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Effects of Twelve Week Multi-Skills Movement Programme on Motor Development in 7-10 Years Old Boys

Yasin ERSÖZ[1] Cem Şeref BEDİZ

Abstract

Motor development is an important factor affecting the health status physically, psychologically and socially in both childhood and adulthood. It is important to develop motor skills starting from childhood and to participate in a variety of physical activities for this. In this study, it is aimed to reveal the motor development of 7-10 years old boys who receive multi-skill movement training outside of school and to examine the developmental differences. 61 volunteer participated in the study, the sample was divided into 31 students as a control group and 30 students as an intervention group receiving multi-skill movement training outside of school. The Test of Gross Motor Development-2 test, which includes locomotor and object control skill subtests, was applied to monitor the motor development of the children participating in the study. Gross motor skill scores from these two subtests were evaluated. At the end of the 12-week movement program, the study group showed a statistically significant improvement in gross motor skills, object control and locomotor sub-skills compared to the control group. A statistically significant improvement was found only in the object control sub-skill in the control group, whose in-school movement education continued. As a result, physical education activities at schools should be evaluated in terms of their duration and content, and children's participation in physical activities that show diversity should be evaluated in terms of motor development.

***Key Words*:** Motor Development, Gross Motor Development, TGMD-2, Multi-Skills

Öz

Motor gelişim, hem çocukluk hem de yetişkinlik döneminde fiziksel, psikolojik ve sosyal açıdan sağlık durumunu etkileyen önemli bir faktördür. Çocukluktan itibaren motor becerilerin geliştirilmesi ve bunun için çeşitli fiziksel aktivitelere katılım önemlidir. Bu çalışmada, okul dışında çoklu beceri hareket eğitimi alan 7-10 yaş erkek çocukların motor gelişimlerinin ortaya konması ve gelişimsel farklılıkların incelenmesi amaçlanmıştır. Çalışmaya 61 gönüllü katılmış, örneklem 31 öğrenci kontrol grubu ve 30 öğrenci okul dışında çoklu beceri hareket eğitimi alan müdahale grubu olarak ayrılmıştır. Çalışmaya katılan çocukların motor gelişimlerini izlemek için lokomotor ve nesne kontrol becerisi alt testlerini içeren Test of Gross Motor Development-2 testi uygulanmıştır. Bu iki alt testten elde edilen kaba motor beceri puanları değerlendirilmiştir. 12 haftalık hareket programının sonunda çalışma grubu, kontrol grubuna kıyasla kaba motor becerileri, nesne kontrolü ve lokomotor alt becerilerinde istatistiksel olarak anlamlı bir gelişme göstermiştir. Okul içi hareket eğitimine devam edilen kontrol grubunda ise sadece nesne kontrolü alt becerisinde istatistiksel olarak anlamlı bir gelişme tespit edilmiştir. Sonuç olarak, okullardaki beden eğitimi etkinlikleri süre ve içerik açısından değerlendirilmeli, çocukların çeşitlilik gösteren fiziksel etkinliklere katılımı motor gelişim açısından değerlendirilmelidir.

Anahtar Kelimeler: Motor Gelişim, Kaba Motor Gelişim, TGMD-2, Çoklu Beceri

[1] Corresponding Author, Mersin University, Mersin-Türkiye, yersoz@mersin.edu.tr

INTRODUCTION

Childhood is a critical period for the development of basic movement skills; because the neurological capacity to learn basic movement skills is most present in this period (Gallahue & Donnelly, 2003). It has been found that there is a linear relationship between preschool and adolescent children having insufficient basic movement skills and inactive life (Hume et al. 2008; Williams et al. 2008). Clark and Metcalfe (2002) stated that the lack of development of basic locomotor and object control skills in children causes physical activity limitations in later ages. In addition, Whitall (2003) suggested that the development of motor skills in children contributes to the development of perceptual, cognitive and emotional processes. Gallahue, Ozmun, and Goodway (2019) stated that, in the hourglass model of motor development, children between the ages of 7-10, who are at the beginning of the school age, are in the transition stage in terms of movement phase. Therefore, they said that care should be taken in order not to customize or restrict the activity-related movements of children in this period. They also stated that a narrow focus on skills during this stage can have negative effects for the other specialized movement periods.

Diverse in-school and out-of-school activities for this age group can offer opportunities to develop basic motor skills. Physical education lesson plans in terms of in-school activities have recently undergone intensive development and many changes. Despite the initiatives of physical education experts, PE teachers, students and parents still struggle with a range of problems, sometimes more, sometimes less successfully. UNESCO's Worldwide Survey of School Physical Education report revealed evidence that national governments promised to allocate sufficient physical education classes through legislation, but some countries are slow or inadequate in terms of implementation quality (Murphy, Routen & Tones, 2014). There are thoughts that some shortcomings are present in the quantity and quality of physical education classes around the world (Amusa, Toriola & Goon, 2013; Block & Obrusnikova, 2007; Hardman, 2002; Hickson, Robinson, Berg & Hall, 2010; Lieberman, Houston-Wilson & Kozub, 2002; Sugino & Mimura, 2013; Vickerman, 2007). For this reason, out-of-school sports activities can provide a favorable environment for the physical, cognitive and social development of children.

Multi-skill movement training, which aims to develop basic movement skills among out-of-school sports activities, is applied in many private centers. However, little is known about the impact of these programs on basic movement skills. Bakhtiari et al. (2011) stated that the experimental group of female third graders from primary school participating in the movement program selected for eight-week motor development, except for the Physical Education lesson, showed a high level of motor development. Fowheather et al. (2008), on the other hand, found that a longer period of time should be applied to evaluate whether the nine-week training program is effective for children who attend a club that provides multi-skill training after school. In addition, the increase in physical activity level and movement skills brought by multi-skill training also positively affects children's levels of fitness, perceived physical competence, physical self-perceptions and psychological health in children's lives. There are results of this research in the literature (Crocker, Eklund, & Kowalski, 2000,; Fox & Wilson, 2008;; Okely, Booth, & Chey, 2004; Welk & Eklund, 2005; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). Besides researches on this subject contribute to the physical, psychological and social health of children, it will be useful for researchers and experts (e.g., physical education teacher, trainer) who make applications in this field.

In this direction, the aim of the study is to examine the effect of the after-school multi-skill movement program designed to increase motor skill competence for 12 weeks on locomotor skills, manipulative skills and gross motor skills (total skill score) in boys aged 7-10 years. For this purpose, the hypotheses of the research are given below.

H_1: The 12-week multi-skill training program increases the locomotor skill level in boys between the ages of 7-10.

H_2: The 12-week multi-skills training program increases the level of object control skills in boys aged 7-10 years.

H_3: The 12-week multi-skills training program increases the level of gross motor skills (total skill score) in boys aged 7-10 years.

METHOD

Participants

61 male volunteer students between the ages of 7-10 studying at a private school participated in the research. The inclusion criteria of the study were determined as children who agreed to participate in the study, being healthy and not having a known medical problem that could affect motor competence. Among the participants, 30 male students studying in a multi-skill sports club (M age =7.1 yr SD=0.9) formed the intervention group, 31 male students who did not participate in a sports activity outside of school (M age =7.5 yr SD=1) formed the control group.

While 42 volunteer students from the multi-skill club were included in the intervention group before the study, 12 students were excluded from the study because they did not complete the 12-week program. Again, 17 students from the control group were excluded from the study because they did not participate in the posttest measurements for different reasons. The fact that the students participating in the research study in different schools leads to a weak group equivalence, but the students who are close to each other in terms of socio-economic level who study at private paid private schools with the same opportunities were included in the study and the group equivalence was achieved as much as possible. Before starting the study, parents of the students were informed about the research with an informed consent form and approval of the university ethics committee was obtained.

Assessment of Gross Motor Development

The Test of Gross Motor Development-2 (TGMD-2) was performed to measure the gross motor skills of the intervention and control groups. TGMD-2 is a validated, criterion- and norm-referenced process-oriented assessment that was designed to qualitatively evaluate gross motor skill performance of children between the ages of three and ten years (Ulrich, 2000). The TGMD-2 is an appropriate tool for assessing the motor skills of children in different populations around the world (Valentini, 2012; Kim, Kim, Valentini & Clark,2014; Farrokhi, Zareh, KarimiAlvar, Kzaemnejad& Ilbeigi,2014; Lopes, Saraiva & Rodrigues,2018). In the evaluation of the TGMD-2 test, 6 locomotor tests each consisting of 3 to 5 criteria (running, gallop, jumping, leg spreading, two-leg jumping, slipping) and 6 object control tests (hitting the ball, dribbling, catching, kicking, up ball throw, ball rolling) are scored as 1 or 0 points based on successful application or failure of skill criteria through observation. Two trials were conducted for each skill, and the collected scores determined the total score of locomotor and object control subtests. Scores obtained from locomotor and object control subtests were converted to standard scores according to age, and gross motor skill scores were determined from the sum of these standard scores.

Measurements were made in the gym for both groups. Before starting the test application, the skill stations to be applied to the children in general were explained. It was determined which hand and foot the children used before transferring to the skill station. Verbal and visual narration was given at each skill station. No suggestions or corrections were made while applying the movement. For evaluation, tests were recorded with the camera and camera shots were used in the same angle arrangement according to the stations where the skills were applied. The scoring of the criteria in the evaluation of TGMD-2 test was done by one researcher by slowing down the normal play speed by 1/4 in the media player.

Body Weight and Height Measurement

Body weight and height measurements were measured with appropriate clothes and bare feet using SECA brand stadiometer before the test application.

Procedure

A pretest–posttest nonequivalent comparison group design was used in this study. An overview of the study design and measurements taken are given in Table 1.

Table 1: Overview of the study.

Intervention group(n=30)		
Pre-Test	Interventions (12 weeks)	Post-Test
Test Of Gross Motor Development Locomotor Test Object Control Test	**Multi-Skills Movement Program** Fitness, Educationalm Games, Football, Swimming, Tenis, Hockey, Gymnastic, Step-Aerobic, Handball, Beseball, Basketball, Traditional Games, Voleyball, Table Tenis, Taekwondo, Badminton, Copoeria	**Test Of Gross Motor Development** Locomotor Test Object Control Test
Control group(n=31)		

The multi-skill movement program of the intervention group was given in Junior Academy Sport, a sports facility that runs a multi-movement program by experienced trainers with various coaching qualifications and trained in the faculty of sports science. In the 12-week multi-skill movement program, children aged 7-10 received 72 hours of movement training in 17 different sports branches, 4 days a week for a total of 1.5 hours a day (Table.2). In the sports branches selected for movement training, the course contents for the program consist of fun games for the development of basic skills and basic applications of the sports branch. The application program has been created by academics working in the field of children and sports, who conduct multi-skill club consultancy. After-school multi-skills movement program intervention was not applied to the control group. The students in the control group were asked to follow their normal routines and not to participate in out-of-school sports programs during the intervention period.

Table 2: Multi-Skills Movement Programme

	Multi-Skils Programme	7 years old	8-9 years old	10 years old
1	Fitness	3hr	3hr	3hr
2	Educational Games	6hr	6hr	3hr
3	Football	6hr	6hr	6hr
4	Swimming	6hr	6hr	6hr
5	Tenis	6hr	6hr	6hr
6	Hockey	3hr	3hr	3hr
7	Gymnastic	6hr	6hr	6hr
8	Step-Aerobic	x	3hr	3hr
9	Handball	6hr	6hr	6hr
10	Beseball	3hr	3hr	3hr
11	Basketball	6hr	6hr	6hr
12	Traditional Games	6hr	3hr	3hr
13	Voleyball	6hr	6hr	6hr
14	Table Tenis	x	3hr	3hr
15	Taekwondo	3hr	3hr	3hr
16	Badminton	6hr	3hr	3hr
17	Copoeria	x	x	3hr
			72 hr	

Statistical analysis

Statistical analyses were performed using SPPS 23 Package program.Descriptive statistical analysis (mean, standard deviation, frequency, minimum and maximum value) was performed in order to define the characteristics of the research group in the analysis of the data. Data suitability for normal distribution was evaluated with the Kolmogorov Smirnov test and it was determined that the data were distributed normally. Therefore, parametric measurement methods were used to analyze the data obtained from the research. Paired sample t-test was used in the analysis of repeated measurements within the group, and Independent-Sample t test was used in the comparison of data between groups. Significance level was taken as $p<0.05$. Percentage change of participants between 1st and 2nd measurement was calculated with the formula: %Δ: (2nd measurement-1st measurement) / 1st measurement*100

RESULTS

As a result of the independent group t-test conducted to compare the groups participating and not participating in the multi-skill movement program, it was found that there was no statistically significant difference in the characteristics of the participants such as body weight and height(Table 3).

Table 3: Comparison of Physical Properties of Intervention and Control Groups

		X	t	p
Age (year)	Intervention	7.6 ± 0.9	0,32	0.74
	Control	7.5 ± 1		
Body Weight (kg)	Intervention	29.9 ±9.8	0,86	0,39
	Control	31.9 ±8.5		
Height (cm)	Intervention	128 ± 9	-1,68 158	0,1
	Control	131 ±8.9		

Table 4: Intervention Group Repeated Measuring Values

	Intervention (n=30)	
	Pre	Post
Locomotor	36,5±5,3	40,3±4,4***
Object Control	37,7±5,4	41,4±4,8***
Gross Motor	87±9,2	97,1±11,32***

TGMD-2 scores before movement program (Pre); after movement program (Post);
* : p< 0.05,** : p<0,01, *** : p 0.001 Mean ± SD.

There is a statistically significant difference between the mean scores of "locomotor skill", "object control" and "total skill" in the pretest and posttest results of the participants ($p< 0.01$). Posttest results of motor skills of individuals participating in multiple training programs are higher than pretest results(Table 4).

Table 5: Repeated Measurement Values of Control Group

	Control (n=31)	
	Pre	Post
Locomotor	39,4±4	40,2±4,2
Object Control	37,4±6,2	38,8±5,5***
Gross Motor	91±10,4	92,9±10

TGMD-2 scores before movement program (Pre); after movement program (Post);
* : p< 0.05,** : p<0,01, *** : p 0.001 , Mean ± SD.

There is a statistically significant difference between the mean "object control" scores of the participants in the pre-test and post-test results (p <0.001). The posttest results in the "object control" dimension of the motor skill of the individuals who did not participate in the multiple training program were higher than the pretest results(Table 5).

Table 6: Comparison of Motor Skill Characteristics of Intervention and Control Groups

	Intervention (n=30)			Control (n=31)		
	Pre	Post	%Δ	Pre	Post	%Δ
Locomotor	36,5±5,3	40,3±4,4	11,2***	39,4±4*	40,2±4,2	2,1
Object Control	37,7±5,4	41,4±4,8	10,6***	37,4±6,2	38,8±5,5	4,4
Gross Motor	87±9,2	97,1±11,32	11,8***	91±10,4	92,9±10	2,3

TGMD-2 scores before movement program (Pre); after movement program (Post);
* : p< 0.05,** : p<0,01, *** : p 0.001 , %Δ: 2-1/1×100, Mean %Δ percent change, Mean ± SD.

In the comparison of motor development characteristics between groups, when the pretest measurements of the two groups were compared, no difference was found between the object control skill values. Locomotor skill values are significantly higher in the control group. However, there was no difference between the total skill values of the two groups. When the posttest measurements of the two groups were compared at the end of the multi-skill training period, the posttest measurement values did not differ significantly between the two groups. On the other hand, when the differences between the pre-test and post-test measurements of the two groups are compared (%Δ: percentage distribution), the % increase in all three dimensions of motor development in the intervention group was statistically significantly higher than in the control group(Table 6).

DISCUSSION

This study aimed to examine the gross motor development of boys between the ages of 7-10 who receive multi-skill movement training outside of school, and the research findings support the hypothesis that the out-of-school multi-skill training program will improve gross motor skills and its subcomponents, which are locomotor and manipulative skills.

Studies in the literature have shown that there is a positive relationship between children's participation in organized physical activity and their basic movement skills performance (Fahimi et al., 2013, Robinson, 2011, Vandorpe et al., 2012). Although the motor development test batteries used and the content and duration of the selected skill movement programs differ, the sample groups showed that the effects of organized physical activity programs outside of school on the progression of basic movement skills Wang (2004), Sheik (2011), Akbari (2009) Bakhtiari 2011) also confirms their research. Akbari et al. (2009) revealed that traditional games for 8 weeks as an activity outside of school have quite positive effects on the development of motor skills in boys aged 7-9 years. Bakhtiari et al. (2011) stated that the experimental group of female third graders participating in the movement program selected for eight-week motor development, except for the Physical Education lesson, showed a high level of motor development. These two studies are similar to our research in terms of the test battery used to reveal

motor development, the selected extracurricular activity program and its findings, both gross motor skills and locomotor and object control subcomponents significantly improved in the application groups. Sheikh (2011) and Wang (2004) examined the effects of selected movement program applications on motor development in preschool children using different developmental test batteries. Thus, Sheikh (2011) et al. did not observe a significant difference on development in coordination skills in both genders in preschool children aged 5-6 years, and again Wang et al. (2004) did not show a significant difference on development in locomotor skills in children aged 3-5, and object control skills. In the preschool period, some motor skills of the chosen movement program, which was applied in addition to the education, improved. Although Lennart and Päll (2006) did not implement an out-of-school movement program, in their study, in which primary school children evaluated the level of out-of-school physical activities with a modified observational method and the intensity of their out-of-school physical activities using an accelerometer, they evaluated the development levels of primary school children. They made it clear that the level of development of the skill (throwing ball and jumping) was related to the skill-specific physical activity outside of school, and was not related to the general level of physical activity. Contrary to these studies, when compared the control and study group, Foweather et al. (2008) did not reveal significant improvement in gross motor skills such as jumping, sprinting, hitting the ball, and catching, except for static balance, in children who attended the after-school multi-skill training club for 9 weeks. The findings may have differed in terms of the weak numerical power of the sample group due to the fact that the study was a trial study, and also that the research groups were not separated according to the gender variable. Regarding the effect of different physical education interventions at school on motor development other than after-school activities, Pagona and Costas (2008) applied a specially prepared physical education curriculum to 9-year-old children studying in the third grade and evaluated it in terms of motor development at the age of 9, 10 and 18. The study group showed a significant improvement in all three periods compared to the control group. In this study, it was emphasized that apart from the effects of the special program, the effects of the developmental process and the motor skills acquired in childhood could potentially remain active for the rest of their life. From this point of view, Physical Education classes for the motor development of children are the most common organized physical activity accessible to all children in education, but in many countries it raises many questions about its sufficiency in terms of duration, content and application (Murphy, Routen & Tones, 2014). Therefore, the effects of different Physical Education curricula on the development of children have been revealed in the literature (Sallis, McKenzie, Alcaraz, Kolody, Faucette & Hovell, 1997; McKenzie, Alcaraz, Sallis & Faucette, 1998; Kelder, Mitchell, McKenzie, Derby, Strikmiller, Luepker & Stone, 2003; Jan, 2009). In our research findings, a significant improvement was observed in object control skills, which is a subcomponent of gross motor skills, in the control group who participated in organized physical activity only with the Physical Education course. Regarding this development, it may be related to the activities of popular team sports (football, basketball, volleyball, etc.) activities that include more object control skills in physical education lessons and the presence of suitable areas for these sports branches in the school gardens (basketball hoop, football goal, volleyball net, etc.) and optional use by children. Demirhan et al. (2008) pointed out "lack of facilities, insufficient course hours and lack of equipment" as the three most important problems and shortcomings during lessons in their research on the execution of the physical education curriculum and programs in Turkey. In addition, according to physical education teachers, they revealed that the five activities that should take place in physical education classes with the highest percentage value are volleyball, basketball, tennis, football and swimming, respectively. According to the students, this order happened to be volleyball, swimming, scouting, football and basketball. The intensity of popular team sports among both teachers' and students' selection of activities shows this trend.

Although these multi-skill movement training experiences of children are effective in motor skill development, individuals' physical dimensions, age, gender, inheritance and past experiences and the development of each of these aspects may reveal differences, especially in periods when the development is rapid (Espenschade, 1940). Although there are motor skill factors related to development among the age group participating in our study, the TGMD-2 test battery we used in our study to evaluate the motor skill performance corrected the subtest motor skill scores varying in different age groups to allow a consistent progression at age level with standard scoring. There are studies showing that motor skill performance is negatively affected in obese children regarding motor skill

performance in terms of physical measures (Okely, Booth & Chey, T, 2004; Graf, Koch, Kretschmann-Kandel, Falkowski, Christ, Coburger & Predel, 2004; Castetbon & Andreyeva, 2012; Lopes, Stodden, Bianchi, Maia & Rodrigues, 2012). D'Hondt (2011) found that childhood overweight and especially obesity in children negatively affected gross motor skill performance, even considering maturity differences in boys and girls aged 5 to 12 years. Most notably, differences in body mass index have become more pronounced in older age groups of children. Although we did not determine the body mass index of our research groups, it showed that there was no statistically significant difference between the two groups in the physical characteristics of children such as body weight and height.

As a result, this study emphasizes the review of the effectiveness of Physical Education lessons, which have been revealed as a result of many studies, and to ensure that children participate in a variety of post-school physical activities that will increase their basic movement skills for their physical, cognitive, affective and social development, which are important for a lifelong healthy life. Multiple skill development programs that will provide this diversity may vary depending on many factors such as duration, content, application methods and practitioner performance. In addition, it is also important how much the developments achieved in these programs are transferred to later periods. Therefore, application contents, methods and follow-up findings of multi-skill development programs should be reviewed in future studies.

Authors' Statement of Contribution to the Article

Idea/Concept: Yasin Ersöz, Cem Şeref Bediz; Article design: Yasin Ersöz, Cem Şeref Bediz; Consulting: Cem Şeref Bediz; Data Collection and Processing: Yasin Ersöz; Analysis/Comment: Yasin Ersöz, Cem Şeref Bediz; Literature review: Yasin Ersöz, Cem Şeref Bediz; Article writing: Yasin Ersöz; Critical Analysis: Cem Şeref Bediz; Source/Material: Yasin Ersöz, Cem Şeref Bediz; Article Submission Corresponding Author: Yasin Ersöz

Conflict of Interest

The authors have no conflict of interest to declare.

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Ethics Committee Approval

This study is in line with the Declaration of Helsinki. Before starting the study, parents of the students were informed about the research with an informed consent form and approval of the university ethics committee was obtained.

Peer Review

After the blind review process, it was found suitable for publication and accepted.

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