

## **Effect of Gallahue Model-based Developmental Exercises on Quantitative and Qualitative Development of Fundamental Kicking Skill**

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### **Abstract**

This study aimed to investigate the effect of Gallahue model-based developmental appropriate exercises on qualitative and quantitative improvement of kicking fundamental skill in male first grade students at elementary school. For this purpose, using available sampling method, 30 children were selected as sample. After pre-test, the kicking fundamental skill checklist (qualitative evaluation) and maximum mileage (quantitative evaluation) were used to divide the subjects into three groups of 10 people. The first group performed developmental Gallahue model-based kicking exercise for 8 weeks, 2 sessions per week, and 45 minutes each session. The second group performed routine school activities. The third group had no activity. Then, the post-test was conducted and the results was recorded. The covariance analysis results showed that there was significant difference between subjects in terms of kicking mean scores ( $p < 0.01$ ). In development appropriate program group, the effect on quantitative and qualitative development was 0.058 and 0.042, respectively. However, designing an appropriate developmental program and enriching educational environment may make it possible to develop fundamental skills which are the basis of athletic skills development.

**Keywords:** Developmental Appropriate Program, Fundamental Skills, Kicking, Male Students.

## **Introduction**

The motor development is a process in which the child develops different motor patterns and movement skills (Sari et al., 2017). The childhood is an untroubled period of life; a normal child has no worries but playing games. The physical function of child depends on his/her age, gender, socioeconomic status, and athletic activities in kindergartens and schools (Fisher, 2005). In childhood period, the fundamental movement patterns emerge. The fundamental movement skills form the basis for development of athletic skills. These skills affect both sports performance and daily movements of individuals (Hvwen et al., 2007). The early childhood years shape the pattern of physical activities and movement skills development. The greater the child's physical activity, the more likely he/she will develop his/her fundamental skills (Gallahue et al., 2012). An incorrect interpretation of concept of fundamental movement patterns development is the belief that these skills are characterized by maturation and are very little affected by task demands and environmental factors. Some child development specialists have repeatedly written about natural development of movements and games. They believe that children develop these movements naturally and only by maturation. However, although maturation plays a role in development of fundamental movement patterns, it should not be seen as the only effective factor (Kristen et al., 2014).

In this regard, Newell (1986) introduced movement patterns development constraints and grouped them in the form of task, environmental, and individual (functional and structural) needs. The environment is one of the limiters affecting movement patterns development. The individuals' learning experiences are important for next learnings. Since the pre-school and school years are the most important periods for development of fundamental skills, the appropriate and rich environment may play a significant role in acquiring skills (Sheikh et al., 2011). Although there are many studies on impact of intervention programs and environmental enrichment on fundamental skill development, the general programs are used which encourage children to participate in free activities; the participation in these programs may not lead to learning of fundamental skills (Katz & Pantil, 2007). Also, there are few studies which investigate the effect of physical activity on development of fundamental skills; they have provided conflicting results. Johnson (1990) examined the effect of 10-week intervention program on fundamental skill development in preschool children; the findings did not show any significant difference between control and experimental groups. Bergen (2000) investigated the impact of educational programs on development of throwing and kicking fundamental skills. The sample included 36 preschool students. The findings showed that using whole body approach, the intervention program group had better performance in implementing these skills. In addition, Robinson et al (2011) used developmental exercises to investigate the impact of these exercises on development of dribbling and kicking fundamental skills among preschool children. The findings showed that the intervention group had better performance in post-test.

The movement skills intervention programs should be trained properly to develop these skills. There is still disagreement among clinicians about the best developmental program to develop fundamental skills in children (Graham & Halt, 2010). The introduction of a well-designed and proper program for children's development is one of the best ways to develop movement skills at early ages (Hands et al., 2002). The next issue is the method of evaluating the effects of motor development interventions. There are many different ways to measure fundamental skills

performance in children, including (product and result) quantification; the results of this measurement is compared with normal groups and may be used to detect motor problems of children (Choi Fang, 2007). The quality evaluation (process) is another method of evaluating motor function which is used in recent years. The qualitative evaluation includes systematic observations and judgment about quality of movements to provide the best intervention programs in order to improve performance. In quality evaluation, a checklist is used to investigate children's movements as a whole (observing the movements of entire body) or as a section (observing body parts separately) (Hands et al., 2002). The previous studies have more emphasized on result and product of intervention programs. Although the quantitative values provide information about the child's motor development, they alone do not indicate the level of skills in children. Therefore, a program is needed which measures both of them.

Recently, some specialized developmental Gallahue model-based programs have been designed for development of foundational skills; they aim to help children to interact better with environment and acquire motor skills. These programs may measure the quantity and quality of children's fundamental skills. One of these programs emphasizes on kicking and includes four levels: pre-control, control, application, and efficiency; it covers the basic level of initial sessions to highest level of last sessions. In pre-control level, the children become familiar with skills fundamentals. The control is a higher level which more emphasizes on directing movement in different directions. At application level, the emphasis is more on performing skill in actual form. As the highest level, the efficiency level combines all skills and children perform in actual form (Gröge et al., 2007). This programs' levels are connected; the high levels may not be reached unless achieving the previous levels (Graham & Parker, 2010). These exercises develop the coordinated patterns of foot movements and are the basis for development of specialized skills.

The kicking is a fundamental manipulative skill which is the foundation of many organized sports. This basic skill is developed at three preliminary, developing, and developed stages. The studies have mostly investigated the biomechanical factors of kicking among adults (Tracy et al., 2012, Lyce et al., 2010). Given the importance of kicking in organized sports and its key role in creating coordinated patterns in foot movements, there are few studies on impact of training programs on development of this fundamental skill. However, this study aims to investigate the effect of kicking exercises on development of this fundamental skill among male students at elementary schools.

## **Methodology**

This was a quasi-experimental applied research. The population consisted of all healthy and non-athlete male first grade students at elementary school in Karaj in 2002-2003. Using available sampling method, 30 children were selected as sample. After pre-test, the subjects were divided into three groups of 10 people. They filled a demographic characteristics questionnaire which included questions such as age, weight, health record, dominant hand, parent's income and education level, sports activity record, and motivation to perform physical activities. It should be mentioned that the consent form was also included at the end of questionnaire. After collecting the questionnaires, considering questionnaire's questions and objectives of study, some subjects were excluded such as the children whose parents had master degree or higher, had high incomes, and those who have participated in sports classes.

The Ulrich’s motor development test (2000) was used as research tool; it is a valid tool to evaluate the development of gross motor skills. It was first developed by Ulrich (1985) on the basis of motor skills; its reliability (=0.87) and validity (= 0.96) was confirmed among American children 3 to 10 years old. The validity and reliability of this test was also confirmed by Zarezade and Farokhi (2009) in Iran; the internal reliability coefficient for loco-motor movement, control of object, and total combined score was reported to be 0.78, 0.74, and 0.80, respectively (Zarezade, 2010).

The movements were recorded by camera to score skills. The motor development test checklist was used to analyze kicking skill. This checklist was provided based on Ulrich test (2000); its face and content validity was confirmed by experts. The qualitative scoring method was based on analysis of body section approach which is scored as (0) and (1); the score (1) is used when the child fulfill the criteria and score (0) is used when the child does not fulfill the criteria. Each skill is performed twice and the skill score is obtained by adding criterion scores. Also, a tape measure was used to measure the participants’ maximum distance of kicking. The Canon PowerShot A480 video camera with 30 frames per second at three angles (back, front, and side) was used to determine development level and prevent from repetition of test.

Then, based on pre-test scores, development level, age, weight, physical activity history, and right-handiness, the subjects were homogenized in three groups. The first group performed the developmental Gallahue model-based fundamental kicking skill specialized training for 8 weeks, 2 sessions per week, and 45 minutes each session (10 minutes for warm-up, 25 minutes for specific kicking exercises, and 10 minutes for cool-down); it includes four levels: pre-control, control, application, and efficiency. Each part of this program focused on a specific skill. In pre-control level, the children become familiar with skills fundamentals. The control is a higher level which more emphasizes on directing movement in different directions. At application level, the emphasis is more on performing skill in actual form. As the highest level, the efficiency level combines all skills and children perform in actual form.

The second group performed regular school sports activities under the supervision of their sports teacher. The third group had no activity. At the end, the Ulrich test was conducted like the pre-test and the results were recorded. The descriptive (central tendency, graphs, and tables) and inferential (Shapiro – Wilk, Levin test, variance, and covariance analysis) statistics were used to analyze the data (P <0.01).

**Findings**

Table 1: Comparison of groups in terms of mean and standard deviation of pre-test and post-test quantitative scores for kicking fundamental skill

Groups	Pre-test		Post-test	
	Mean	Standard deviation	Mean	Standard deviation
Control	5.82	0.827	5.67	0.730
Regular school activities	5.88	0.741	6.37	0.839

Appropriate development program	5.57	0.6333	7.43	1.31
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According to table 1, the mean of control group at pre-test and post-test is 5.82 and 5.67, respectively. In routine school activities group, the mean at pre-test and post-test is 5.88 and 3.37, respectively. In appropriate development program, the mean at pre-test and post-test is 5.57 and 7.43, respectively.

Table 2: Comparison of groups in terms of mean and standard deviation of pre-test and post-test qualitative scores for kicking fundamental skill

Groups	Pre-test		Post-test	
	Mean	Standard deviation	Mean	Standard deviation
Control	4.10	0.733	4.30	1.15
Regular school activities	4.20	0.816	4.80	0.788
Appropriate developmental program	4.10	0.803	6	0.666

According to table 2, the mean of control group at pre-test and post-test is 4.10 and 4.30, respectively. In routine school activities group, the mean at pre-test and post-test is 4.20 and 4.80, respectively. In appropriate development program, the mean at pre-test and post-test is 4.10 and 6, respectively.

Table 3: Results of Levine test for equality of groups variances in population

Research scales	F	FIRST DEGREE OF FREEDOM	SECOND DEGREE OF FREEDOM	SIG. (P)
Quantitative	0.987	2	27	0.363
Qualitative	1.23	2	27	0.548

As shown in Table 3, the null hypothesis is confirmed for equality of variances at two groups. This means that the hypothesis of equation of scores variance at both experimental and control groups is confirmed.

Table 4: Analysis of covariance to investigate the effect of group membership on kicking quantitative scores in three groups (in meter)

Variables	DEGREE OF FREEDOM	MEAN OF SQUARES	F	SIGNIFICANCE (P)	IMPACT SIZE	STATISTICAL POWER
Pre-test	1	12.73	23.58	0.001	0.467	0.997
Group membership	2	10.02	18.56	0.001	0.588	1

According to table 4, there is a significant difference between groups in terms of kicking scores means ( $P < 0.01$ ); the effect size is 58 percent. The statistical power is equal to one; this indicates the high statistical accuracy of this test and adequacy of sample size. The Tukey test was used to compare the pairs of groups; the results are provided in table 5.

Table 5: Mean difference of kicking scores of groups (quantitative)

	Mean difference	Sig. level
Control group Regular school activities	-0.633	0.054
Control group Appropriate development program	-1.66	0.001
Regular school activities Appropriate development program	1.33	0.001

According to table 5, there is significant difference between groups in terms of mean. However, this difference is not significant between control group and routine school activities group.

Table 6: Analysis of covariance to investigate the effect of group membership on kicking qualitative scores in three groups (in meter)

VARIABLES	DEGREE OF FREEDOM	MEAN OF SQUARES	F	SIG. (P)	IMPACT SIZE	STATISTICAL POWER
Pre-test	1	0.909	1.13	0.296	0.042	0.117
Group membership	2	7.86	9.83	0.001	0.421	0.970

According to table 6, there is a significant difference between groups in terms of kicking scores means ( $P < 0.01$ ); the effect size is 42 percent. The statistical power is equal to 0.970; this

indicates the high statistical accuracy of this test and adequacy of sample size. The Tukey test was used to compare the pairs of groups; the results are provided in table 7.

Table 7: Mean difference of kicking scores of groups (qualitative)

	Mean difference	Sig. level
Control groupRegular school activities	-.487	0.244
Control groupAppropriate developmental program	-1.72	0.001
Regular school activitiesAppropriate developmental program	-1.24	0.005

According to table 7, there is significant difference between groups in terms of mean. However, this difference is not significant between control group and routine school activities group.

### Discussion and conclusion

The findings showed that an appropriate developmental program was more effective in developing kicking fundamental skill than school routine activities and inactivity. The specialized foot exercises develop the coordinated patterns of foot movements and are the basis for development of specialized skills. The participation of children in regular physical activities and development appropriate programs may improve their health and develop their motor, cognitive, and social skills.

Moreover, the quality of training and the type of program are important factors in development of children's movements; these should be considered in interventions. This is consistent with findings of Amoi (2006), Sheikh et al. (2011), Kristen et al. (2014); they also examined the impact of interventions on development of fundamental skills using targeted movements and creative programs and concluded that these programs contribute to development of fundamental skills.

An incorrect interpretation of concept of fundamental movement patterns development is the belief that these skills are characterized by maturation and are very little affected by task demands and environmental factors. Some child development specialists have repeatedly written about natural development of movements and games. They believe that children develop these movements naturally and only by maturation. However, although maturation plays a role in development of fundamental movement patterns, it should not be seen as the only effective factor. The environmental conditions play an important role in development of these skills. In fact, the child's past experiences impacts on his/her learning in future (Rockwell et al., 2013).

Also, the findings are consistent with findings of Robinson et al. (2011); they examines the impact of free games on development of manipulative fundamental skills in preschool children

and showed that these games do not have effect on development of manipulative skills. Therefore, it is important to provide various and appropriate movement experiences to realize the full development of children. The targeted exercise opportunity is one of the important factors affecting the effectiveness of movement experiences and motor skills training compared with free games. The children need to be encouraged and have opportunity to practice and train, enriched and motivating environment, and high quality education in ecological environment to grow and improve their movement abilities. In this regard, Newell (1986, 1984) has shown that the development of FMS (fundamental movement skills) occurs at the result of interaction between constraints of task, organism, and environment. In other words, the fundamental movement skills are conducted within a dynamic system which involves a specific task by a learner with certain characteristics in a particular environment. Therefore, the environment, as a constraint, plays a significant role in development of fundamental skills. The exercises which are appropriate for needs of children are one of the best ways to enrich the environment.

According to findings, there was no significant difference between daily routine activities and control groups. Although the free games are a way to enrich environment to meet the needs of children, the participation in these programs may not lead to learning of these fundamental skills. This is inconsistent with findings of Bergen (2000) and Clark (2004) who investigated the impact of free games on development of fundamental skills and found that these games lead to development of fundamental skills. The movement skills intervention programs should be trained properly to develop these skills. The assessment of movement skills is necessary for efficient and effective planning, and identifying the weaknesses and strengths of these programs. The quantitative and qualitative assessments of children's movements may be effective in creating best program appropriate to needs of children. The past studies have considered only one aspect of motor development. There is need to develop a program which is capable to conduct both types of measurements (Gallaheau et al., 2012).

The next issue in developmental interventions is the hours of training sessions, components of skill, and the diversity of children's movements. The factor that has not been considered in most interventions is the relationship between spent time in interventions and development of various fundamental skills (Tracy et al., 2012). The intervention programs among children seem to experience an unpredictable crisis. Perhaps, this is due to uniformity of programs which are used in these interventions. Therefore, there is a need for a program which may specifically address the impact of environment and educational programs on fundamental skills of children (Tracy et al., 2012). Another features of Gallaheau-based appropriate developmental programs are the certain amount of training sessions' hours, components of skills, and creation of diversity in movements of children. The targeted movements and specialized exercises which are related to skills development increase levels of motivation and enjoyment of physical activity and lead to developmental of fundamental movements in children; these may lead to participation in organized sports activities in future. Many children will never develop fundamental skills without having a proper developmental program. Enriching movement experiences is a major part of interventional programs for children. The quality, diversity, and motivation and nature of training program play an important role in its effectiveness (Graham & Halt, 2010). The specialized kicking exercises involve four levels: pre-control, control, application, and efficiency; they are applied appropriate to child's developmental level for enriching environment. Each skill is composed of specific components. The useful program should include all these skill



levels. The appropriate developmental program considers the skill components separately and in combination and thus leads to formation of coordinated patterns in fundamental movements and greater participation in sports activities. According to findings, however, it is suggested that the intervention programs for children will be appropriate to their developmental level, be in the form of special training programs, and contain creative movements for development of fundamental patterns.

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