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CHILDREN'S ENJOYMENT OF A MOTOR SKILL TEST IN PHYSICAL EDUCATION

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ABSTRACT

In 2016, a novel motor skill test, the Athletic Skills Track (AST), was developed to assess motor skill competence of children in the PE setting. The main purpose of this study was to examine children's enjoyment when being tested with the AST in a regular PE lesson. The study was conducted among 239 children, aged 4-to-12-years-old. All children completed the AST, where after they rated their enjoyment using a Smileyometer. One week later, 131 children completed another motor skill test, the Körperkoordinationtest für Kinder (KTK), where after they were asked to rank their enjoyment with the AST, the KTK, measurements of body height and weight, and a periodical cognitive test, using a Funsorter. The majority (98%) of the children rated their enjoyment of the AST as good to brilliant. 76% of the children ranked the AST as the most enjoyable in relation to the other three tests. No significant differences were found in enjoyment of the AST between boys and girls, nor between children with different motor competence levels. Most the children enjoyed performing the AST in a regular PE lesson. Future studies should examine the effect of feedback and repeated testing on children's enjoyment.

Keywords: *Motor skill competence, children, physical education, fundamental movement skills.*

1. INTRODUCTION

The decrease in health-related parameters among children, such as their motor skill competence, physical activity (PA) level, and sedentary behavior, has

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become a worldwide concern in the last decades (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Biddle & Asare, 2011; Chen, Mason, Hypnar, & Bennett, 2016; D'Hondt, Deforche, Gentier, Verstuyf, Vaeyens, De Bourdeaudhuij, …. Lenoir, 2014; Dollman, Norton, & Norton, 2005). Various government policies have foregrounded schools to be instrumental in addressing these issues (Cale & Harris, 2013). This has changed the role of schools and physical education (PE) over the last decade (Cale & Harris, 2006; Shephard & Trudeau, 2010; Webb, Quennerstedt, & Öhman, 2008). Since then, various initiatives have been integrated into the school and PE curricula to promote public health (Green, 2014). Recently, a shift in focus can be observed in PE from health- and fitness-related goals to aspects of physical literacy. Physical literacy is "the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life" (Whitehead, 2013). The concerns on children's health and the embracement of physical literacy in PE has led to more health-related testing in the PE setting (Sum *et al.*, 2016). The focus on physical literacy has also renewed the attention for children's motor skill competence, a basic element of physical literacy (Whitehead, 2013). According to Wrotniak, Epstein, Dorn, Jones and Kondilis (2006) motor skills competence is a crucial component for children's engagement in physical activity.

Children's motor skill competence can be measured with several assessment tools. Cools *et al.* (2009) reviewed such tools and stated that, in general, the tests are not very feasible in a PE setting. It takes at least 20 minutes to measure one individual child. Furthermore, special test materials and extensive knowledge of the test protocols are required to conduct the tests. Besides the burden for PE teachers, some researchers also warn that monitoring all kinds of health-related parameters within PE might be counterproductive to the promotion of PA, especially for the children most in need of encouragement (Cale & Harris, 2009; Naughton, Carlson, & Greene, 2006). The measurement can be unpleasant or even embarrassing for children because it measures the children who are at risk in a confronting manner (Cale & Harris, 2009; Stanec, 2009).However, testing in PE can be valuable. For example, it can contribute in supporting a physically active and healthy lifestyle and in enhancing the PE curriculum (Lloyd, Colley, & Tremblay, 2010; Rowland, 2007; Silverman, Keating, & Phillips, 2008). Cale *et al.* (2014) have described a list of recommendations for PE teachers how to approach testing in PE to make it enjoyable for children. The most practical recommendations are: 1) make sure that the testing takes place in a regular context (PE lesson). 2) make the testing enjoyable for all children. 3) do not focus on the outcome of the measurements, and 4) carefully select an assessment tool that takes account of all children, also the children who need feedback on motor skill competence, PA and healthy lifestyle the most (Cale *et al.*, 2014). These

recommendations are in line with the positive pedagogical approaches to testing in PE of Silverman *et al.* (2008). They claim that testing should not be used in an isolated manner without an educational purpose.

In 2016, a novel motor skill test has been developed for 4- to 12-year old children that was especially designed to fit into the context of PE (Hoeboer et al., 2016). This test is called the Athletic Skills Track (AST). The main purpose of this study was to examine children's enjoyment when being tested with the AST in a regular PE lesson. We also examined whether boys have another level of enjoyment than girls when performing the AST and whether children with poorer motor skills have another enjoyment level of the AST than children with better motor skills. A secondary purpose of this study was to examine how children enjoy the AST compared to other tests that children are exposed to during their primary school period.

2. METHODS AND MATERIALS

2.1 Setting and Subjects

This study was conducted at a random selection of two internship schools from the The Hague University of Applied Sciences in The Netherlands. Both primary schools were located in the The Hague city area and were willing to participate in the study. All parents of the children from grade 1 to 8 (4-12 years old) received an information letter with details about the purpose and nature of the study, where after informed consent was obtained from the parents or guardians of all children. Ninety-three percent of the children (n=239; 136 boys and 103 girls) were allowed by their parents or guardians to participate in the study. The study protocol was approved by the Ethical Committee of the Faculty of Human Movement Sciences, VU University Amsterdam, The Netherlands (ECB 2015-31).

2.2 Measurements

Testing was spread out over a two-week time-period in February 2016. All children conducted the AST in the first measurement week, where after their enjoyment of the test was measured using a Smileyometer (Read, 2008). The AST was conducted during a regular PE lesson in a separate section of the gym by two research assistants (fourth year PE students of the The Hague University of Applied Sciences) who had been trained in conducting the tests according to the protocol (Hoeboer *et al.*, 2016, 2017) in two meetings.

To investigate the second research question, one week later 131 randomly selected children completed a more clinical motor skill test, the Körperkoordinationtest für Kinder (KTK) during a regular PE lesson. The KTK was conducted by the same two research assistants who were also trained in conducting the KTK according to the protocol (Lenoir *et al.*, 2014; Vandorpe *et al.*, 2011). When the children finished the KTK they were asked to rank their enjoyment of the AST, the KTK, measurements of body height and weight, and a periodical cognitive test called CITO, using a Funsorter (Risden, Hanna, & Kanerva, 1997).

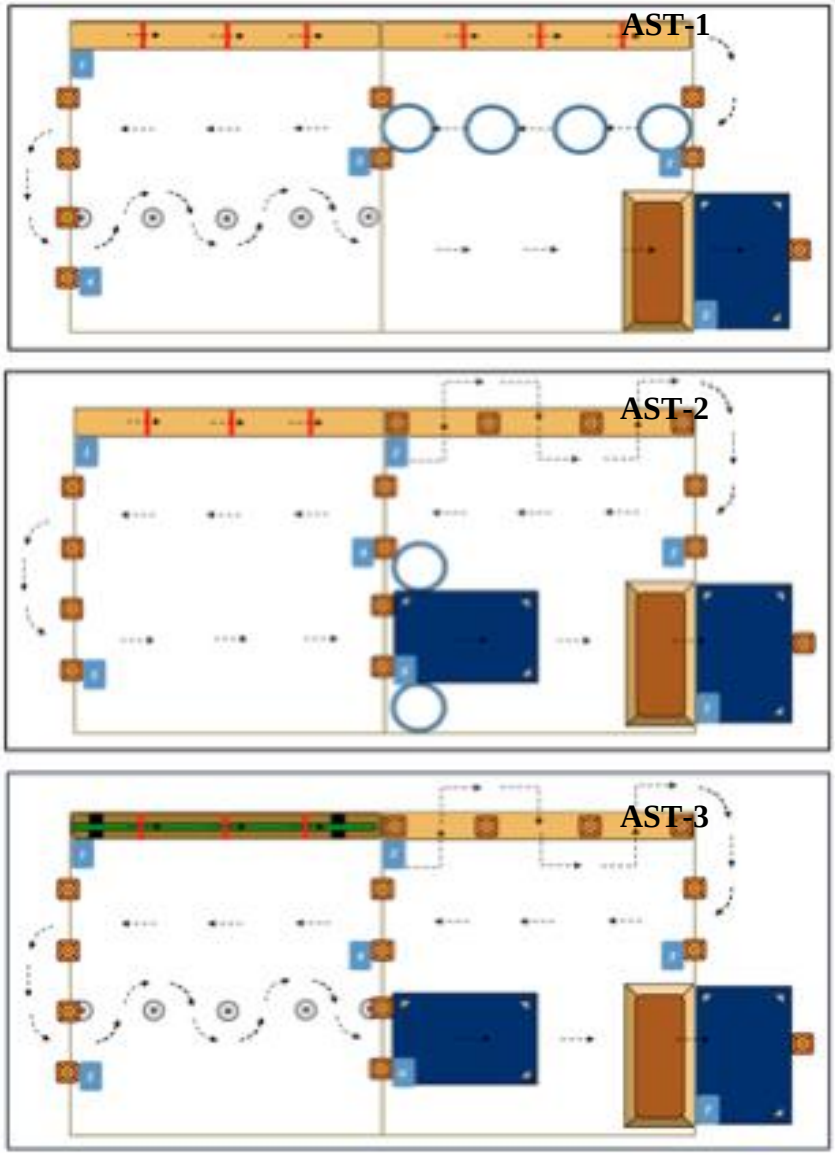
Both the anthropometric measurements and the CITO test are executed once every year at the participating schools. The anthropometric measurements were conducted between January 2016 and February 2016 during a regular PE lesson by children's PE teacher in a separated room near the gym. The CITO test was executed in January 2016, under the supervision of children's group teacher in the classroom. In the following paragraphs, each test will be described in more detail.

2.3 Athletic Skills Track

All children completed the Athletic Skills Track (AST). The AST is a motor skill test that has been developed to assess fundamental movement skills (FMS) among 4- to 12-year-old children in a PE setting (Hoeboer *et al.*, 2016, 2017). The test was executed according to the test manual. The AST contains three age-related tracks consisting of a series of 5 to 7 concatenated FMS (locomotive and stability skills) (AST-1: n=5; AST-2: n=7; and AST-3: n=7) to be completed as fast as possible. In all three tracks the same FMS are tested, but the difficulty of the tasks is ascending from AST-1 to AST-3. AST-1 has been designed for the youngest children in the age of 4 to 6 years and consists of the following skills: 1) Walking, 2) Traveling jumps, 3) Alligator crawl, 4) Slaloming, and 5) Clambering. Children between 6 and 9 years performed AST-2. In this track, the following skills had to be performed: 1) Walking, 2) Traveling jumps, 3) Hopscotch, 4) Alligator crawl (backwards), 5) Running (backwards), 6) Pencil roll, and 7) Clambering. Children in the age of 9 to 12 years completed AST-3 consisting of: 1) Walking (backwards), 2) Traveling jumps, 3) Bunny hopping, 4) Alligator crawl (backwards), 5) Slaloming (backwards), 6) Forward role, and 7) Clambering (see figure 1). Previous studies have shown that the AST is a valid and feasible motor skill test to assess children's FMS in a PE setting (Hoeboer *et al.*, 2016, 2017). The AST was performed during a regular PE lesson in 1/3rd of the gymnasium. In the other 2/3rd of the gymnasium the PE lesson was conducted as usual under the supervision of the PE teacher. The children practiced the track

three times after an example given by the research assistant and then had an individual test attempt where time to complete the track was measured by a research assistant with a stopwatch. For all children, it was their first experience with the test. It took less than 1 minute per child to complete the AST.

Figure 1: AST schematically displayed AST (AST-1 = 4-to-6-year old children, AST-2 = 6-to-9-year old children, AST-3 = 9-to-12-year old children



Körperkoordinationstest für Kinder

Children's enjoyment of the AST was compared to their enjoyment of a more clinical motor skill test, the KTK (Kiphard & Schilling, 2007). The children performed this test also for the first time. This test is not especially designed for the PE setting. The KTK consists of four subtests: (1) Walking backwards three times along each of three balance beams (3 m length; 6, 4.5, and 3 cm width, respectively; 5 cm height); (2) Moving across the floor in 20 seconds by stepping from one plate (25 cm × 25 cm × 5.7 cm) to the next by transferring the first plate, stepping on it, etc.; (3) Jumping from one leg over an increasing pile of pillows (60 cm × 20 cm × 5 cm each) after a short run-up; and (4) Jumping laterally as many times as possible over a wooden slat (60 cm × 4 cm × 2 cm) in 15 seconds. The test protocol for the Dutch language area was followed (Lenoir *et al.*, 2014; Vandorpe *et al.*, 2011). It took ± 25 minutes per child to complete the KTK.

2.4 Anthropometric Measurements

Children's enjoyment of the AST was also compared to their enjoyment of the measurement of their body height and weight. Children's body height and weight were measured by their PE teacher using a standard procedure of the municipality health services. Body weight was measured with a standard digital scale (Seca 877). Body height was measured using a standard measurement scale in millimeters. The children were individually measured in a separate space during a PE lesson. They were measured on bare feet in their sportswear (shorts and t-shirt). The results of the anthropometric measurements are not shown because they were not used for the purpose for this study.

2.4.1 CITO test

To compare children's enjoyment of the AST to their enjoyment of an a-physical test they are familiar with in the school setting, the CITO test was included in the research design. The CITO is a periodical cognitive test developed by the National Institute for Educational Measurement (CITO). The test gives an indication of the general proficiency level in cognitive development consisting of four subjects, i.e., Language, Math, Word orientation and Study skills. Children perform this test twice a year in the primary school period in a regular classroom setting under the supervision of their classroom teacher. All children of a class execute the test in the same timeframe. For the purpose of this study children were asked to remember their last experience with the CITO test in January 2016. The outcomes of the CITO are not shown because these results were not used for the purpose for this study.

2.4.2 Smileyometer

In order to measure children's enjoyment of the AST a Smileyometer was used. The Smileyometer has been developed to measure children's enjoyment (Read, 2008). It is based on the Funometer, a 'thermometer' with a vertical bar representing the amount of fun (Read, MacFarlane, & Casey, 2002). The Smileyometer uses a pictorial representation of enjoyment ranging from 'awful' (1) to 'brilliant' (5) on a Likert scale as shown in Figure 1.

After the children finished the AST children were asked to, individually, select one smiley that fitted their enjoyment of the AST best, in the dressing room. Similar scales have been used in previous studies, for example in a study on the management of postoperative pain. Children have been presented with pain faces before and after surgery (Bosenberg, Thomas, Lopez, Kokinsky, & Larsson, 2003).

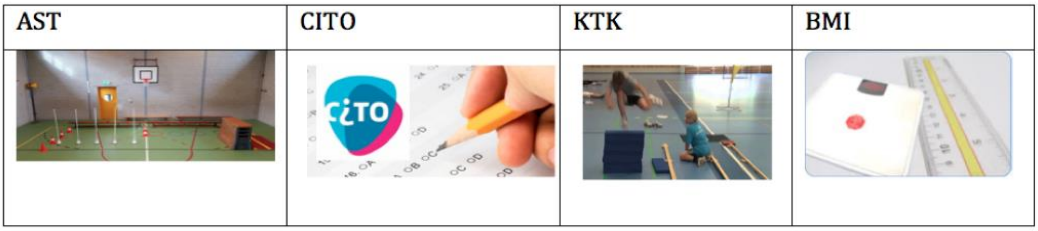
Figure 2: Smileyometer used to record children's enjoyment with the AST

2.4.3 Funsorter

After the children finished the KTK (n=131) they were asked to rank their enjoyment of the AST, the KTK, measurements of body height and weight, and the CITO, using a Funsorter (Risden, Hanna, & Kanerva, 1997). The purpose of the Funsorter is to rank a series of connected activities in order to establish which is most enjoyable (Sim, MacFarlane, & Read, 2006). After a short explanation, the children were asked to rank the four tests using four pictograms with an image of the tests. The children were asked to put the four loose pictograms in order from least enjoyable (1) to most enjoyable (4) to execute.

The funsorter was conducted individually in the dressing room (see Figure 3: Funsorter).

Figure 3: Funsorter (AST = Athletic Skills Track, CITO = a-physical test, KTK = Körperkoordinationstest für Kinder, BMI = Anthropometric measurements)



2.5 Data Analyses

Of the 239 children who were allowed by their parents or guardians to participate in the study all children met the inclusion criteria (age: between 4 and 12 years old). All the children completed the AST and the Smileyometer. A subgroup of 131 children also completed the KTK and the Funsorter. The outcome measurement of the AST is time to complete the track. The faster the child finishes the track the higher the motor skill competence (Hoeboer *et al.*, 2016). The raw test scores on the KTK were converted into age- and gender-specific motor quotients (KTK MQ) using the test protocol for the Dutch language area (Lenoir *et al.*, 2014). Children were then classified into five categories of motor giftedness based on the classification of Kiphard and Schilling (2007). Children with a MQ value between 86 and 115 are considered as having a normal gross motor coordination (NMG), children with a MQ value between 71 and 85 as having a moderate gross motor coordination disorder (MMD) and children scoring 70 or less as having a severe gross motor coordination disorder (SMD). Children scoring between 116 and 130 are considered as having a good motor coordination (GMG) and children scoring 131 and higher as high motor gifted (HMG).

Descriptive statistics were performed to characterize the sample and to report children's outcomes on the AST, the Smileyometer and the Funsorter. To analyze a normal distribution of the outcome parameters, histograms were plotted and the kurtosis and skewness values for each of the outcome parameters were assessed. Since the outcome measurement of the Smileyometer and the Funsorter were not normally distributed non-parametric tests were used.

First, differences in enjoyment of the children performing AST-1, AST-2 or AST-3 were tested using a Somers d test. Secondly, differences between boys and girls in their enjoyment of the AST were tested non-parametrically using an Independent Samples Mann-Witney U test. The influence of motor giftedness on

children's enjoyment was tested with an Independent Samples Kruskal-Wallis Test. Next, the Funsorter results were tested non-parametrically with the Related-Samples Friedman's Two-Way Analysis of variance by Ranks to examine if the enjoyment of the four tests differed significantly from each other. All statistical analyses were performed using IBM SPSS 23.0 64-bit edition. Values were considered statistically significant at $p < 0.05$.

3. RESULTS

In total, 239 4- to 12-year old children (136 boys and 103 girls) completed the AST. Of this total sample, 131 children also completed the KTK (80 boys and 103 girls). The children's age and score on the AST and the KTK are shown in Table 1. On average, it took about 22.5 ± 4.0 seconds to complete AST-1, 26.1 ± 4.6 seconds to complete AST-2, and 24.1 ± 4.5 seconds for AST-3. The average KTK Motor Quotient was 90 ± 11.

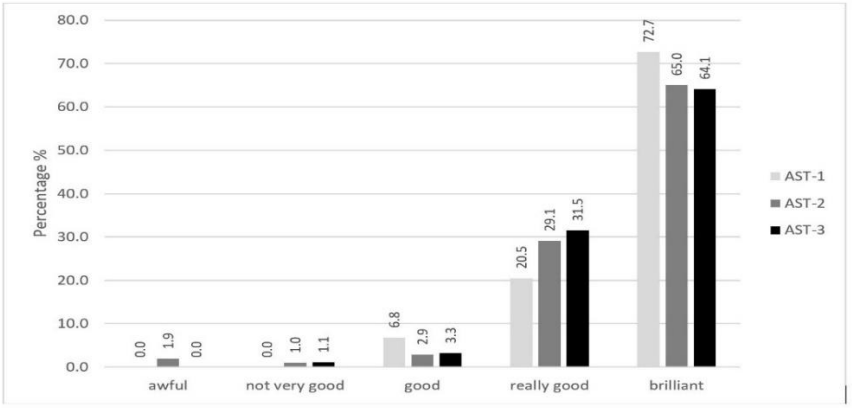
Table 1: Descriptive statistics of children's age and score on AST and KTK

		N	Mean	(±SD)	95% CI	
					Lower	Upper
Age (years)	Boys	136	8	2	7.92	8.64
	Girls	103	9	2	8.09	8.92
	Total	239	8	2	7.41	8.20
AST-1 (sec)	Boys	29	22.2	4.3	20.57	23.86
	Girls	15	23.1	3.3	21.27	24.89
	Total	44	22.5	4.0	21.29	23.71
AST-2 (sec)	Boys	60	25.7	4.5	24.55	26.88
	Girls	43	26.6	4.7	25.10	28.02
	Total	103	26.1	4.6	25.10	26.97
AST-3 (sec)	Boys	47	24.6	3.9	23.41	25.71
	Girls	45	23.8	5.1	22.27	25.33
	Total	92	24.1	4.5	23.25	25.13
KTK (MQ)	Boys	80	89	11	86.88	91.89
	Girls	51	90	11	86.67	92.79
	Total	131	90	11	87.61	91.43

Children's enjoyment of the AST

All children reported their enjoyment of the AST using the Smileyometer. The majority of the children (98%) indicated that the AST was enjoyable. They enjoyed the AST really good to brilliant (Figure 4). Of the 239 children two children reported that the AST was awful. There was no significant difference in enjoyment between children that completed AST 1, 2 and 3 (Somers d = 0.036, p = 0.489).

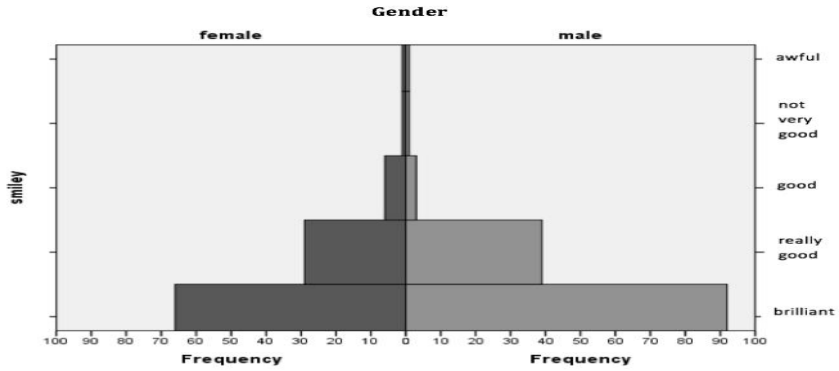
Figure 4: Level of reported enjoyment per athletic skills track according to the smileyometer (AST-1 N=44, AST-2 N=103, AST-3 N=92)



An Independent Samples Mann-Whitney U test was conducted to determine if there were differences in Smileyometer scores for boys and girls. Distributions of the Smileyometer scores were similar, as assessed by visual inspection. Median Smileyometer scores were not significantly different between boys and girls (U = 6.67, z = -0.753, p = 0.452).

With an Independent Samples Kruskal-Wallis H Test the differences in enjoyment measured with the Smileyometer was investigated between children with different motor skill levels (MQ categories). Distributions of enjoyment measured with the Smileyometer were not similar for all groups (SMD, MMD, NMG, GMG, HMG) as assessed by visual inspection of a boxplot. However, the distribution of the Smileyometer scores is not significantly different across all categories of the MQ classification (X2(3) = 1.623, p=0.654) (see Figure 5: frequencies of reported enjoyment).

Figure 5: Frequencies of reported enjoyment

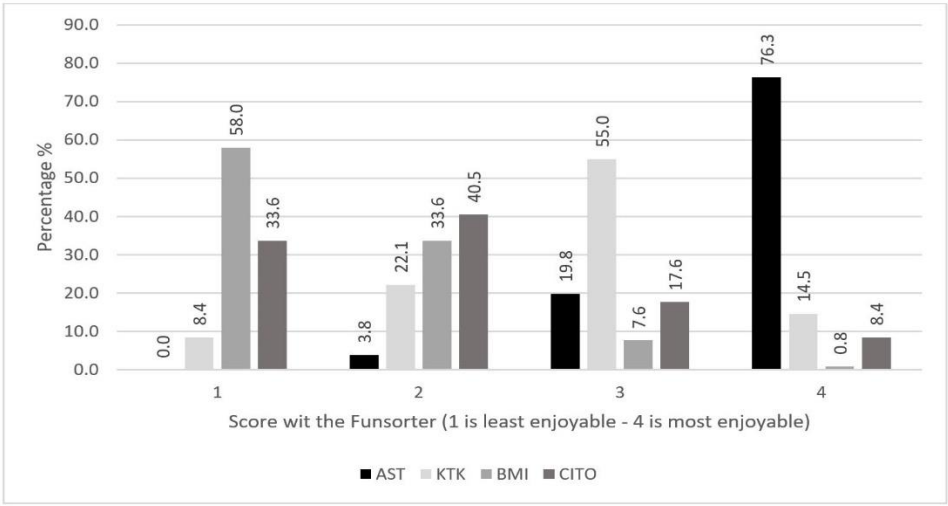


Children's enjoyment of the AST related to other tests

In Figure 6 the results of the Funsorter are systematically displayed. It shows that the AST was never ranked as the least fun and 76% as most fun.

According to the Related-Samples Friedman's Two-Way Analysis of variance by Ranks test the 'fun' scores were not evenly distributed across the four tests (X2(3) =220.409, p = 0.05). Post hoc pairwise analysis revealed significant differences between AST (Mdn = 4.0), anthropometric measurements (Mdn = 1.0), CITO (Mdn = 2.0), and KTK (Mdn = 3.0) (p = 0.05).

Figure 6: Level of enjoyment during the AST, KTK, anthropometric measurements and the CITO-test as reported with the Funsorter (N=131)



4. DISCUSSION

As the AST was developed to assess children's FMS in a regular PE context taking account of all children, the main purpose of this study was to examine children's enjoyment of the AST. Other purposes were to examine if boys have another opinion than girls about the AST and to investigate if differences in motor giftedness resulted in another rating of the AST. A secondary purpose of this study was to examine how children enjoy the AST compared to other tests that children are exposed to during their primary school period.

Most children (98%) were positive about the AST. In addition, 76% of the children ranked the AST as the most fun to perform in relation to three other tests. No significant differences in enjoyment were found between age groups (AST-1, AST-2 and AST-3), nor between gender or children with different levels of motor giftedness. These findings are in line with the experience of PE teachers with the

AST. In 2017, 86 primary schools in the The Hague region have used the AST to assess the FMS of 4- to 12-year old children (Hoeboer, 2017). Although data about PE teachers' experience was not gathered systematically, they were positive about the AST and did not report negative enjoyment of children with the AST. The results are also in line with our expectations because we took into account the recommendations of Cale *et al.* (2014). To our knowledge, this is the first study looking into enjoyment in relation to motor competence testing. Therefore, it is difficult to compare our findings with previous studies on motor competence assessment liking.

Although the Smileyometer has proofed to be an easy and quick to use tool in this and previous studies (Tomlinson, von Baeyer, Stinson, & Sung, 2010) and it has shown to be a reliable and valid self-report scale for children in other studies, for example to indicate pain (Wong, 2001), the Smileyometer has some limitations that should be taken into account when interpreting the results of our study. First, social desirability cannot be ruled out when using a Smileyometer (King & Bruner, 2000). Perhaps that children have the tendency to respond in a manner that will be viewed favorable by others. This tendency poses a social desirability bias that should be considered, especially with the 'like'-culture nowadays. In addition, the Smileyometer was only used for the AST. Children might be as positive about the KTK, or the other two tests when using this 5-item Likert scale.

Secondly, there is inconclusive evidence about the age children are able to use the Smileyometer. A previous research shows that the Smileyometer is a reliable measurement tool for children older than 4 years old (Zaman, Abeele, & De Grooff, 2013). Other researchers on the other hand, claim that the Smileyometer is not very useful for children younger than 10 years old because the variability of the responses is very low. Children younger than 10 years old tend to choose the highest (most positive) score (Read, 2008).

Thirdly, one can question the sensitivity of 5-item Likert scale to assess differences between boys and girls or children with different levels of motor giftedness in children's enjoyment. However, in a review that compared different faces scales to indicate pain differences between boys and girls have been found in responsiveness, reliability and validity (Tomlinson *et al.*, 2010).

Another limitation of this study that should be mentioned is the use of pictograms to rank the enjoyment of the four tests. The influence of the visual representation of the four tests depicted on the Funsorter cards cannot be ruled out. Perhaps photographs, or pictures with a child on it leads to a more positive test rating compared to more neutral or abstract pictures of the test. In future studies, the visual representation of the tests depicted on the cards should be at a similar level of iconicity, to avoid different interpretation of identical pictures.

The different time intervals between performing the four tests and rating them might have had an influence on the test outcomes, due to differences in retrieval of experiences after different time intervals. When children have a bad experience, the memories of that event tend to be stronger than with a positive experience (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). In future research, similar time intervals should be used between the tests and ranking of the tests.

In the future, it might also be interesting to look at children's perceived motor competence in relation to their enjoyment of a motor competence test. According to Barnett *et al.* (2009) the perceived motor skill competence might have an important role in measuring assessment liking. Although children with different levels of - objectively measured - motor giftedness did not rate their enjoyment of the AST significantly different, children with a big difference between their own perceived level of motor skill competence and their objective level of motor skill competence might enjoy the AST differently.

Further research could also investigate children's enjoyment of the AST on the long term. The novelty of the AST could be causing a distortion in measuring its user experience. Novelty effect occurs when individuals who participate in research respond to a novel situation differently in the context of the study than they would in the real world (Gravetter & Forzano, 2003). When the AST loses its novelty, it might also lose its appeal. Furthermore, the effect of providing feedback and the way this is done to the children about their performance on the AST on assessment liking should be studied.

5. CONCLUSION

In conclusion, the results of this study show that the majority of the 4- to 12-year old children enjoyed conducting the AST in a regular PE lesson. Their enjoyment is not dependent of age, gender or objective measured level of motor giftedness.

These findings, together with the good internal consistency, high test-retest reliability (range: 0.800 (95% CI: 0.669-0.871) - 0.881 (95% CI: 0.780-0.934)) and moderate to good concurrent validity when correlated to the Motor Quotient (MQ) of the KTK (range: r = -0.502 (p<0.01) - r = -0.767 (p<0.01)) as shown in previous studies, strengthen the use of the AST in the PE setting (Hoeboer *et al.*, 2016).

6. ACKNOWLEDGEMENT

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