities in schools; this may explain the stability of the students' performance on these tasks. On the other hand, others subtests include unfamiliar movements tasks, which may explain the unstable performance.

4.4.2 Validity of the BOT-2

This is the last section addressing Research Question 3, and it discusses internal consistency of the BOT-2 to examine the validity of using the measure among Saudi children.

Pearson product-moment correlations were computed separately for male and female participants, see Tables 32 and 33. First, the correlation included each item point score with its subtest point score for both genders. A significant positive correlation was found at the .01 level between the majority of items and their subtest scores (e.g., the male sample r-values ranged from .28 to .88, and the female sample r-values ranged from .37 to .87). Also, some items were significant at the .05 level for both groups. Only one item did not correlate significantly with its subtest score; this was the “walking forward on a line” item of the balance subtest, for male participants, $r(92) = .15$, $p > .05$. In addition, the correlation between the remaining items included: filling in shape-circles, and filling in shape-stars. In the FMP, there were no results as all females recorded full scores. Correlations are presented in Appendix B.

Table 32

Pearson Correlation Coefficients (r) of Subtest Scales, Total Motor Composite, and Short Form for Saudi Male Participants (n = 92)

	FMP	FMI	Fine Manual Control	MD	ULC	Manual Coordination	BC	BAL	Body Coordination	RSA	STR #	Strength and Agility	Total Motor Composite	Short Form
FMP														
FMI	.499**													
Fine Manual Control	.891**	.827**												
MD	.368**	.266*	.348**											
ULC	.357**	.224*	.337**	.452**										
Manual Coordination	.432**	.281**	.410**	.827**	.860**									
BC	.443**	.355**	.458**	.408**	.589**	.577**								
BAL	.237*	.230*	.258*	.385**	.547**	.534**	.457**							
Body Coordination	.429**	.338**	.439**	.441**	.655**	.639**	.864**	.827**						
RSA	.065	.039	.038	.424**	.388**	.460**	.435**	.509**	.542**					
STR	.091	.014	.064	.249*	.334**	.360**	.270**	.440**	.414**	.702**				
Strength and Agility	.091	.027	.057	.372**	.372**	.438**	.370**	.496**	.502**	.909**	.928**			
Total Motor Composite	.595**	.458**	.610**	.616**	.701**	.786**	.748**	.673**	.847**	.646**	.596**	.665**		
Short Form	.579**	.372**	.549**	.536**	.643**	.703**	.656**	.575**	.739**	.589**	.589**	.630**	.856**	

Note. # Coefficients based on Full Push-ups * = p < .05 ** = p < .01

Table 33

Pearson Correlation Coefficients (r) of Subtest Scales, Total Motor Composite, and Short Form for Saudi Female Participants(n= 96)

	FMP	FMI	Fine Manual Control	MD	ULC	Manual Coordination	BC	BAL	Body Coordination	RSA	STR #	Strength and Agility	Total Motor Composite	Short Form
FMP														
FMI	.241*													
Fine Manual Control	.719**	.795**												
MD	.137	.368**	.333**											
ULC	-.052	.189	.070	.266**										
Manual Coordination	.037	.331**	.225*	.719**	.825**									
BC	.031	.173	.141	.216*	.095	.184								
BAL	-.030	-.001	-.016	.093	.100	.108	.096							
Body Coordination	.031	.111	.083	.196	.154	.203*	.677**	.757**						
RSA	-.080	.172	.068	.124	.323**	.335**	.213*	.335**	.355**					
STR	-.130	-.028	-.085	-.093	.156	.074	.257*	.318**	.383**	.509**				
Strength and Agility	-.158	.040	-.053	-.052	.274**	.195	.283**	.340**	.416**	.774**	.905**			
Total Motor Composite	.274**	.531**	.528**	.514**	.579**	.685**	.476**	.433**	.631**	.598**	.479**	.591**		
Short Form	.092	.451**	.347**	.405**	.609**	.647**	.380**	.203*	.397**	.496**	.439**	.526**	.788**	

Note. # Coefficients based on Knee Push-ups * = p < .05 ** = p < .01

Second, statistically significant ($p < .01$) positive correlations were found between each subtest scale score and its motor area composite. Similarly, statistically significant correlations ($p < .01$) were found between each subtest score and the total motor proficiency score, and between the motor area composite score and the overall motor proficiency score. Further, the results show a strong correlation between the total motor composite and the short form scores for both genders. Finally, the results show higher r-values for the boys compared to the girls in all the aforementioned correlation coefficients, $r(92) = .45 - .92$, $r(96) = .27 - .90$, respectively. Tables 32 and 33 provide the detailed results.

4.5 Summary of the results

In responding to the research questions above, this study has found important information regarding children's physical development. Such information may be used by teachers and policy makers to inform the development of programs and policies. While there are clear differences between the Saudi students' scores and the BOT-2 norms, these differences are not consistent across all areas tested by the BOT-2. Interestingly these differences appear to relate to possible social and cultural differences.

The first research question explored the similarities and the differences between Saudi children and American children (BOT-2 norms). The results revealed that the groups differed on some subtests, and performed similarly on other subtests. Overall, the Saudi female groups scored higher than the BOT-2 norms in movement tasks involving fine motor skills, but scored lower than the BOT-2 norms on movement tasks involving gross motor skills. Additionally, the Saudi male groups scored lower than BOT-2 norms in the majority of subtests. These findings confirm the impact of different cultural backgrounds on children's motor development.

The second research question explored the impact of gender, grade, and residential area on five motor area composites (fine manual control, manual coordination, body coordination, strength and agility, and total motor composite). The results showed that scores on the majority of motor-area composites appear to be affected by gender, grade, and residential area. These findings indicate an impact of environmental and biological factors on motor development.

The last research question examined the appropriateness of using BOT-2 in Saudi society. This question focused on objectivity, reliability, and validity. The results, showing consistent levels of coding, and a high level of correlation between subtests, indicated the appropriateness of using BOT-2 to assess Saudi children's motor development. The findings support previous studies that confirmed the possibility of using BOTMP and BOT-2 in different societies.

5 DISCUSSION AND CONCLUSION

5.1 Introduction

The present study used the BOT-2 to assess Saudi children's motor performance which allowed results to be compared to the BOT-2 norms from American children. Subsequently, the impact of three factors (gender, grade, and residential area) across the five assessed motor areas were investigated. In addition, the study sought to determine the appropriateness of the BOT-2 by examining the objectivity, reliability, and validity of the tool.

This final chapter will discuss key findings from this research and point out the limitations of the study. The contributions that this research makes to motor development research and knowledge will then be acknowledged, with implications for policy, practice, and future research being highlighted. Finally, the conclusion will emphasise the need for Saudi teachers to recognise the impact of social and cultural factors on the motor outcomes of children and thus take these into account in their curriculum planning.

5.2 Discussion of the Research Findings

This discussion of findings is organised into three sections according to the research questions: comparison of Saudi children to American norms, differences among Saudi groups, and appropriateness of using BOT-2 in Saudi society. In each section the initial findings will firstly be presented, followed by links to relevant literature, and, wherever possible, cultural underpinnings will be highlighted.

5.2.1 Motor performance of Saudi and American children

The comparison between Saudi groups and American norms involved eight subtest point scores from the BOT-2, with all results based on point scores. This comparison is divided according to gender. Table 34 presents a summary of the significant relationships against the BOT-2 norms, by grade and gender.

Table 34
Summary of the Significant Relationships between Saudi Groups, by Gender, Compared to the BOT-2 Norms

		Males		Females	
	Subtest	Lower	Higher	Lower	Higher
Fine manual control	FMP	5			3, 5
	FMI	1, 3, 5		1	
Manual coordination	MD	1, 3, 5		1, 3, 5	
	ULC	3, 5		1, 3, 5	
Body coordination	BC	1, 3, 5		1, 3, 5	
	BAL	1, 3, 5		1, 3, 5	
Strength and agility	RSA	1, 3, 5		1, 3, 5	
	STR		1, 5	5	1

The results from the present study can be compared to those from previous studies. However, as this study used the BOT-2 and the other studies used the BOTMP, the comparison needs to recognise specific test items in the BOTMP and the BOT-2. The majority of BOT-2 subtests have very similar test items to the BOTMP subtest but have different subtest titles (see Table 3 in Chapter 2). For example, the visual-motor control subtest in the BOTMP includes the majority of the test items of the FMP subtest in BOT-2, such as cutting out a circle and drawing lines through paths. The following discussion will compare the findings from this study derived from BOT-2 assessments with those from the literature that used the earlier BOTMP.

5.2.1.1 Saudi males

The majority of subtest scores for all age groups revealed a consistent pattern of the Saudi groups having motor performance levels below those of the BOT-2 norms. Generally, these results are similar to those of Hassan (1991), who found that the American norms were significantly higher than scores of children from the United Arab Emirates (UAE) in all BOTMP subtest scores except in visual-motor control. Jifri (2003) also found, using the BOTMP, that the scores of Saudi males were significantly lower than the American norms in four out of eight subtests. Further, Jifri found that Saudi group scores were significantly higher in only two subtests – response speed and visual-motor control. These two subtests are related to the fine motor composite area.

Two exceptions to the general findings above are seen in the FMP and STR subtest scores. First, there were no significant differences in FMP subtest scores between Saudi and American children in the first and third grades. This appears different to the findings in motor performance reported by Hassan (1991) and Jifri (2003), who indicated that the UAE and Saudi males scored significantly higher than American norms in the visual-control subtest, directly comparable to the BOT-2 FMP subtest, as Test items such as cutting out a circle, drawing lines through paths-crooked, and drawing lines through paths-curved are included in both the BOTMP and BOT-2 subtests. Further, the Saudi first grade scored significantly higher than BOT-2 norms in STR subtest, again differing from the findings of Jifri. However, as Hassan (1991) and Jifri (2003) compared their study samples with BOTMP American norms established in 1978, far earlier than the 2005 norms of the BOT-2, the relativities between motor development in Saudi and US societies may explain the suggested differences.

Tabatabainia (1995) found that 6-year-old Iranian children scored higher than American norms on the strength subtest. This finding is similar to the current study results at the same age level. This higher performance of Saudi males did not continue in the advanced ages (grades 3 and 5) on the strength subtest. This may be linked to the more limited content of the physical education curriculums in Saudi schools and their capacity to develop children's strength. This interpretation is in agreement with The Department of Education, Victoria, Australia (1996), Gallahue and Donnelly (2003), and Larzelere (2009) who suggested that physical education lessons, especially in primary schools, play an important role in developing children's motor skills.

5.2.1.2 Saudi females

In general, the findings revealed that there are significant differences between Saudi female groups compared with BOT-2 norms on all subtest scores at all age levels. This result is very similar to that for males with the one major difference being in the FMP subtest in which 3rd and 5th grade Saudi females scored significantly higher than BOT-2 norms of 3rd and 5th grade children.

The findings are consistent with Hassan (1991), who reported that on one subtest, visual-control, the UAE females scored higher than American females' norms. They also align with those of Saeki et al. (1985), who confirmed that Japanese-descent children exceeded American children on the visual-control subtest. In addition, Chui et al. (2007) recorded similar results when they compared the scores of children from Hong Kong with American norms.

This overall finding of higher scores on the FMP is likely to be aligned to some of the activities undertaken in girls' schools. For example, the Saudi art curriculum in girls' schools focuses on activities such as drawing and sewing, which help Saudi female pupils to improve their fine motor skills. All these activities require the use of small tools such as pencils and scissors which link to the FMP subtest tasks. This suggestion regarding the impact of these activities provided in the Saudi girls' schools is further supported by the observed age differences. In the 1st grade no significant differences between two groups in FMP subtest scores were found. The impact of some of the school activities on fine motor proficiency levels was confirmed by Al-Thumali (2005) and Chui et al. (2007). In addition, the results intimated by Chow et al. (2001) and also Jifri (2003), who noted that Asian children have more opportunities to develop their fine motor skills because they use chopsticks, further supports the suggested cultural links from this study.

Interestingly, these findings show that the Saudi females only scored significantly below the BOT-2 norms for the FMI subtest at 1st grade, but not in the later age levels. This result is in agreement with Hassan (1991), who found that the significant differences between UAE females and the BOTMP norms in fine motor composite subtests were highest at early age levels, with less extreme differences at older age levels.

Like the males' scores, the females' scores decreased in the later grades. The Saudi females recorded significantly higher scores than the BOT-2 norms on the STR subtest scores ($p = < .01$) in 1st grade. However, there was no difference for 3rd grade females, and for 5th grade females, the BOT-2 norms were significantly higher. These results are consistent with those of Gallahue and Donnelly (2003), Magill (2011), and Pang and Fong (2009) who found that motor skills in children do not develop as a result of maturity factor; rather, children need encouragement and frequent opportunities to practice, and the quality of physical education instruction may also contribute to motor skill development. However, due to the absence physical education lessons for girls in Saudi Arabia, these children have limited opportunities to improve their motor proficiency. This limitation may explain the finding that, for most subtests, the BOT-2 norms, derived from a US sample, exceeded scores obtained by the Saudi girls.

5.2.1.3 Differences between BOT-2 norms and Saudi sample

Overall, the results showed that there is generally a convergence between study groups' results and the BOT-2 norms. However, the differences between two groups identified (Saudi groups and BOT-2 norms) may be attributed to the large differences between the two societies in some aspects such as environment and culture. These findings confirm those of previous relevant studies such as Habib (1997); Hassan (1991); Jifri, (2003) and Tabatabainia (1995).

5.3 Differences Among Saudi groups

This section will focus on the three independent variables (gender, grade level, and residential area). The effect of these variables on the four motor-area composites as well as the total motor composite will be considered, with all results based on scale scores. Table 35 provides a summary of the results for discussion.

Table 35

Summary of Effect of Independent Variables on Motor-Area Composites Among Saudi Groups

Composite Motor Areas	Independent Variables		
	Gender	Grade	Residential Area
Fine manual control	Females higher	ns	Urban higher
Manual coordination	Males higher	1st highest	Urban higher
Body coordination	ns	1st highest	ns
Strength and agility	Males higher	1st highest	Rural higher
Total motor composite	ns	1st highest	ns

5.3.1 Fine manual control

The results obtained in this study regarding fine manual control scores indicated a significant difference between genders (males and females) and residential areas (urban and rural). There were no significant differences found in fine manual control between grades.

Females scored significantly higher than males in the fine manual control motor area. Overall, the differences between genders in most movement tasks can be viewed from a nature- nurture perspective (Blakemore et al., 2009; Zosuls et al., 2011), with the differences more likely to be related to nurture. In terms of nurture, females are more likely than males to engage in activities that require fine motor skills (Cook & Cook, 2009; Kennedy et al., 2012). In addition, the Saudi female curriculum includes sewing and painting, which further explains the potentially more advanced development of fine motor skills and thus the higher fine manual control scores among females than males. This view is consistent with that put forward by Al-Thumali (2005) and Saeki et al. (1985). These researchers confirmed the effect of some programs on fine motor skill development. Moreover, these results align with those from several other international studies (e.g., Blakemore et al., 2009; Chui et al., 2007), which found that females performed better than males in fine motor skill tasks.

The results revealed that the urban participants had better performance in fine manual control tasks than rural participants. This difference can be attributed to the lifestyles in urban Saudi society. For example, using video games and smart phones is more common among urban children because of greater internet access in these areas, and these activities are likely to affect development in fine manual control. This view is supported by Chow et al. (2001) and Jifri (2003), who argue that lifestyle affects fine motor skills. Similarly, Malina et al. (2004) argue that motor development increases with increased practice opportunities, with the playing of video games and use of smart phones representing real development of these skills.

When the finding regarding residential area is examined according to gender, an interesting interaction effect can be seen. The results for males are the same as reported above; that is, male participants in urban areas performed better than their rural counterparts in fine manual control. However, no difference in performance was noted across the female groups. It is speculated that girls, regardless of where they live, engage in similar cultural activities at home and at school that support development in this area. For example, in Saudi culture it is very common that girls contribute to activities in the home, such as cooking and cleaning, which requires the use and control of small tools by fingers and hands. In this way, culture may affect girls' physical activities (Smith, 2010).

5.3.2 Manual coordination

The findings regarding manual coordination indicated that there was a significant difference between genders, grade levels (1st, 3rd, and 5th), and residential groups (urban and rural). Male participants recorded significantly higher scores than did female participants. When being assessed in this motor-area, the students used tools to complete tasks such as transferring pennies, stringing blocks, and catching or throwing a ball. Boys are known to achieve maturity in all the throwing patterns (overarm, sidearm, and underhand) earlier than girls (Gabbard, 2012). Generally, boys' performance in throwing skills has been found to be better than girls' at all age levels (Lippa & Ebooks, 2005; Loovis & Butterfield, 1993; Payne & Isaacs, 2011). Moreover, Chui et al. (2007) found that boys aged from 6 – 10 years old scored higher than girls at the same age levels on an upper-limb coordination subtest. In contrast, there were no differences found between boys and girls on the upper-limb speed and dexterity subtest, which includes test items such as placing pennies, sorting cards, and stringing beads. These findings are close to those from the current study, with a likely link being to the manual dexterity and upper-limb coordination subtest scores that contribute to the overall manual coordination motor-area score.

Further, the results revealed that 1st-grade students recorded better performance than 3rd and 5th grade students. This result may be due to the fact that PE curricula do not focus on the development of coordination for children. Educational experiences play an important role in increasing children's motor control (Gallahue & Ozmun, 2006). Children require encouragement, frequent opportunities to practice, and quality instruction in an ecologically sound environment in order to develop and refine their motor skills (Gallahue & Donnelly, 2003; Magill, 2011; Pang & Fong, 2009). Therefore, it is not surprising that 3rd and 5th grade participants had lower manual coordination scores than 1st grade students.

Finally, the urban participants were found to have higher scores than their peers in rural area. It is recognised that coordination with small objects is affected by common daily activities (Bruininks & Bruininks, 2005). The difference in the manual coordination levels, superior in urban Saudi males, may be because urban children in Saudi Arabia have more opportunity to use modern lifestyles tools such as eating utensils (spoons and forks) and are more likely to wear shoes require tying.

5.3.3 Body coordination

A significant difference was found between grade levels (1st, 3rd, and 5th) in the body coordination motor area. There were no differences found in this area according to gender or residential area. This motor area includes movement tasks involved in playing sports and balance ability (Bruininks & Bruininks, 2005). It is recognised that children aged from 7 to 14 years need to engage in specific types of sports or activities to improve their coordination in motor skills (Gallahue & Ozmun, 2006). However, it is not common for Saudi children in primary schools to participate in sports teams. Further, the PE curricula offered limited opportunities for children to develop their balance ability whether through stability, stasis, or movement. These limitations are likely to be linked to the lesser development in this skill area as children progress to higher grades.

5.3.4 Strength and agility

The findings revealed that there were significant differences in strength and agility between genders grade levels, and residential areas.

Male participants recorded higher scores than female participants. Strength and agility are measured by movement tasks, such as running and long jump, which depend on gross motor skills. According to Gallahue and Ozmun (2006), boys and girls perform similarly in running speed and long jump until age 6 or 7, after which boys perform better than girls. Additionally, boys are more likely to engage in activities that require gross motor skills (Cook & Cook, 2009), further contributing to their development. For example, in Saudi society, playing soccer is common among Saudi boys (Jifri, 2003). This type of sport is rich in gross motor skills such as jumping, running, and kicking.

The 1st-grade students scored significantly higher on strength and agility than did 3rd and 5th grade students. This finding was unexpected and differed from the BOT-2 norms, which show no differences in strength and agility motor-area composite scores between children aged 4 – 7 years and children aged 8 – 11 years (the age groups included in the study). The reason behind the difference found in the current study may be different levels of involvement in physical activities between children of different ages. Thus, because the older children usually spend more time than younger children playing video games on the internet or smartphones, they possibly spend less time on activities which involve gross motor skills such as running and jumping.

The rural participants recorded higher scores than urban participants. This result is consistent with Bakhtiar (2014), Qndil (1983), and Tsimeas et al. (2005), who found that rural children were better than their urban peers in motor skills related to gross motor skills, such as running, galloping, and horizontal jumping. The researchers suggested that this difference may reflect differences in the physical environment and activity types; that is, rural children have greater access to parks and are more likely to engage in active outdoor play. In Saudi Arabia there is clear contrast between urban and rural lifestyles and environments (Sonbol et al., 2008), which may affect children’s motor development. The current finding is in agreement with the finding by the District of Physical Education in the Ministry of Education in Taif city (1990-2005), that rural students have better results than urban students in long-distance running in local sports competitions.

5.3.5 Total motor composite

The final finding to be considered relates to the total motor composite. The motor composite is the sum of all the above composite motor area scores. The findings showed significant differences among the three grade levels (1st, 3rd, and 5th). However, no significant differences between gender groups (males and females) or between residential groups (urban and rural) were seen.

The results revealed higher overall test scores for 1st graders compared to 3rd and 5th graders, but there was no significant difference between the scores of 3rd and 5th graders. As this composite is aggregated across all four areas, we can look to other results to explain the observed difference. For example, 1st graders showed better performances than 3rd and 5th graders in the manual coordination, body coordination, and strength and agility motor area composites. A key factor in this may relate to limitations in the PE curricula in primary schools. Physical education lessons, especially in primary schools, play an important role in developing children's motor skills (Department of Education, 1996; Gallahue & Donnelly, 2003; Larzelere, 2009).

According to Thomas and Thomas (2008), many studies have confirmed that there is a greater similarity than difference in motor skills performance between boys and girls. For example, Düger et al. (1999) found only two significant gender differences on eight test items of motor proficiency – response speed and cutting out a circle with preferred hand. In the current study, female groups scored higher than male groups in the fine manual control motor area; in contrast, male groups performed better in the strength and agility motor area. This finding raises several questions about the role and content of the Saudi male PE lessons, as those lessons are targeted to improve males' motor development in all motor areas.

No difference in the overall performance by residential groups (urban and rural) was found. This result is consistent with Adawi (1991) and Tsimeas et al. (2005), who found no clear differences in the lifestyles between urban and rural children. However, in the current study the urban participants scored higher than rural participants in fine manual control and manual coordination motor areas. On the other hand, rural participants performed better in the strength and agility motor area. Thus, while some similarities and differences between Saudi children in urban and rural areas were observed, these may have balanced to indicate no difference on the overall motor composite assessment.

5.4 Appropriateness of Using BOT-2 in Saudi Society

This section will review the appropriateness of using the BOT-2 with Saudi children, in terms of the objectivity, reliability, and validity of the tool. Each aspect will be discussed separately.

5.4.1 Objectivity of the BOT-2

The average agreement among male and female assessors was between 80% – 100% and 85% - 100% sequentially. This indicates substantial convergence in the average scores between examiners. These results coincide with Lucas et al. (2013), who found 83% – 100%

inter-rater reliability across all BOT-2 SF items. The current findings suggest a good level of understanding of the tool's administration by the study's examiners, reflecting that the training process was effective.

The average difference recorded in the BOT-2 manual (Bruininks and Bruininks (2005) was from 0.6 to 00 points. This may be because the sample size affects the inter-rater reliability. The sample size used in psychometric evaluation of the BOT-2 was 47, and the current study used only 10 examiners. A large sample is more likely to provide meaningful results (Sattler, 2008). ICC is related to reliability, but percentage agreement is also an appropriate measure of the objectivity of scoring (Sattler, 2008). In the current study, the maximum average difference between raters was two points, and this was recorded on one occasion on the ULC subtest with male examiners. In this particular subtest, the examinee deals with ball either by himself or by throwing it to the examiner. Some test items require high concentration from the examiner, such as dribbling a ball – one hand, dribbling a ball – alternating hands, and throwing a ball at a target. Therefore, the examiner may not be able to properly observe the examinee's performance, and this may increase the difference between the examiners relative to other subtests.

5.4.2 Reliability of the BOT-2

Pearson's correlation coefficient value between both occasions was r = .40 – .92 for males and r = .43 – .95 for females across all subtest and composite scores. Overall, stability between both groups was quite close. Test-retest reliability in Bruininks and Bruininks's (2005) manual for children ages 4 -7 and 8 -12 are r = .47 - .88 and r = .45 - .94 respectively, with an average test interval of 19 days. Those age groups and the time between tests are similar to those in the current study. According to Kegel et al. (2012), good test-retest reliability (r = .65) was found for the BOT-2 balance subtest scores for children aged 4 -7 years. The lowest test-retest reliability in the current study (r = .40) was for the BAL subtest for males. This may be because the BAL subtest includes items that examine the balance ability of participants with their eyes closed, standing on a line with both feet or only one foot, and standing on a balance beam with both feet or only one foot. Children's scores on these items may be affected by such things as wearing shoes of the wrong size. The current result is very close to the test-retest reliability (r = .45) found by Bruininks and Bruininks (2005) for the BAL subtest, which was the lowest reliability found for the participants aged 8 – 12 years. For female participants, the body coordination composite score and ULC score were the lowest (r = .43 and r = .44, respectively). Impaired test-retest reliability for body coordination may occur for the same reasons mentioned in relation to the BAL test items, as this composite score is the sum of BAL and BC subtest scores. Also, the result for ULC is similar to the one identified in the section regarding BOT-2 objectivity, which may confirm female examiners' difficulty in observing some test items. With the exception of above results, all subtest and composite r values were convergent with Bruininks and Bruininks (2005).

The test-retest reliability by ICC ranged from .58 to .95 for males and from .50 to .95 for females. This result was consistent with findings of Mercer et al. (2009) and Lucas et al. (2013), but it was lower than the reliability ($r = .88 – .99$) found by Wuang and Su (2009). However, reliability for all subtest and composite scores was in the range of fair to excellent, as defined by Fleiss (1986) (< 0.40 is poor reliability, > 0.40 - < 0.75 is fair to good reliability, and ≥ 0.75 is excellent reliability). These benchmarks for test-retest reliability were used by Lucas et al. (2013) and Wuang and Su (2009). However, in Lucas et al. (2013), the time between first and second test administrations ranged from 11 to 114 days. This long period of time may allow maturation and learning to affect the results (Drost, 2011; Kimberlin & Winetrstein, 2008). However, in the study by Wuang and Su (2009) the test-retest interval was similar to that in the current study.

5.4.3 Validity of the BOT-2

Overall, correlations found in the current study are in agreement with the findings of previous studies. First, the Pearson correlation coefficients between item point scores and their subtest were close to those found by Hassan (1991). For instance, correlations in upper-limb coordination in Hassan's study were $r = .51 - .78$ for males and $r = .46 - .80$ for females. In the current study, the correlation coefficient value in same subtest for males and females averaged .36 - .83 and .44 – 82 respectively. Second, the correlation between each subtest scale score and its motor-area composite in the current study ranged from .82 to .92 for male participants and from .67 to .90 for female participants. These findings are close to Bruininks and Bruininks (2005) findings for age groups 4 – 7 and 8 – 11 ($r = .79 - .88$). This strong relationship between scores for each subtest and its motor-area composite is logical as the subtests measure the same motor skills as their composites. For example, fine manual control and its subtests focus on fine motor skills. Moreover, in the next cooralation this suggestion may be true as cross the correlation findings r value between subtest and its composite was higher than r value between subtest and total motor composite. Fourth, corrolations between composite motor area scores and overall motor composite scores were slightly lower compared with those found for the same ages in Bruininks and Bruininks (2005) for both genders. Finally, there was a strong correlation between BOT-2 complete form and short form in both males and females (r = .85 and .78 respectively). This correlation was in very close argement with Jifri (2003), who found a correlation of r = .89. The BOT-2 SF has been used in many studies, such as those by Chowdhury et al. (2010), Kambas et al. (2012), and Wrotniak et al. (2006). This strong positive correlation between both forms of BOT-2 may increase the use of BOT-2 in the future studies.

It is important to note that the majority of studies mentioned earlier applied the BOTMP, which differs from the BOT-2 in terms of some test items and the distribution for composite scores. That may affect the comparison of findings.

5.5 Limitations

The results discussed need to be viewed with a number of limitations in mind. Acknowledging the limitations of the current study will help the motor development field to assess the findings from the current study and identify directions for future investigations. Limitations in the research will also impact on the capacity for generalisation of study findings, which is a common issue in many studies. The major limitations in this study are seen in two areas.

The first issue is related to the study sample. Although the study sample includes male and female students from urban and rural settings, it is limited to schools that come under the Taif City Education District – one of largest educational zones in Saudi Arabia. Thus, the study participants are not necessarily representative of all urban and rural Saudi children. Also, there are limitations relating to geographical school locations within the Taif City Education District zone. The study sample was limited to students who enrolled in schools that have suitable spaces to achieve the BOT-2 test conditions. For example, the school required an indoor playground with enough space to conduct the shuttle run test item. Thus students from very small schools were not included in the sample.

The second point is related to scoring procedures. Although the data collection was undertaken by eight teacher examiners, trained by the researcher, the role of teachers was restricted to that of recording raw scores. This differed to the procedure in some previous studies in which the examiners completed all scoring procedures (e.g., Kegel et al., 2012; Lucas et al., 2013). In this study the researcher, highly experienced in the testing and scoring procedures, undertook the final scoring processes. Training teacher examiners to undertake the full scoring would have required significant additional training, not justified in this study, where the researcher was available to undertake this role.

5.6 Contributions of the Research

Regardless of limitations, this research provides the first detailed cross-cultural study of motor development in Saudi children using the BOT-2 and, as such, makes a contribution in three distinct areas. First, research findings enrich the information about the motor proficiency of Saudi children at three grade levels (1, 3, and 5). Second, differences in motor proficiency varied according to gender, grade, and residential area. Third, the research showed that BOT-2 is an objective, reliable, and valid tool to assess Saudi children's motor development.

5.7 Implications

A number of broad implications for policy, practice, and future research can be drawn from this study. The implications for policy and practice are interconnected and thus are presented together. Implications for future research are advanced not only for motor development studies in Saudi, but also for studies that take a global perspective.

5.7.1 Policy and practice

A key implication of this research is for education planners in Saudi Arabia. The findings of this study should inform appropriate physical education curriculum design, particularly in relation to children at the three grade levels investigated. More importantly, the differences according to gender and residential location highlight the capacity for the curriculum to ensure a basic level of motor development in all children regardless of gender or location.

At the school level PE teachers need to be aware of these findings in order to provide tailored learning experiences within an enhanced curriculum. Learning experiences should be based on an assessment of each student's motor proficiency level, and this study points to using the BOT-2 as the assessment tool. Therefore, university preparation of PE teachers should include specific training in the use of the BOT-2 complete form or short form. The procedural translation of the administration of the BOT-2, in Arabic, provided by this research offers a valuable resource to support this initiative. In the study sample, the results indicated that the BOT-2 is an appropriate assessment instrument for evaluating the motor proficiency of boys and girls in all age groups in Saudi society. Also, the results revealed that there is a significant correlation between the results of the BOT-2 long form and short form.

Therefore, BOT-2 short form should be considered a reliable test to evaluate Saudi children's motor development. Accordingly, movement specialists in Saudi Arabia should be able to use most of the items of the BOT-2 with confidence and adapt other items to develop their own assessment of motor development.

Taken together these policy and practice recommendations provide new directions for education planners, PE teachers and universities in Saudi.

5.7.2 Future research

Based on the results of this study, further investigations are recommended in the motor development field. First, this research was focused at three grade levels (1, 3, and 5), so future studies need to investigate other grades for two reasons: (a) to give a more comprehensive picture of motor proficiency levels of Saudi students from 4 through 21 years of age and (b) to ensure that the BOT-2 is an appropriate tool for use with all students throughout Saudi society.

Moreover, this study revealed some areas of differences in motor proficiency scores between genders (males and females) and between children from different residential areas (urban and rural) in Saudi society. Therefore, future studies into these differences may factors affecting motor proficiency levels. In addition, further research should be conducted to determine the effect of psychological and health factors on motor proficiency levels in Saudi children and, for example, would extend the work on the relationship between mastery of some motor skills tasks and obesity (Baine, 2008; Castetbon & Andreyeva, 2012).

Furthermore, the results of this research may contribute to a larger cross-cultural study involving comparisons between motor proficiency levels in Saudi children and in children from other societies. Such a large study would also provide opportunity to test the appropriateness of BOT-2 in different societies. Although the BOT-2 was published in 2005, few studies have confirmed its application in and across different societies.

5.8 Conclusions

This research provides a rich and comprehensive understanding of the motor proficiency levels of children in the Kingdom of Saudi Arabia. In addition, the use of the BOT-2 has supported a comparative assessment of these levels with the BOT-2 norms derived from children from the US. In doing so, this study has confirmed the viability of using this tool to assess motor proficiency levels within Saudi society. The new information from this study provides a foundation for policy makers, universities, and school staff to refine practice and better support the motor development of Saudi children.

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APPENDICES

Appendix A: Ethics Approval Documentation

GRIFFITH UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

10-Dec-2013

Dear Mr Al-Thumali

I write further to the additional information provided in relation to the conditional approval granted to your application for ethical clearance for your project "NR: Assessment of Motor Proficiency Levels in Children in Saudi Arabia" (GU Ref No: EDN/B1/12/HREC).

This is to confirm receipt of the remaining required information, assurances or amendments to this protocol.

Consequently, I reconfirm my earlier advice that you are authorised to immediately commence this research on this basis.

The standard conditions of approval attached to our previous correspondence about this protocol continue to apply.

Regards

Rick Williams
Manager, Research Ethics
Office for Research
Bray Centre, N54 Room 0.15 Nathan Campus
Griffith University
ph: 07 3735 4375
fax: 07 373 57994
email: rick.williams@griffith.edu.au
web:

Cc:

Researchers are reminded that the Griffith University Code for the Responsible Conduct of Research provides guidance to researchers in areas such as conflict of interest, authorship, storage of data, & the training of research students.
You can find further information, resources and a link to the University's Code by visiting
http://policies.griffith.edu.au/pdf/Code%20for%20the%20Responsible%20Conduct%20of%20Research.pdf

Taif Education Department Approval

In The Name of Allah the Most Gracious, the Most Merciful

KNIGDOM OF SAUDI ARABIA
Ministry of Education
General Administration for Education
in Taif Governorate
Department of Planning and Development

Number :
Date : 09.04.2013
Attachment :

Subject: Facilitate the task of the Researcher AlThumali, Fahad Jameel in Scientific Study application (Doctorate)

Dear Elementary School Principal

May Allah Guide you

Researcher Name	:	AlThumali, Fahad Jameel.
Faculty	:	(Griffith University) in Australia.
Specialization	:	Doctorate in Motor Development/ Physical Education Department.
University	:	Taif University.
Study Title	:	"Assessment of Motor Proficiency Levels in Children in Saudi Arabia "
Study Tool	:	(Bruininks- Oseretesky Test of Motor Proficiency).
Study Sample	:	Elementary Stage Students (Male and Female).

Peace and Blessing of Allah be upon you
Based on the presentation of the above mentioned researcher to apply a special tool for his study, Due to completed procedures of the study. We hope to facilitate his task in applying the tools of the Taif Education Department Approval to.

We appreciate your cooperation ....

General Manager of Education in Taif Governorate

Dr. Mohammed Hassan Alshumrani

We attest the translation
Supervisor of English
Ahmad Aseeri
8.6.13

Taif Education Department Approval (Arabic)

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التربية والتعليم
الإدارة العامة للتربية والتعليم بمحافظة الطائف
إدارة التخطيط و التطوير

وزارة التربية والتعليم
Ministry of Education

الرقم : ....
التاريخ : ٢٨ / ٥ / ١٤٣٤هـ
المشفوعات : ....

الموضوع : تسهيل مهمة الباحث/فهد بن جميل الثمالي في تطبيق دراسة علمية (دكتوراه) .

المكرم/ة/ مدير/ة المدرسة الابتدائية : .... وفقه/ها الله

اسم الباحث	فهد بن جميل الثمالي .
الكلية	مبتعث /جامعة جرفث (Griffith University) في استراليا .
التخصص	دكتوراه في التطور الحركي/قسم التربية البدنية.
الجامعة	جامعة الطائف .
عنوان الدراسة	"تقييم مستويات الكفاءة الحركية لأطفال المملكة العربية السعودية" .
أداة الدراسة	اختبار (Bruininks-Oseretesky Test of motor Proficiency) .
عينة الدراسة	المرحلة الابتدائية : طلاب/طالبات .

السلام عليكم ، و رحمة الله ، و بركاته ، و بعد :

بناءً على ما تقدم به الباحث الموضح اسمه أعلاه لتطبيق الأداة الخاصة بدراسته، ونظرًا لاكتمال إجراءات الدراسة نأمل منكم تسهيل مهمته في تطبيق أدوات الدراسة على العينة المشار إليها .

،، شاكرين لكم ومقدرين تعاونكم ،،

المدير العام للتربية والتعليم بمحافظة الطائف

٢٨ / ٥

د . محمد بن حسن الشمراني

٢٨ / ٥ / ١٤٣٤

Appendix B: Correlation Values of Participants

Female Participants

Table C1

Pearson Correlation Coefficients (r) Between Item Point Scores and its Subtest Point Scores for the Female Sample (N = 96)

Test items	BOT-2 subtest							
	FMP	FMI	MD	ULC	BC	BAL	RSA	STR
Filling in shapes-circle#	-							
Filling in shapes-star#	-							
Drawing lines through paths-crooked	.50**							
Drawing lines through paths-curved	.47**							
Connecting dots	.68**							
Folding paper	.87**							
Cutting out a circle	.83**							
Copying a circle		.20*						
Copying a square		.51**						
Copying overlapping circles		.64**						
Copying a wavy line		.37**						
Copying a triangle		.55**						
Copying a diamond		.68**						
Copying a star		.76**						
Copying overlapping pencils		.64**						
Making dots in circles			.81**					
Transferring pennies			.78**					
Placing pegs into a pegboard			.76**					
Sorting cards			.80**					
Stringing blocks			.79**					
Dropping and catching a ball-both hands				.67**				
Catching a tossed ball-both hands				.64**				
Dropping and catching a ball-one hand				.77**				
Catching a tossed ball-one hand				.72**				
Dribbling a ball-one hand				.81**				
Dribbling a ball-alternating hands				.82**				
Throwing a ball at a target				.44**				
Touching nose with index fingers-eyes closed					.14			
Jumping jacks					.57**			
Jumping in place-same sides synchronized					.44**			
Jumping in place-opposite sides synchronized					.45**			
Pivoting thumbs and index fingers					.69**			
Tapping feet and fingers-same sides synchronized					.44**			
Tapping feet and fingers sides synchronized-opposite					.68**			
Standing with feet apart on a line- eyes open						.11		
Walking Forward on a Line						.43**		
Standing on one leg on a line-eyes open						.45**		
Standing with feet apart on a line-eyes closed						.50**		
Walking forward heel-to-toe on a Line						.49**		
Standing on one leg on a line-eyes closed						.51**		
Standing on one leg on a balance beam-eyes open						.47**		
Standing heel-to-toe on a balance beam						.50**		
Standing on one leg on a balance beam-eyes closed						.42**		
Shuttle run							.69**	
Stepping sideways over a balance beam							.69**	
One-Legged stationary Hop							.50**	
One-Legged side hop							.68**	
Two-legged side hop							.73**	
Standing long jump								.57**
Knee push-ups								.83**
Sit-ups								.62**
Wall sit								.67**
V-up								.67**

Note. FMP : Fine Motor Precision, FMI : Fine Motor Integration, MD : Manual Dexterity, ULC : Upper-Limb Coordination, BC : Bilateral Coordination, BAL : Balance, RST : Running Speed and Agility, and STR : Strength. # there was no differences among performance participants in these items. *= p < .05 **= p < .01

Male Participants

Table C2

Pearson Correlation Coefficients (r) Between Item Point Scores and its Subtest Point Scores for the Male Sample (N = 92)

Test items	BOT-2 subtest							
	FMP	FMI	MD	ULC	BC	BAL	RSA	STR
Filling in shapes-circle	.25*							
Filling in shapes-star	.21*							
Drawing lines through paths-crooked	.47**							
Drawing lines through paths-curved	.59**							
Connecting dots	.55**							
Folding paper	.88**							
Cutting out a circle	.83**							
Copying a circle		.28**						
Copying a square		.45**						
Copying overlapping circles		.66**						
Copying a wavy line		.47**						
Copying a triangle		.58**						
Copying a diamond		.63**						
Copying a star		.78**						
Copying overlapping pencils		.70**						
Making dots in circles			.73**					
Transferring pennies			.82**					
Placing pegs into a pegboard			.67**					
Sorting cards			.79**					
Stringing blocks			.83**					
Dropping and catching a ball-both hands				.36**				
Catching a tossed ball-both hands				.63**				
Dropping and catching a ball-one hand				.61**				
Catching a tossed ball-one hand				.71**				
Dribbling a ball-one hand				.70**				
Dribbling a ball-alternating hands				.83**				
Throwing a ball at a target				.57**				
Touching nose with index fingers-eyes closed					.28**			
Jumping jacks					.70**			
Jumping in place-same sides synchronized					.65**			
Jumping in place-opposite sides synchronized					.69**			
Pivoting thumbs and index fingers					.66**			
Tapping feet and fingers-same sides synchronized					.40**			
Tapping feet and fingers sides synchronized-opposite					.60**			
Standing with feet apart on a line- eyes open						.22*		
Walking Forward on a Line						.15		
Standing on one leg on a line-eyes open						.32**		
Standing with feet apart on a line-eyes closed						.54**		
Walking forward heel-to-toe on a Line						.40**		
Standing on one leg on a line-eyes closed						.71**		
Standing on one leg on a balance beam-eyes open						.75**		
Standing heel-to-toe on a balance beam						.69**		
Standing on one leg on a balance beam-eyes closed						.70**		
Shuttle run							.71**	
Stepping sideways over a balance beam							.71**	
One-Legged stationary Hop							.80**	
One-Legged side hop							.72**	
Two-legged side hop							.78**	
Standing long jump								.41**
Full push-ups								.42**
Sit-ups								.55**
Wall sit								.42**
V-up								.50**

Note. FMP : Fine Motor Precision, FMI : Fine Motor Integration, MD : Manual Dexterity, ULC : Upper-Limb Coordination, BC : Bilateral Coordination, BAL : Balance, RST : Running Speed and Agility, and STR : Strength. *= p < .05 **= p < .01

Appendix C: The BOT-2 Arabic Translation of Instructions

"Procedural" Manual

دليل تطبيق اختبار الكفاءة الحركية (BOT-2) باللغة العربية

دليل لغوي اجرائي

الأهداف:

- تقديم دليل ومرشد لتطبيق اختبار الكفاءة الحركية (BOT-2) لتعريف بمحتويات الاختبار وأداء المهارات.
- تقديم ملخص مؤجز لمستخدم اختبار الكفاءة الحركية (BOT-2) واللغة المناسبة للتواصل مع المفحوص لأطفال من المملكة العربية السعودية.

المحتويات:

- يحتوي هذا الدليل على خطوات تطبيق اختبار الكفاءة الحركية (BOT-2) والمتضمن ثمان اختبارات كل اختبار يهدف إلى اختبار مهارة حركية محددة هذه المهارات هي:

الاختبار الأول : دقة المهارات الدقيقة (Fine Motor Precision)	الإختبار الخامس: التوازن (Balance)
الاختبار الثاني: تكامل الحركات الدقيقة (Fine Motor Integration)	الاختبار السادس: الجري السريع والرشاقة (Running Speed and Agility)
الاختبار الثالث: البراعة اليدوية (Manual Dexterity)	الاختبار السابع: توافق الجزء العلوي من الجسم (Upper-Limb Coordination)
الاختبار الرابع: التوافق الجانبي (Bilateral Coordination)	الاختبار الثامن: القوة البدنية (Strength)

- يحتوي كل اختبار على عدد من العناصر. كل عنصر يمثل قياس مهاري مستقل.

ملحوظات:

- هذا دليل لغوي اجرائي لتسهيل تطبيق اختبار الكفاءة الحركية (BOT-2) لا يغني عن دليل المستخدم و المساعد في إدارة الاختبار.
- لا يشمل هذا الدليل على طريقة تصحيح لعناصر الاختبار
- هذا الدليل تمت كتابته باللغة العربية بهدف تطبيق دراسة ميدانية في المملكة العرية السعودية، وهو عبارة عن وسيلة مساعدة في تطبيق اختبار الكفاءة الحركية (BOT-2) ولا يعتبر ترجمة للاختبار.

الاختبار الأول : دقة المهارات الدقيقة

ويحتوي على سبعة عناصر:

- العنصر الأول : ملء شكل دائري.

الهدف	أن يملأ المفحوص شكل دائري (انظر كراسة الاختبار ص ٢).
الاجراء	• لون الدائرة مع محاولة بقائك داخل الحدود الشكل. • خذ من الوقت ما تشاء. • مستعد؟ إبدا.
تعليمات للفاحص	• خذ القلم الاحمر بيدك (اليمنى/ اليسرى) • أشر إلى الشكل الدائري.

- العنصر الثاني: ملء شكل النجمة.

الهدف	أن يملأ المفحوص شكل النجمة (انظر كراسة الاختبار ص ٢).
الاجراء	• لأن, لون النجمة مع محاولة بقائك داخل حدود الشكل. • خذ ما تحتاج من الوقت ما تشاء. • مستعد؟ إبدا.
تعليمات للفاحص	• أشر إلى شكل النجمة.

- العنصر الثالث: رسم خط خلال طريق متعرج.

الهدف	أن يرسم المفحوص خط خلال طريق **متعرجه** بداية (صورة السيارة) وله نهاية (صورة الكراج). (انظر كراسة الاختبار ص ٣).
الاجراء	• خذ القلم الأحمر ارسم خطا من هنا (شكل السيارة) حتى نهاية الشارع (شكل الكراج). • حاول ابقاء القلم بين الخطين ولا تخرج من الشارع . • خذ ما تحتاج من الوقت. • مستعد؟ إبدا.
تعليمات للفاحص	• على الفاحص أن يشير إلى السيارة التي تمثل بداية الطريق. • على الفاحص أن يشير إلى الكراج التي تمثل نهاية الطريق.

- العنصر الرابع: رسم خط خلال طريق منحني.

الهدف	أن يرسم المفحوص خط خلال طريق **منحنى** بداية (صورة السيارة) وله نهاية (صورة الكراج). (انظر كراسة الاختبار ص ٣).
الاجراء	• خذ القلم الأحمر إرسم خطا من هنا (شكل السيارة) حتى نهاية الشارع (شكل الكراج). • حاول ابقاء القلم بين الخطين ولا تخرج من الشارع . • خذ ما تحتاج من الوقت. • مستعد؟ إبدا.
تعليمات للفاحص	• على الفاحص أن يشير إلى السيارة التي تمثل بداية الطريق. • على الفاحص أن يشير إلى الكراج التي تمثل نهاية الطريق.

- العنصر الخامس: توصيل النقاط

الهدف	أن يرسم خطوط مستقيمة للتوصيل بين النقاط (انظر كراسة الاختبار ص ٤).
الاجراء	• ارسم خطوط مستقيمة للتوصيل بين النقاط. • حاول ان لا ترفع القلم عن الورقة إلى أن تنتهي من ربط جميع النقاط. • خذ ما تحتاج من الوقت. • مستعد؟ ابدا.
تعليمات للفاحص	• أشر إلى النقاط وأشرح طريقة التوصيل بين النقاط.

- العنصر السادس: طي الورقة:

الهدف	أن يطوي المفحوص أركان الورقة المقدمة له ثم يقوم بطي الورقة من حد المنتصف (انظر كراسة الاختبار ص ٥).
الاجراء	• حاول ان تطوي ركن الورقة على حد هذا الخط بهذه الطريقة (يمثل الفاحص طريقة الطي). • أكمل طي جميع الاركان بنفسك بنفس الطريقة. • قم بطي الورقة من حد خط المنتصف.
تعليمات للفاحص	• اشرح طريقة الاختبار للمفحوص كمثال (يقوم الفاحص بطي ركن الورقة المخصص للفاحص بعد ذلك يشير الفاحص على باقي اركان الورقة). • بعد طي الأركان أشر إلي خط المنتصف.

- العنصر السابع: قص الدائرة:

الهدف	أن يقص المفحوص شكل الدائرة على حد المنطقة الغامقة. (انظر كراسة الاختبارص٦).
الاجراء	• احمل المقص بيدك (اليمنى/ اليسرى) • قص الورقة على شكل الدائرة الغامقة. • خذ ما تحتاج من الوقت.
تعليمات للفاحص	• اشرح طريقة الاختبار للمفحوص كمثال (طريقة حمل الوقص، الاشارة الى الشكل الدائري وحدود القص). • ذكر المفحوص بقص الدائرة على حد المنطقة الغامقة.

الاختبار الثاني: تكامل الحركات الدقيقة

ويحتوي على ثمانية عناصر

- العنصر الاول: نسخ دائرة

الهدف	أن ينسخ المفحوص دائرة باليد المفضلة. (انظر كراسة الاختبارص٧).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر الثاني: نسخ مربع</u>

الهدف	أن ينسخ المفحوص مربع باليد المفضلة. (انظر كراسة الاختبارص٧).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر الثالث: نسخ دائرتين متداخلتين</u>

الهدف	أن ينسخ المفحوص دائرتين متداخلتين باليد المفضلة. (انظر كراسة الاختبارص٨).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر الرابع: نسخ خط متموج</u>

الهدف	أن ينسخ المفحوص خط متموج باليد المفضلة. (انظر كراسة الاختبارص٨).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر الخامس: نسخ مثلث</u>

الهدف	أن ينسخ المفحوص مثلث باليد المفضلة. (انظر كراسة الاختبارص٩).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر السادس: نسخ معين</u>

الهدف	أن ينسخ المفحوص معين باليد المفضلة. (انظر كراسة الاختبارص٩).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر السابع: نسخ نجمة</u>

الهدف	أن ينسخ المفحوص نجمة باليد المفضلة. (انظر كراسة الاختبارص١٠).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

- <u>العنصر الثامن: نسخ قلمين متداخلين</u>

الهدف	أن ينسخ المفحوص قلمين متداخلتين باليد المفضلة. (انظر كراسة الاختبارص١٠).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • في هذا الصندوق الفارغ ارسم مثل هذا الشكل. • خذ من الوقت ما تشاء • مستعد؟ ابدا.
تعليمات للفاحص	• ذكر المفحوص بنسخ مثل الشكل.

الاختبار الثالث: البراعة اليدوية

ويحتوي على خمسة عناصر:

- العنصر الاول: عمل نقاط في الدوائر باليد المفضلة

الهدف	أن يضع المفحوص نقاط داخل الدوائر باليد المفضلة . (انظر كراسة الاختبارص١١).
الاجراء	• امسك القلم بيدك (اليمنى/ اليسرى) • ضع نقطة واحدة في كل دائرة بأسرع ما تستطيع. • مستعد؟ ابدا.
تعليمات للفاحص	• دع المفحوص يضع نقاط في الدوائر المعدة للتجربة

- العنصر الثاني: وضع النقود المعدنية في الصندوق

الهدف	أن يضع المفحوص النقود داخل الصندوق. (انظرإلى مساعد إدارة الاختبار ص٣١).
الاجراء	• ضع النقود واحدة تلو الأخرى وبأسرع ما تستطيع في الصندوق بإستخدام كلتا اليدين (التقاط النقود باليد المفضلة ثم نقل النقود إلى اليد الاخرى لداخل الصندوق) • لس من الضروري أن تأخذ النقود بالترتيب • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة • دع المفحوص يضع ثلاث قطع كتجربة

- <u>العنصر الثالث: إدخال مسامير داخل لوح مثقب باليد المفضلة</u>

الهدف	أن يضع المفحوص المسامير داخل الثقوب. (انظرإلى مساعد إدارة الاختبار ص٣٣).
الاجراء	• أنقل كل مسمار من هذه المسامير التي امامك بإستخدام يدك (اليمني/ اليسري) وبأسرع ما يمكن إلى اي ثقب في الوح . • قم بتثبيت اللوح باليد الأخرى. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة • دع المفحوص ينقل ثلاث مسمامير كتجربة

- <u>البند الرابع: فرز البطاقات الورقية باليد المفضلة</u>

الهدف	أن يفرز المفحوص البطاقات الورقية. (انظرإلى مساعد إدارة الاختبار ص٣٥).
الاجراء	• ضع جميع البطاقات الحمراء هنا وجميع البطاقات الزرقاء هنا . • إستخدم يدك (اليمنى/ اليسري) قم بفرز البطاقات واحدة تلو الأخرى بأسرع ما تستطيع • إستمر في فرز البطاقات حتى أقول لك توقف. • تذكر ان تضع يدك الأخرى على الطاولة. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة • ضع جميع البطاقات على الطاولة ثم يضع بطاقة من كل لون في احد الجانبين • دع المفحوص يفرز ثلاث بطاقات كتجربة

- <u>الغنصر الخامس: نضم الخرز باليد المفضلة</u>

الهدف	أن ينضم المفحوص خرز. (انظرإلى مساعد إدارة الاختبار ص٣٧).
الاجراء	• إدخل هذه المكعبات في هذا الخيط بأسرع ما يمكن بإستخدام يدك المفضلة (اليمني/ اليسرى). • إحمل الخيط في يدك لأخرى ثم إدخل هذه المكعبات في الخيط واحدا تلو الآخر • لاحظ لاداعي لدفع المكعبات إلي آخر الخيط. • إستمر في ادخال الخرز حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة • دع المفحوص يضع ثلاث مكعبات كتجربة

الاختبار الرابع: التوافق الجانبي

ويحتوي على سبعة عناصر:

- <u>العنصر الاول: لمس الانف بالسبابة والعينان مغلقتان</u>

الهدف	أن يلمس المفحوص أنفه بسبابته . (انظرإلى مساعد إدارة الاختبار ص٤١).
الاجراء	• ضع ذراعيك جانبا بشكل مستقيم. إغلق يديك مؤشرا بالسبابتين • ألمس مقدمة آنفك برأس سبابتك ثم اعد ذراعك جانبا ثم قم بأداء نفس الحركة مستخدما اليد الأخرى. • الأن إفعل ذلك وعيناك مغلقتان ورأسك ثابت. • إستمر في لمس الأنف حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر الثاني: القفز في المكان مع فتح وضم القدمين ورفع الزراعين لأعلى بشكل متزامن

الهدف	أن يقفز المفحوص في المكان مع وضم القدمين ورفع الزراعين لأعلى بشكل متزامن . (انظرإلى مساعد إدارة الاختبار ص٤٣.)
الاجراء	• ضع ذراعيك جانبا، ثم اقفز في المكان مع فتح القدمين ورفع الذراعين لأعلى. ثم مع القفز ضم القدمين مع خفض الذراعين للجانب (على الفاحص آن يؤدي الحركة). • تذكر ليس من الضروري ان تصفق باليدين فوق الراس • الأن قم بالقفز بهذه الطريقة حتى أقول لك توقف • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر الثالث: القفز في المكان مع تحريك نفس الجانب من الجسم بشكل متزامن

الهدف	أن يقفز المفحوص في المكان مع تحريك نفس الجانب من الجسم بشكل متزامن . (انظرإلى مساعد إدارة الاختبار ص٤٥.)
الاجراء	• ضع رجلك المفضلة (اليمني/ اليسرى) في الأمام ورجلك الأخرى في الخلف. ثم ضع الذراع التابع لنفس جهة الرجل المفضلة لأمام رافعا إياها بمستوى الكتف ثم ضع الذراع الأخرى إلى الخلف. • عندما أقول لك إبدا إقفز في مكانك واضعا الرجل والذراع التى في الأمام خلفا والرجل والذراع التي في الخلف أماما • إستمر بالقفز بهذه الطريقة حتى أقول لك توقف • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر الرابع: القفز في المكان مع تحريك الجانب المعاكس من الجسم بشكل متزامن

الهدف	أن يقفز المفحوص في المكان مع تحريك الجانب المعاكس من الجسم بشكل متزامن . (انظرإلى مساعد إدارة الاختبار ص٤٧.)
الاجراء	• ضع رجلك غير المفضلة (اليمني/ اليسرى) في الأمام ورجلك الأخرى في الخلف. ثم ضع الذراع المعاكسة للرجل غير المفضلة لأمام رافعا إياها بمستوى الكتف ثم ضع الذراع الأخرى إلى الخلف . • عندما أقول لك إبدا إقفز في مكانك واضعا الرجل والذراع التى في الأمام خلفا والرجل والذراع التي في الخلف أماما • إستمر بالقفز بهذه الطريقة حتى أقول لك توقف • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر الخامس: تعاقب إرتكاز الإبهام مع السبابة

الهدف	أن يلمس المفحوص إبهامه بسبابة يده الاخرى بالتعاقب . (انظرإلى مساعد إدارة الاختبار ص٤٩.)
الاجراء	• لامس السبابة من كل يد لإبهام اليد الأخرى . • أنظر كيف أفصل الإبهام والسبابة وأحركهما. • إستمر في تحريك الإبهام والسبابة بهذه الطريقة حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة وإذا دعت الضرورة يمكن للفاحص وضع الإبهام والسبابة للمفحوص

- العنصر السادس: النقر بالقدم والسبابة من نفس الجانب بشكل متزامن

الهدف	أن يضرب المفحوص بقدمه الارض وسبابته الطاولة من نفس الجانب بشكل متزامن . (انظرإلى مساعد إدارة الاختبار ص٥١.)
الاجراء	• اضرب برجلك الارض وبسبابتك الطاولة من نفس الجانب من الجسم في نفس الوقت. ثم قم بنفس الحركة مع الجانب الاخر للجسم. • إستمر حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر السابع: النقر بالقدم والسبابة في الجانب المعاكس وبشكل متزامن

الهدف	أن يضرب المفحوص بقدمه الارض وسبابته الطاولة من الجانب المعاكس بشكل متزامن . (انظرإلى مساعد إدارة الاختبار ص٥٣.)
الاجراء	• اضرب برجلك الارض وبسبابتك الطاولة من الجانب المعاكس لرجلك من الجسم في نفس الوقت. ثم قم بنفس الحركة بالرجل الاخرى مع السبابة المعاكسة • إستمر حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

الإختبار الخامس: التوازن

ويحتوي على تسعة عناصر:

- العنصر الاول: الوقوف على الخط (العينان مفتوحتان)

الهدف	أن يقف المفحوص على الخط . (انظرإلى مساعد إدارة الاختبار ص٥٧.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • عندما أقول لك ابدء خذ خطوه طبيعية لأمام بتحريك الرجل غير المفضلة ووضعها فوق الخط هكذا مع النظر لأمام. • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- العنصر الثاني: المشي إلى الأمام على خط مستقيم

الهدف	أن يمشي المفحوص على الخط . (انظرإلى مساعد إدارة الاختبار ص٥٩.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • عندما أقول لك ابدء إمشي بخطوات طبيعية ألى أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- <u>العنصر الثالث: الوقوف بالقدم المفضلة على الخط (العينان مفتوحتان)</u>

الهدف	أن يقف المفحوص على الخط . (انظرإلى مساعد إدارة الاختبار ص٦١.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • الأن إرفع رجلك الآخرى هكذا مع النظر إلى الهدف. • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- <u>العنصر الرابع: الوقوف على الخط (العينان مغلقتان)</u>

الهدف	أن يقف المفحوص على الخط والعينان مغلقتان . (انظرإلى مساعد إدارة الاختبار ص٦٣.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • عندما أقول لك ابدء خذ خطوه طبيعية لأمام بتحريك الرجل غير المفضلة ووضعها فوق الخط هكذا مع النظر إلي الهدف. • الأن إغمض عينيك . • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- العنصر الخامس: المشي إلى الأمام على خط مستقيم مع ملامسة كعب الرجل أصابع القدم

الهدف	أن يمشي المفحوص على الخط مع ملامسة كعب الرجل أصابع القدم . (انظرإلى مساعد إدارة الاختبار ص٦٥.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • الأن إمشي مع ملامسة أصابع رجلك الخلفية بكعب الرجل الأمامية • إمشي حتى نهاية الخط • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة • ذكر المفحوص بأن يجعل قدمية على الخط ووضع يدية على خصرة

- العنصر السادس: الوقوف بالقدم المفضلة على الخط (العينان مغلقتان)

الهدف	أن يقف المفحوص على الخط بالقدم المفضلة والعينان مغلقتان . (انظرإلى مساعد إدارة الاختبار ص٦٧.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك. • الأن إرفع رجلك الآخرى هكذا مع النظر إلى الهدف. • الأن إغمض عينيك . • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- الفصل السابع: الوقوف على العارضة التوازن بإستخدام الرجل المفضلة (العينان مفتوحتان)

الهدف	أن يقف المفحوص على عارضة التوازن بالقدم المفضلة . (انظرإلى مساعد إدارة الاختبار ص٦٩.)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على عارضة التوازن ثم ضع يديك على خصرك. • الأن إرفع رجلك الآخرى هكذا مع النظر إلى الهدف. • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- العنصر الثامن: الوقوف مع ملامسة اصابع القدم الخلفية بكعب القدم الأمامية على عارضة التوازن

الهدف	أن يقف المفحوص على عارضة التوازن مع ملامسة أصابع القدم الخلفية بكعب القدم الأمامية . (انظرإلى مساعد إدارة الاختبار ص٧١)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على عارضة التوازن والرجل الأخرى على الأرض . • بمجرد آن أقول لك إبدا، ضع يديك على خصرك مع اخذ خطوة قصيرة بتحريك الرجل غير المفضلة على عارضة التوازن بحيث يلامس كعب الرجل الامامية آصابع الرجل الخلفية. • قف هكذا إلى أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

- <u>العنصر التاسع: الوقوف على العارضة التوازن بإستخدام الرجل المفضلة (العينان مغلقتان)</u>

الهدف	أن يقف المفحوص على عارضة التوازن بالقدم المفضلة والعينان مغلقتان . (انظرإلى مساعد إدارة الاختبار ص٧٣)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على عارضة التوازن ثم ضع يديك على خصرك. • الأن إرفع رجلك الآخرى هكذا مع النظر إلى الهدف. • الأن إغمض عينيك. • قف هكذا إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة

الاختبار السادس: الجري السريع ووالرشاقة

ويحتوي على خمسة عناصر:

- <u>النصر الاول: الجري المكوكي</u>

الهدف	أن يجري المفحوص لإلتقاط مكعب من الأرض ثم يعود . (انظرإلى مساعد إدارة الاختبار ص٧٧)
الاجراء	• عندما أقول لك في مكانك المحدد، إستعد، إنطلق، اركض بأقصى بسرعتك القصوى حتى تصل إلى المكعب الاحمر خذه و أحضره بسرعة حتى تصل هذا الخط. • تذكر لا تخفف من سرعتك. • في مكانك مستعد؟ إنطلق.
تعليمات للفاحص	• أشر إلى المربع • أشير إلى الخط

- <u>العنصر الثاني: الخطو على جانبي عارضة التوازن</u>

الهدف	أن يخطو المفحوص على جانبي عارضة التوازن . (انظرإلى مساعد إدارة الاختبار ص٧٩)
الاجراء	• قف بجانب عارضة التوازن مع وضع يديك على خصرك. • عندما اقول لك ابدأ خذ خطوه جانبية فوق العارضة بالقدم القريبة من العارضة ثم حرك رجلك الاخرى بنفس الاتجاه لكي تنتقل للجة الاخرى. • بعد ذلك أرجع إلى الوضع الاصلى بنفس الطريقة. • إستمر في الأداء حتى أقول لك توقف. • تذكر أن تخطوا بقدم واحده. • مستعد؟ ابد
تعليمات للفاحص	• قم بأداء الحركة

- <u>البند الثالث: الحجل في المكان بالقدم المفضلة</u>

الهدف	أن يحجل المفحوص في المكان . (انظرإلى مساعد إدارة الاختبار ص٨١)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) على هذا الخط ثم ضع يديك على خصرك مع رفع رجلك الاخرى هكذا. • إقفز في مكانك على قدمك إلى آن أقول لك توقف • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- <u>العنصر الرابع: الحجل الجانبي بالقدم المفضلة</u>

الهدف	أن يحجل المفحوص للجانبين بقدم واحده . (انظرإلى مساعد إدارة الاختبار ص٨٣)
الاجراء	• ضع رجلك المفضلة (اليمنى/ اليسرى) بجانب هذا الخط ثم ضع يديك على خصرك مع رفع رجلك الاخرى هكذا. • إقفز من فرق الخط للجهة الاخرى ثم إرجع إلى الوضع الاصلي . • إستمر في الاداء حتى أقول لك توقف. • حاول أن تقفز قريب من الخط هكذا. • مستعد ؟ ابدا
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

- <u>العنصر الخامس: القفز الجانبي بالقدمين معا</u>

الهدف	أن يقفز المفحوص للجانبين بالقدمين معا . (انظرإلى مساعد إدارة الاختبار ص٨٥)
الاجراء	• قف على القدمين معا بجانب هذا الخط ثم ضع يديك على خصرك. • الان إقفز بالقدمين معا للجهة الاخري من على الخط هكذا. • إستمر في الأداء حتى أقول لك توقف. • مستعد؟ ابدا
تعليمات للفاحص	• أشير إلى الخط • قم بأداء الحركة

الاختبار السابع: توافق الجزء العلوي من الجسم

ويحتوي على سبعة عناصر:

- <u>العنصر الاول: إسقاط الكرة على الأرض ثم الإمساك بها (بكلتا اليدين)</u>

الهدف	أن يمسك المفحوص بالكرة بكلتا يديه . (انظرإلى مساعد إدارة الاختبار ص٨٩)
الاجراء	• ممسكنا كرة التنس بيديك ، قف على قدميك مع مد ذراعيك لأمام . • الأن اسقط الكرة على الأرض ثم امسك بها بكلتا اليدين. • إستمر حتى أقول لك توقف. • مستعد؟ ابدا
تعليمات للفاحص	• قم بأداء الحركة • دع المفحوص يجرب لمرة واحدة

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- <u>العنصر الثاني: لقف الكرة المقذوفة (بكلتا اليدين)</u>

الهدف	أن يلقف المفحوص الكرة المقذرفة بكلتا يديه . (انظرإلى مساعد إدارة الاختبار ص٩١)
الاجراء	• قف امامي. عندما أقذف لك الكرة، إمسكها بيديك. • إمسك الكرة بكلتا يديك في كل مرة أقذفها إليك. • مستعد؟ ابدا
تعليمات للفاحص	• دع المفحوص يجرب لمرة واحدة

- البند الثالث: إسقاط الكرة على الأرض ثم الإمساك بها (باليد المفضلة)

الهدف	أن يمسك المفحوص الكرة بيد واحدة . (انظرإلى مساعد إدارة الاختبار ص٩٣)
الاجراء	• ممسكنا كرة التنس بيدك المفضلة (اليمنى/ اليسرى) ، قف على قدميك مع مد ذراع اليد المفضلة لأمام . • الأن اسقط الكرة على الأرض ثم امسك بها بنفس اليد. • إستمر حتى أقول لك توقف. • مستعد؟ ابدا
تعليمات للفاحص	• قم بأداء الحركة • دع المفحوص يجرب لمرة واحدة

- العنصر الرابع: لقف الكرة المقذوفة (باليد المفضلة)

الهدف	أن يلقف المفحوص الكرة المقذرفة بيد واحدة . (انظرإلى مساعد إدارة الاختبار ص٩٥)
الاجراء	• قف امامي. عندما أقذف لك الكرة، إمسكها بيدك المضلة (اليمنى/ اليسرى) • إمسك الكرة بيد واحدة في كل مرة أقذفها إليك. • مستعد؟ ابدا
تعليمات للفاحص	• دع المفحوص يجرب لمرة واحدة

- العنصر الخامس: تكرار دفع الكرة لأسفل بإتجاه الأرض (باليد المفضلة)

الهدف	أن يدفع المفحوص الكرة لأسفل بإتجاة الأرض باليد المفضلة . (انظرإلى مساعد إدارة الاختبار ص٩٧)
الاجراء	• ممسكنا كرة التنس بيدك المفضلة (اليمنى/ اليسرى) ، قف على قدميك مع مد ذراع اليد المفضلة لأمام. • الأن اسقط الكرة على الأرض ثم قم بتكرار دفع الكرة لأسفل بنفس اليد. • إستمر حتى أقول لك توقف. • حاول أن تثبت في مكانك. • مستعد؟ ابدا
تعليمات للفاحص	• قم بأداء الحركة

- العنصر السادس: تكرار دفع الكرة لأسفل بإتجاة الأرض (بكلتا اليدين بالتبادل)

الهدف	أن يدفع المفحوص الكرة لأسفل بإتجاة الأرض بكلتا اليدين بالتبادل . (انظرإلى مساعد إدارة الاختبار ص٩٩)
الاجراء	• ممسكنا كرة التنس بيدك المفضلة (اليمنى/ اليسرى) ، قف على قدميك مع مد ذراع اليد المفضلة لأمام. • الأن اسقط الكرة على الأرض ثم قم بتكرار دفع الكرة لأسفل بيد واحدة من بين اليدين بالتناوب. • إستمر حتى أقول لك توقف. • حاول أن تثبت في مكانك. • مستعد؟ ابدا
تعليمات للفاحص	• قم بأداء الحركة

- <u>العنصر السابع: رمي الكرة نحو الهدف (باليد المفضلة)</u>

الهدف	أن يصيب المفحوص الهدف بالكرة باليد المفضلة . (انظرإلى مساعد إدارة الاختبار ص١٠١)
الاجراء	• قف خلف هذا الخط . إرمي الكرة داخل الدائرة بيدك المفضلة. • مستعد؟ ابدا
تعليمات للفاحص	• أشير إلى الخط. • أشير إلى الهدف. • قم بأداء الحركة. • دع المفحوص يجرب لمرة واحدة.

الاختبار الثامن: القوة البدنية

ويحتوي على خمسة عناصر:

- <u>العنصر الاول: القفز الطويل من الثبات</u>

الهدف	أن يقفز المفحوص من الثبات اطول مسافة ممكنه . (انظرإلى مساعد إدارة الاختبار ص١٠٥)
الاجراء	• قف خلف هذا الخط جاعلا قدميك متباعدتين بإتساع كتفيك . إثني ركبتيك، إنحني إلى الأمام، وأرجح ذراعيك إلى جانبيك عددة مرات. • عندما أقول لك إبدأ أعد ذراعيك إلى الخلف واقفز إلى الأمام بأقصى ما تستطيع جاعلا ذراعيك تتأرجح إلى الأمام مع ملاحظة الهبوط على كلتا القدمين. • تذكر أن تثني ركبتيك، تؤرجح ذراعيك، إقفز بإقصى ما تستطيع، وإهبط على كلتا قدميك. • إذا فقدت توازنك حاول أن تقع إلى الأمام. • مستعد؟ ابدا
تعليمات للفاحص	• أشير إلى الخط. • قم بأداء الحركة. • دع المفحوص يجرب لمرة واحدة.

- العنصر الثاني:

أ ـ ثني ومد الذراعين من الجثو الأفقي

الهدف	أن يثني ويمد المفحوص ذراعيه من الجثو الأفقي . (انظرإلى مساعد إدارة الاختبار ص١٠٧)
الاجراء	• ضع ركبتيك على هذه الوسادة . ضع يديك على الأرض بتساع كتفيك ثم ضع ساقيك بشكل متقاطع مع رفع القدمين لأعلا. • إدفع بذراعيك الأرض حتى ينتقل جذعك وظهرك لأعلى والذراعين مفرودتين تماما، ثم إثنى ذراعيك حتى يلمس صدرك الارض. • تذكر أن تجعل ظهرك ورقبتك في وضع مستقيم مع النظر لأمام. • إستمر في ثني ومد الذراعين بأقصى سرعة حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• أشير إلى الوسادة • قم بأداء الحركة.

ب ـ ومد الذراعين من الإنبطاح المائل

الهدف	أن يثني ويمد المفحوص ذراعيه من الإنبطاح المائل . (انظرإلى مساعد إدارة الاختبار ص١٠٩)
الاجراء	• إنبطح على الأرض مستند على كفيك بتساع صدرك و اصابع قدميك • إدفع بذراعيك الأرض حتى ينتقل جذعك وظهرك لأعلى والذراعين مفرودتين تماما، ثم إثنى ذراعيك حتى يلمس صدرك الارض. • تذكر أن تجعل ظهرك ورقبتك في وضع مستقيم مع النظر لأمام. • إستمر في ثني ومد الذراعين بأقصى سرعة حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة.

- <u>العنصر الثالث: الجلوس من الرقود</u>

الهدف	أن يجلس المفحوص من وضع الرقود . (انظرإلى مساعد إدارة الاختبار ص١١١)
الاجراء	• إستلقي على ظهرك مع ثني الركبتين ووضع الذراعين جانبا . • ضع ذقنك إلى صدرك، إجعل ذراعيك وكتفيك في حالة إستقامة إرفع زراعيك وكتفيك لأعلى حتى تصل إلى ركبتيك ثم إرجع حتى يلامس ظهرك الأرض. • إستمر في الجلوس والإستلقاء بأقصى سرعة حتى أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة.

- <u>العنصر الرابع: الإرتكاز على الحائط</u>

الهدف	أن يرتكز المفحوص على الحائط من وضع نصف قرفصاء . (انظرإلى مساعد إدارة الاختبار ص١١٣)
الاجراء	• ضع ضهرك على الجدار ثم حرك قدميك قليلا لأمام. • الأن زحلق ظهرك على الجدار ببطء حتى اقول لك أتبت. ثم شبك زراعيك هكذا. • اثبت على هذا الوضع إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة.

- العنصر الخامس: رفع الذراعين والقدمين عن الأرض

الهدف	أن يرتكز المفحوص على الحائط من وضع نصف قرفصاء . (انظرإلى مساعد إدارة الاختبار ص١١٣)
الاجراء	• إنبطح على الأرض مع مد الذراعين لأمام. • عندما أقول لك ابدا ارفع ذراعيك وكتفيك عن الأرض مع رفع القدمين في نفس الوقت. • تذكر ان تجعل زراعيك وقدميك في وضع مستقيم مع الظر لأمام. • اثبت على هذا الوضع إلي أن أقول لك توقف. • مستعد؟ ابدا.
تعليمات للفاحص	• قم بأداء الحركة.