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Reliability and Validity of Physical Literacy Assessment Tools in the High School Aged Population

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Reliability and Validity of Physical Literacy Assessment Tools in the High School Aged Population

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ABSTRACT

Reliability and Validity of Physical Literacy Assessment Tools in the High School Aged Population

Context: As obesity continues to rise in children, there is a greater need to implement intervention strategies to improve physical activity. Physical literacy is a growing concept that focuses on improving life-long physical activity levels through appreciating the influence of a child's ability, confidence and desire to be active. Physical literacy assessment tools have previously focused on populations under 15 years old. The purpose of this study was to evaluate the reliability and validity of physical literacy assessment tools in the high school/adolescent population. **Methods:** A repeated measures study design was used to assess the inter-rater reliability and construct validity of the PLAYbasic assessment tool. Students, age 15-18, currently enrolled in physical education classes at a local high school were recruited to participate in this study. Each participant performed 7 tasks: overhand throw, kicking of a ball, backwards walk heel-to-toe, run there and back, hop, long jump, and a jump landing task while being evaluated for movement ability by two separate raters. Tasks within each domain were evaluated using a 100-point visual analog scale (0= not competent, 100= proficient). Landing mechanics were assessed using the Landing Error Scoring System (LESS). Separate two-way random effects models along with standard errors of measurement (SEM) were used to assess inter-rater reliability. Pairwise Pearson correlation coefficients were used to evaluate the associations between each of the 7 tasks. **Results:** Overhand throw (SEM = 8.26), kick (SEM = 8.74), balance (SEM = 5.98), and running (SEM = 6.35) tasks all demonstrated good inter-rater reliability (ICC > 0.75). Significant, but moderate to weak correlations were observed between throwing and kicking tasks (r^2=0.38, P=0.01), balance and running tasks (r^2=0.45, P=0.05), and between long jump and throwing (r^2=0.46,P=0.05), kicking (r^2=0.48, P=0.05), and running (r^2=0.49, P=0.05). **Conclusion:** Findings from this study show the PLAYbasic assessment tool is an efficient, valid assessment of movement skills, and reliable tool for screening physical literacy ability. Tasks being used are not redundant and should continue to be used, the assessment tool is reliable in the high school aged population, and other measures, such as LESS and long jump, may provide additional areas of assessment for children's physical ability.

I. REVIEW OF THE LITERARTURE

This literature review will cover the current trend of obesity in the youth population and look at the effects that the current levels of physical inactivity have on obesity and other related comorbidities. In addition, this literature review will elaborate on previous efforts taken to improve physical activity among children and discuss the role that establishing physical literacy levels could have on improving the physical activity participation in the youth population. Along with physical literacy, we will discuss the role that sport participation could have on physical activity levels and the potential consequences that sport specialization may bring to the youth athlete.

1.1 Public Health Perspectives

1.11 Obesity Prevalence in Children

According to the CDC, approximately 93.3 million adults and 13.7 million children and adolescence are presently obese in the United States[1,2]. Specifically, 14.8% of high school students are obese while nearly a third (30.4%) are considered overweight or obese (state of childhood obesity. Org). Since 1975, obesity has nearly tripled throughout the world[3]. The continued rise in obesity is alarming and has become a major public health concern given the association it has with other diseases. Comorbidities associated with obesity, including type 2 diabetes, hypertension, coronary artery disease, cancer, and cognitive disorders are subsequently increasing in prevalence as childhood obesity rates increase[4]. As the prevalence of comorbidities associated with obesity rise, so does the price of healthcare. Literature shows the average annual increase in medical spending due to obesity is $732[5].

The main cause of obesity in children is due to the overconsumption of calories compared to expenditure[6]. Modifying children's diets to reduce their caloric intake or increasing physical activity are two primary methods to reduce obesity. In this study, the focus will be on physical activity due to the positive impact and access children have to physical activity through sport and physical education.

1.12 Physical Activity Participation Among Children

The health benefits associated with improved levels of physical activity are well cited in the literature[7,8]. Physical inactivity can lead to a number of potential consequences including obesity, increased risk of cardiovascular disease, and other comorbidities[9]. Regular physical activity can lead to prevention of multiple chronic diseases and reduce the risk of premature death[10]. Physical activity performed at moderate-to-high intensity has been shown to improve weight loss[11].

The American Heart Association provides recommended guidelines of physical activity for adults and children. Adults are recommended to get 150 minutes of moderate-intense aerobic activity or 75 minutes of vigorous aerobic activity per week[12]. Children ages 6-17 are recommended to get at minimum 60 minutes of moderate-to-vigorous physical activity a day[12]. Nationwide, only 24% of children age 6-17 are participating in 60 minutes or more of physical activity per day[13]. Physical activity participation needs to improve among children to avoid complications that are associated with physical inactivity.

1.13 Physical Activity Interventions in Children

The majority of previous efforts to improve youth physical activity in children have involved community-based or school-based interventions[14,15],[16],[17]. Interventions frequently include promoting teacher-led exercises,[14] the use of accelerometers as an objective measure to track physical activity to provide children with a positive feedback loop to motivate future activity,[18] improved access to opportunity, including markings on the playground to guide activities/games[18,19] or walking clubs.[19] These outcome measures have incorporated a wide variety of potential factors related to physical activity participation, including MVPA (moderate-to-vigorous physical activity), VPA (vigorous physical activity), steps per minute, and percent time in sedentary behavior. Although some efforts have been effective for improving short-term physical activity levels, there is little evidence on the effectiveness of these interventions in the long-term.

Meyer et al. 2014[20], completed a cluster-randomized control trial to examine the long-term effects that a school-based physical activity intervention would have on kids adiposity (skin fold), aerobic fitness (shuttle run), and physical activity levels (accelerometer). The intervention for this study took place over a nine-month span in first and fifth grade students, consisting of three physical education classes per week, for the control and intervention group, while the intervention group also received two additional physical education classes per week. The intervention group received three to five short activity breaks every day focusing on motor skills and was assigned homework that consisted of physical activity. After nine months they found that the when compared to the control group, the intervention group had shown an improvement in adiposity, cardiovascular risk score, moderate-vigorous physical activity, and aerobic fitness[21]. At the three-year follow up the intervention group maintained a higher aerobic fitness and the fifth grade adiposity remained lower when compared to the control group, however other beneficial findings were not sustained[20].

Ridgers et al.[22] studied the effect of playground marking on physical activity levels, which were measured using heart rate and an accelerometer. The intervention collected data at three separate time points: baseline, 6-weeks, and 6 months. The intervention was effective in increasing MVPA and VPA over time from baseline to 6-months showing the short-term effectiveness that this intervention can have. However, in another study by Ridgers et al.[23], the same measures were tracked at baseline, 6-months, and 12-months. The intervention group was more active during the specified recess time with the effect being strongest at 6-months compared to baseline and 12-months. Using playground markings and structures has a short-term benefit, yet there is no clear evidence showing previous intervention effectiveness on life-long physical activity.

1.2 Physical Literacy

Previous efforts of improving physical activity in school-aged children have mainly focused on short-term effectiveness. Due to lack of evidence surrounding long-term effectiveness of current efforts, there is a need to find a more efficient and long-term answer for increasing physical activity rates in children. A potential way to increase physical activity in children could be to develop and increase student physical literacy levels, which focus on the life-long physical activity.

Physical literacy is a relatively new concept that was first expressed in the early 1990’s by Dr. Margret Whitehead. Countries around the world are far ahead of the United States when it comes to studying and understanding physical literacy. In other countries, physical literacy is developed as a framework and used as an outcome in physical education and school sport[24].

There are a variety of definitions for physical literacy in the literature. The International Physical Literacy Association (IPLA) defines physical literacy as “the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life.”[25] Canadian Sport for Life (CS4L) defines physical literacy as “the motivation, confidence, physical competence, knowledge and understanding to value take responsibility for engagement in physical activities for life”[26]. Shape America Society of Health and Physical Educators (SHAPE) defines physical literacy as “the ability to move with confidence and competence in a wide variety of physical activities in multiple environments that benefit the healthy development of the whole person.”[27] The Aspen Institute defines physical literacy as “the ability, confidence, and desire to be physically active for life.”[28] With most definitions stemming from the definitions provided by the IPLA, it shows the importance to look at physical literacy not only from a standpoint of “is the person capable of doing the movement”, but rather through multiple lenses to focus on the effects that the persons confidence, motivation, and understanding to how and why they perform a particular movement is also influencing their physical literacy.

1.21 Ability

As mentioned above, one of the main components of physical literacy is the person's ability to perform tasks required for physical activity participation. Ability involves motor control produced within a group of muscles while an individual is performing certain activity-related motions. In a review by Bremer et al.[29] the authors concluded that an important factor to child physical and mental health is their development of proficient movement skills.

Having competency with the fundamental motor skills required to complete physical activities and tasks is imperative for lifelong physical activity. Fundamental movement skills often consist of multiple motor tasks: balance, running, jumping, galloping, hopping, throwing, catching, kicking, skipping, and leaping. These tasks are can be categorized into balance, locomotor (e.g. jumping, galloping, leaping), and object control (throwing, kicking, catching). Children that participate in more organized physical activity have shown increased ability to complete fundamental movement skills[30].

1.22 Confidence

Psychologically, confidence is a person perceived ability to successfully perform a task or objective. For improved physical literacy levels, it is important that while performing the task, the person is confident in their ability. If they are not confident, they are going to be able to successfully complete the task, the odds of them willingly participating in the task decreases. However, what is being found is that in younger populations, their perceived confidence is actually greater than their competence when it comes to overall and object control tasks[31]. Previous literature shows with increased age we see increased ability to accurately assess their competency levels[32].

1.23 Desire/Motivation

When discussing physical literacy it is important that we do not only look at the motor competency piece, but that we look at the person as a whole. A valuable piece of physical activity that is often overlooked is their motivation to be active. In order for a child to be physically active, they must first have the desire to be physically active. Previous literature has suggested that participating in physical activity with a friend may increase the motivation to be physically active[33,34]. If a child is not exposed to peer related activity or they lack internal motivation to be physically active, they may feel unprepared or unable to perform certain tasks associated with physical activity. As they continue to feel unable to perform these tasks it is possible this could lead them to less desire to be physically active.

1.24 Assessment of Physical Literacy

There are many different tasks and assessments proposed to be used to evaluate a child's physical literacy level in the literature[26,35, 36]. One of the assessment tools used is the Physical Literacy Assessment for Youth (PLAY)[36]. This is a tool that encompasses all areas of physical literacy. The PLAYfun[36] assessment is made up of 18 tasks that cover multiple domains of a child's physical ability when it comes to physical activity. The domains covered through the 18 tasks are running (i.e run in a square, there and back, and run, jump and land on 2 feet), locomotor (i.e., skip, gallop, hop, jump), upper body object control (i.e., one handed catch, dribbling a ball, overhand throw), lower body object control (i.e., foot dribble, kick a ball at designated area of a wall), and balance (i.e. lift and lower, walk heel-to-toe forwards and backwards). However, there is also a PLAYbasic[37] tool that allows for the testing of physical literacy competency tasks through five tasks: run there and back, hop, overhand throw, kick a ball, and balance walk heel-to-toe backwards.[36] Raters use a 100mm visual analog scale score the tasks. The PLAYself[38] tool is used to capture the child's perceived level of physical literacy and captures the confidence piece of physical literacy. This tool captures the child's confidence in four categories: environment, physical literacy self-description, relative ranking of literacies, and fitness.

Another common screening tool used is the Canadian Assessment of Physical literacy[35]. The CAPL-2 is designed to look at the physical competence, daily behavior, knowledge and understanding, and motivation and confidence of children ages eight to twelve, which may not make this assessment a viable option for older, high school aged populations. The CAPL-2 assessment requires participants to wear a pedometer for seven days and log their step count at the end of each day in order to test daily behavior. The second domain of the CAPL-2 is determining physical competency, which consists of three sub-domains, each accounting for 1/3 of the total physical competency score. PACER (Progressive Aerobic Cardiovascular Endurance Run) test, a timed plank, and Canadian Agility and Movement Skill Assessment (CAMSA) were used to calculate physical competency. CAMSA is a timed test that consists of throwing, kicking, and locomotor activities for the child to perform. PACER test is a cardiorespiratory endurance test and the plank timed plank is testing torso endurance and strength. Although these tests may be beneficial, they make up equivalent portions of the “ability” assessment score as the CAMSA does in the CAPL-2 which may give a score that does not accurately assess the child’s motor competency due to 2/3 of the tests being more endurance based activities.

Passport for Life (P4L)[39] is another physical literacy assessment tool created for the educational system and for educators specifically. This assessment encompasses the categories of: active participation, living skills, fitness skills, and movement skills. Due to P4L not being designed to be used as a comprehensive assessment of physical literacy, it was excluded.

1.25 Role of Movement Quality

There are many methods used to assess lower extremity movement, some of which are single-leg squat, lateral step-down, uni-lateral step down, and single and double leg stop jumps[40,41,42,43]. Altered lower extremity biomechanics place uncommon loads on tissues and joints of the lower extremity[44]. With altered loads on the joints and tissues, it is possible there is an increased risk of injury, showing the importance of having a tool to screen lower extremity mechanics.

One common tool used for assessing lower extremity biomechanics during a drop-landing task is the Landing Error Scoring System (LESS)[45]. The LESS has been proven to be reliable and valid for identifying high risk movement patterns and has shown potential as a tool to be used in screening for ACL injury risk[46]. The LESS is performed by instructing a participant to jump forward, leaving with both feet at the same time, from a 30cm box to a distance equaling half of their body height. Upon landing, the participant is then instructed to immediately perform a maximal vertical jump. The assessment can be completed in limited time with the use of a marker less motion capture system, which has shown to be as reliable as expert LESS raters[47]. Using this assessment tool would allow for another set of data to be collected revolving around the ability of a participant to perform a task and can easily be implemented into the physical literacy testing protocol.

1.26 Muscular Fitness

Many tools have been implemented in schools in order to test the fitness level of youth. Some examples of these assessments are shuttle run, push-up, sit up, vertical jump, sit-and-reach, and sit up among many more[48]. The standing long jump is another task that has been used in evaluation of physical fitness in youth. The long jump is a task that takes minimal time to perform and is able to give an objective measure (distance jumped). The long jump has been shown to be strongly correlated with both lower-extremity and upper-extremity strength tests[49]. Due to the efficiency and fitness measure the long jump provides this would be the most practical test of physical fitness/ability to use in conjunction with a physical literacy screening tool.

1.3 Sport Specialization/Sampling

Nearly 60 million children between the ages of 6 and 18 participate in some sort of organized sport[50]. Within that number, approximately 55-59% of high school students participate in organized sport[51]. In previous literature sport participation is associated with an increase in cardiovascular and muscular fitness, motor coordination, physical activity rates, and a reduction in body mass and other health related issues[52].

Now more than ever kids are deciding to specialize in a single sport rather than sample multiple organized sports. Sport specialization is defined was the intense year-round training of a single sport at the exclusion of all other sports, participation in a single sport for 8-or-more months of the year, and participation in a single sport for more hours per week than the child's chronological age[53,54]. Currently, 10-38% of all teenagers in sport are deciding to specialize and meet the criteria to be considered highly specialized[55]. The number of children deciding to sport specialize is increasing and is starting at nearly two years younger than current colligate and professional athletes report[56,57]. This is happening due to a belief that by focusing solely on a single sport they are more likely to receive a college scholarship and make it to the professional level[57,58]. However, what the literature is showing is that kids that are choosing to specialize are more commonly associated with increased risk of overuse musculoskeletal injuries as well as increased risk of burnout leading to discontinuation of play[54,59,60].

Unlike sports specialization, sports sampling is the participation in 2 or more organized sports. In the younger population (8-14) sampling has been linked to improved landing mechanics and neuromuscular control[61]. This is important to understand so we can encourage kids to try multiple sports, which can act as a way to get them more involved and physically active. With the increased participation rates in multiple organized sports from a younger age, kids not only will have an increased ability during physically active, but they also may be more confident while performing physical activity tasks and more motivated to continue their participation.

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Chapter II

2.1 Introduction

Approximately 13.7 million children are presently obese in the United States[1,2] with rising rates each year[3]. The continued rise in obesity is alarming and is a major public health concern given the associated comorbidities with obesity, including Type-2 diabetes and hypertension[4], and significant health care costs [5]. The rising rates of childhood obesity coincide with growing numbers of children who are failing to meet physical activity guidelines. [6]

Previous intervention strategies to promote physical activity have focused on providing school-based or community-based interventions to children[7,8,9,10]. Although some intervention efforts have effectively improved short-term physical activity levels, there is little evidence supporting the long-term effectiveness of these interventions[11,12]. Due to the lack of long-term effectiveness of physical activity promotion interventions, alternative strategies need to be identified to address the decline in childhood physical activity participation. These strategies likely need to be comprehensive and integrate the numerous barriers and facilitators to physical activity participation.

Physical literacy is an emerging concept internationally that integrates several intrapersonal determinants to physical activity participation. The Aspen Institute defines physical literacy as "the ability, confidence, and desire to be physically active for life"[13]. Several tools have been developed to evaluate constructs related to physical literacy with demonstrated validity[14], and reliability[15]. Physical literacy assessment tools PLAYfun and PLAYbasic have been found to be reliable in children ages 8-14[15]. Importantly, an association between physical activity guidelines and physical literacy scores has been found in children 8-12 years old[16]. The majority of physical literacy research has been conducted with children younger than 15 years old, however, exploring the physical literacy levels among adolescents is also important to understand the relationship between physical literacy and long-term physical activity participation.

The purpose of this study was to evaluate the construct validity of the PLAYbasic assessment tasks to ensure these tasks are still valid with an adolescent population (ages 15-19), and to establish the inter-rater reliability of this tool. We hypothesized that the PLAYbasic tool would demonstrate independent constructs, or a lack of strong associations between tasks, and good to high inter-rater reliability. Other measures of neuromuscular control, such as the long jump and Landing Error Scoring System (LESS), are frequently measured among adolescent populations to assess injury risk[17] and fundamental movement control by health care and educational professionals. The addition of these tools to the PLAYbasic assessment may provide additional informative data when evaluating the ability concept related to physical literacy. Thus, a secondary purpose of this study was to evaluate the construct validity of the PLAYbasic tasks, a long jump task, and the LESS. We hypothesized that these measures would provide additional information that may be contributing to adolescents' long-term physical activity participation.

2.2 Methods

2.21 Study Design

A repeated measures study design was used to assess the inter-rater reliability and to evaluate associations between tasks of the PLAY basic assessment tool[18] in a high school aged population. This tool's purpose is to assess the ability level of participants to perform tasks related to fundamental movement skills, which is a component of physical literacy. Participants completed a single test session and were evaluated by two independent raters during each task performed.

2.22 Participants

Students, age 15-18, currently enrolled in physical education classes at a local high school were recruited to participate in this study. This sample was selected as it was a large group that most represented the general public with around 50% of the students participating in organized sport. Students were excluded from participating if they reported an injury or illness on the day of testing that prohibited them from participating in physical education class. Prior to data collection, each participant and their parent/guardian provided assent and consent, respectively, using a standard form. The University's Institutional Review Board approved all procedures within this study. Prior to data collection, participants completed a baseline questionnaire, which inquired about demographic information, as well as previous sport and physical activity participation.

2.23 Raters

Raters for this study were graduate students recruited from the Department of Kinesiology at the University of Connecticut and were chosen on a volunteer basis. These raters all had background knowledge in human anatomy and movement, but were not considered to be experts related to physical literacy and/or fundament movement skill evaluation. Each rater provided informed consent prior to participation in this study. All raters attended a standard one-hour training session, led by the principal investigator, to review the concept of physical literacy, the PLAYbasic testing protocol[18], and how to grade/score the participants. During the training session, raters were provided with demonstrations of the tasks and asked to score them to familiarize themselves with using the visual scale. Raters had the opportunity to receive feedback from an expert rater on their scoring and ask questions until they indicated that they felt comfortable using the testing protocol.

2.24 Test Procedures

Participants were asked to perform 7 tasks in a randomized order: single-limb hop, overhand throwing of a tennis ball toward a target, kicking a soccer ball above a target line, running there and back, backward heel-to-toe walking, a standardized jump landing, and a long jump. PLAYbasic is a condensed version of the PLAYfun assessment tool and requires the participants to perform 5 tasks that are designed to test their ability and competency in 4 domains: Locomotor, Upper Extremity Object Control, Lower Extremity Object Control, and Balance (Figure 1). Before the participant performed each PLAYbasic task, the rater read a pre-written description and instructions for the task (Table 1).

The long jump task required the participant to stand stationary at a specified point and was instructed to jump as far out as possible and to stick the landing on both feet. Raters measured the distance between the starting line and the participant's heel closest to the starting point upon landing. For the jump landing task, the participants stood on a 30 cm high box and were instructed to jump forward with both feet a distance of half of their body height. Immediately upon landing, participants were instructed to perform a maximal vertical jump.

2.25 Data Reduction and Analyses

The jump landing task was scored using the LESS with a marker less motion capture software[19] (PhysiMax Technologies Ltd, Tel Aviv, Israel). The average total score of 3 trials were used for data analyses. Each fundamental movement skill was scored using a visual analog scale, scored on a 100mm line, providing a score of 0-100 (0-24.99: Initial, 25-49.99: Emerging, 50-74.99: Competent, 75-100: Proficient). For analyses, the score of each rater on all individual tasks and a comprehensive score, made up of the average score between the two raters during each task, was used for each participant. The inter-rater reliability for evaluating each PLAYbasic task was measured using separate two-way random effects models and intraclass correlation coefficients ($ICC_{(2,k)}$) along with standard errors of measurement (SEM) were calculated. Pairwise Pearson correlation coefficients were used to evaluate the associations between each of the 7 tasks using the average score between the raters. Data analyses were performed using SPSS- Version 25 with an a-priori α level of 0.05.

2.3 Results:

A total of 23 participants completed the study (Table 1). The overhand throw, kick, balance, and running tasks all demonstrated good inter-rater reliability (Table 2). Significant, but moderate to weak correlations were observed between throwing and kicking tasks (R=0.738, P=0.01), balance and running tasks (R=0.475, P=0.05), and between long jump and throwing (R=0.536,P=0.05), kicking (R=0.509, P=0.05), and running (R=0.507, P=0.05) (Table 3).

2.4 Discussion

The findings from this study confirm that the PLAYbasic assessment appears to be valid assessment for evaluating movement skills and reliable in a high school/adolescent population. Further refinement is needed in the training of the hop task in order to improve the reliability. Adding long jump and LESS may be advantageous for gaining support for this tool from educators and health care professionals as they provide additional and efficient measures related to human movement. The PLAYbasic tasks demonstrated independent constructs showing that all of tasks being used are evaluating different measures related to human movement control during sport. This is important due to the ability to use the PLAYbasic tool in conjunction with long jump and LESS in order to evaluate physical literacy and be used to monitor interventions to improve physical activity levels among children.

Similar to previous research performed with a younger participants[14], the PLAYbasic assessment tool appears to demonstrate construct validity in a high school-aged population. All of the tests used in the PLAYbasic assessment appear to provide specific pieces of information regarding an individual's ability to perform fundamental skills for physical activity participation. The jump landing task and long jump also demonstrated independent constructs when compared with each other and with the PLAYbasic tasks. This finding is important, as adding an activity like a jump landing task, such as the LESS, provides us with a global measure of lower extremity neuromuscular control, or movement quality. Reduced neuromuscular control while performing sport-specific movements alters joint loading and may increase injury risk[20], which is an important factor for long-term physical activity participation. The addition of long jump is also important as it has been shown to have a strong association with tests used to assess whole body muscular strength and can be used to assess fitness in youth[21].

Another purpose of this study was to evaluate the inter-rater reliability of the PLAYbasic tasks[18]. We hypothesized that all PLAYbasic tasks would demonstrate good inter-rater reliability showing the ability of the assessment tool to be used by all trained raters. This hypothesis was shown true in four of the five PLAYbasic tasks: overhand throw, kicking of a soccer ball, backward walk heel-to-toe, and run there and back. However, this was shown to be untrue for the hop task as poor inter-rater reliability was observed during this task. Previously, Stearns et al.[15] demonstrated that the more comprehensive PLAYfun assessment tool had good inter-rater reliability[15], however, they evaluated reliability for each domain of the assessment versus the individual tasks themselves. Other tasks used to assess locomotor function may have increased inter-rater reliability compared to the hop. However, due to hop being a more dynamic task than some of the other tasks evaluated in this study, spending more time during the training session for the raters on what to look for and how to evaluate this task may be necessary and could affect scores between raters.

The goal of physical literacy interventions is to provide avenues to improve life-long physical activity levels. Previous literature has shown that PLAYfun competency scores increased with age, which is expected as the body continues to develop, and children gain greater exposure to sport participation and dynamic movements. With the goal to evaluate the reliability of the PLAYbasic assessment tool in the high school/adolescent population, it was important that the sample used in this study represented the general population. Nearly half of the participants in this study reported no current sport participation (Table 2), which potentially could correspond with the levels of physical inactivity we see in the youth population.

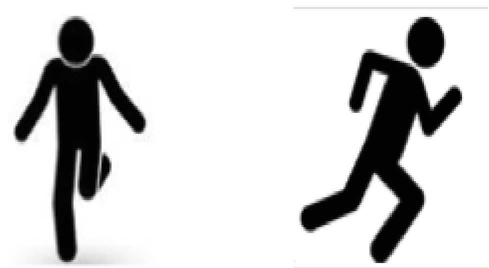
This study is not without limitations. One limitation was this study only focused on the physical ability aspect of physical literacy and was not an all-inclusive evaluation of the other aspects of physical literacy in confidence and desire to be physically active. A major limitation presented itself in the recruitment of participants for this study as many of the students in the physical education class did not want to participate due to various reasons, some of which were: “I don’t like doing physical activity”, “I think it will be too hard for me”, “I don’t want to participate.” This is a limitation, but also shows the importance of looking at not only the physical ability of a person, but the need to evaluate their confidence and desire/motivation to be physically active. This is important in order to find a way to improve the level of physical inactivity and to help avoid other comorbidities related to physical inactivity.

Future directions from this study are to evaluate participants across multiple testing sessions to assess intra-rater reliability of the PLAYbasic assessment tool. Also, to use the PLAYbasic assessment tool on a more physically active population to see if there is possibly a ceiling effect on the tasks used in the assessment.

2.5 Conclusion

The importance of evaluating physical literacy is to identify areas for intervention in order to promote long-term physical activity participation. This study shows three important, key findings. The tasks being used in PLAYbasic appear to be measuring different constructs of movement skills in a high school aged population. Integration of the long jump and a jump-landing task may provide additional areas of assessment for children's physical ability and movement control. Furthermore, the PLAYbasic assessment tool can demonstrate acceptable inter-rater reliability in the high school/adolescent population. Further evaluation of physical literacy assessment tools is warranted.

2.6 Figures



Domain: Locomotor
Task(s): Hop, Run there and back
Instructions:
- Hop - Hop from this pylon to the next
- Run - Run a straight line to the pylon, stop, turn around, and run back

Domain: Balance
Task(s): Backwards walk heel-to-toe
Instructions:
- Balance walk - Walk backwards heel-to-toe from one pylon to the next

Domain: Upper Extremity Object Caontrol
Task(s): Throwing a ball
Instructions:
- Overhand throw – Overhand throw the ball at the wall and make it bounce back over your head

Domain: Lower Extremity Object Control
Task(s): Kick ball
Instructions:
- Kick Ball – Kick the ball with one foot above the marker on the wall

Figure 1. Domains of PLAYbasic: Locomotor, Balance, Upper Extremity Object Control, Lower Extremity Object Control, and the associated tasks.

Table 1.
Characteristics of the study sample showing age, sex, height, weight, days per week physical activity is performed, and current sport participation.

Participants (n)	23
Age, years	16.1 ± 1.01
Sex	
Male	11
Female	12
Height (cm)	173.18 ± 10.86
Weight (kg)	73.44 ± 16.35
Average days of PA per week	3.02 ± 2.51
Current Sport Participation	
None	10
Single Sport	8
Multiple Sport	5

Table 2.
Intraclass correlation coefficient (ICC) with 95% confidence intervals and standard error of measurement (SEM), testing inter-rater reliability.

	Throw	Kick	Balance	Hop	Run
ICC $_{(2,k)}$ (95% CI)	0.78 (0.48, .90)	0.81 (0.56, 0.92)	0.90 (0.77, 0.96)	0.47 (-0.26, 0.77)	0.80 (0.54, 0.92)
SEM	8.26	8.74	5.98	9.32	6.35

Table 3.
Correlations between all PLAYbasic tasks and long jump based on the average score between raters for each task.

	Kick	Throw	Balance	Hop	Run	Long Jump
Kick	1.0	0.738**	-0.076	-0.305	0.307	0.509*
Throw	0.738**	1.0	-0.012	-0.128	0.163	0.536**
Balance	-0.076	-0.012	1.0	0.074	0.475*	0.329
Hop	-0.305	-0.128	0.074	1.0	0.079	0.185
Run	0.307	0.163	0.475*	0.079	1.0	0.507*
Long Jump	0.509*	0.536**	0.329	0.185	0.507*	1.0

*P<0.05, **P<0.01.

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