MOTOR ABILITIES AT 7 YEARS OLD CHILDREN

UDC:796.012.1:373.3-057.874(497.711)
(Original scientific paper)

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Abstract

The structure of motor space in children is one of the essential issues in kinesiology, especially from the aspect of PE teaching process and requirements for adaptation of PE contents to children`s individual possibilities. Therefore, the aim of this paper is to determine the structure of motor space of 7 year old children. The research was conducted at a sample of 123 seven year old children, pupils in second grade in four primary schools in Skopje. The study was realized applying 33 motor tests for estimation of nine motor abilities. The structure of motor space was determined using factor analyses. Obtained results suggest on existence of ten latent dimensions named as: preciseness with throwing objects with hand, speed with change of direction or agility, static strength, factor for precise and explosive movements, coordinated fast movements with legs and trunk, repetitive strength, frequency of movement with legs, balance and two undefined factors (F9 and F10). Isolated factor and their manifestation are highly influenced by the development characteristics and changes specific for the researched period of age.

Key words: *motor abilities, structure, seven year old children, factor analysis.*

INTRODUCTION

Motor abilities are the fundamental determinant of human motor space and are condition for successful realization of human movements. They represent the essence of human motor movements. As complex characteristics, motor abilities are manifested in various movements with different complexity, depending from the type of movement and the development of individual potentials (Jovanovski, 2013).

Individual differences in manifestation and development of motor abilities, beside the genetic disposition, individual tempo of development, activities of the individuals during their ontogenic development and the influences of the external environment (Kukolj, 2006), are also determined by the age and the level of development. This means that certain changes in overall behavior, including the manifestation of motor abilities in certain age period, are specific and characteristic only for that certain age and period of development. This is especially emphasized in the childhood when development is characterized as turbulent, intensive, with continuous changes from year to year and specific manifestation related to motor abilities. Therefore, the study of the structure of motor space of children is one of the key problems in studies in kinesiology in the past few years. This is especially important considering the numerous methodological problems that arise when researching children's motor space as well as the holistic and integral development as one of the main marks of childhood, manifested through the mutual dependence and interaction of segments of motor, cognitive, conative and socio - emotional development (Ismail, 1976; Malina et al, 2004).

Researches of motor abilities in every particular age period in children are also very important from the aspect of physical education teaching process. These arise from the need to respect the individual possibilities of every child, concerning the adjustment of educational contents of children's real possibilities and needs as one of the basic principles in educational work with children as well as in the realization of PE teaching process (Conception for nine years educational system in the Republic of Macedonia, 2007). Previously mentioned requirements of cotemporary educational process, findings that suggest specific and intensive changes in the development of the 7 year old children, as well as the fact that, at this particular age, children are not preschoolers anymore

and become pupils, are the basic motives of conception of this paper. Therefore, the aim of this paper is to determine motor abilities and the structure of motor space in 7 year old children.

Previous findings, supported by information obtained from the available literature lead to the conclusion that the structure of motor space of children in the early school period, including the seven year old children, is not clearly determined and it is not precisely defined. The structure of motor space of children was studied applying two researched models: the structured model (Metikoš et al, 1989) and the functional model, or model of hierarchic structure (Kurelić et al, 1975). In studies with young children, the model of structure was applied in the researches of Dukovski, 1984; Rausavljević, 1992; Perič, 1991; Rajtmajer&Proje, 1990; Pisot&Planinsec,2005; Pejčič & Malacko, 2005; Popeska, 2009, 2011. Results from these researches point out existence of multiple motor abilities, which have not yet been clearly differenced, which are representative of several potential abilities that have a tendency to be self-isolated. Results obtained using the functional model, applied in the researches of Bala, 1981, 2002,2003, 2005; Zurc & Strojnik., 2005; Sabo & Popović, 2005; Lasan,et all, 2005 indicate the existence of general structure of motor space in children, defined according to the influence of regulatory mechanisms represented by a small number of isolated factors. In this research, we use the structural model as a starting point, while in the interpretation and discussion of results, it is complemented by findings and results obtained by a functional hierarchical model.

METHOD OF WORK

The main issue of this study is to determine the structure of motor space of 7 year old children. For that purpose, we conducted a research on a sample of 123 examinees, seven year old male children, pupils in the second grade in four primary schools in Skopje, Republic of Macedonia. Motor abilities were determined applying 33 motor tests, hypothetically used for estimation of nine motor abilities.

The age and possibilities of the children, tasks and requirements similar to the contents of PE curricula, were used as main criteria in selection of the tests. Notes and recommendations from the researchers that previously applied and modified these test with children are implemented in the research procedure (Perić, D. 1991; Dukovski, 1984; Pisot & Planinsec, 2005; Bala, 1981, 1999; Popeska, 2009, 2011). Following motor tests were used: [1] CO – ORDINATION: Co – ordination with stick (KOPAL), Obstacle course backwards (KOPON), Two balls slalom rolling (KOSL2), Rolling with ball on floor (KOTRT); [2] SPEED OF RUNNING:10m running from flying start (BT10LS), running 4 x 10(BT4x10), Cries – cross running 4 x 5м (BTZMT); [3] FREQUENCY OF MOVEMENT: Arm plate – tapping (BSTAR), One foot - tapping(BSTAN), Both feet – tapping on wall (BSTNZ); [4] EXPLOSIVE STRENGTH: Standing broad jump (ESSDM), Throwing medicine ball 1 kg from standing position (ESFMST), Throwing medicine ball 1 kg from sitting position (ESFMG) и 20m dash running (ES20VS); [5] REPETITIVE STRENGTH: Modified pushups (RSSKL), Sit-ups(RSPTR), Trunk lift (PSITR), Hands pulling over the diagonal Swedish bench (RSVKK); [6] STATIC STRENGTH: Bent arms hang (SSVZG), Horizontal hold lying on stomach (SSZLM), Horizontal hold lying on back (SSZLG); [7] FLEXIBILITY: Deep bend on bench (FLDPK), Both legs extension lying on bag (FLRLG), Legs extended forward bend on floor (FLPRP); [8] BALANCE: Walking on upturned Swedish bench (RAOSK), Standing on bench in width (RASKS), Standing on bench in length (RASKD) and [9] PRECISENESS: Throwing circles on stick (PIOBS),Throwing tennis ball in vertical goal with arm (PITET), Throwing ball in horizontal goal with arm (PITHC), Throwing ball in vertical goal with leg (PIVCN), Leading with short stick (PVGKS), Leading with short stick (PVGKD).

The structure of motor space is determined using factor analysis. The intercorelation matrix of applied motor tests is factorized using the Hotteling procedure. Ten significant roots were isolated applying Gutman - Kaiser criteria. Results obtained from the main components are further rotated applying varimax, oblimin and promax rotation. In further interpretation of the results, we used factor analysis applied in promax rotation.

RESULTS AND DISCUSSION

Using Hotteling method of main components, applied at results obtained from measurements of 7 year old male children, we isolated 10 latent

dimensions. These ten dimensions explain the variability of children's motor space with 66.41%. From the total variability of the applied system of motor tests, only 18.0% are explained by the first main component. Separately, other isolated main components explain the variability of the system for values from 8,47% to 3,25%.

According to the results from factor analysis – Promax procedure, presented in Table 1, ten latent dimensions are isolated and which define the structure of motor space of 7 years old children. According to the projections of applied motor tests on isolated factors, we defined the following factors: F1 - preciseness with throwing objects with hand, F2 - speed with change of direction or agility, F3 - static strength, F4 - factor for precise and explosive movements, F5 - coordinated fast movements with legs and trunk, F6 - repetitive strength,F7 - frequency of movement with legs, F8 - balance and two undefined factors (F9 and F10).

The factor nine is determined with significant projections of four motor tests used for estimation of three different motor abilities: coordination, flexibility and preciseness, presented with the following tests: rolling with ball on floor KOTRT (-.98), both legs extension lying on bag FLRLG (.31), throwing circles on stick PIOBS (.40) and throwing ball in vertical goal with leg PIVCN (.37). The biggest influence in determination of F9 has the test rolling with ball on floor KOTRT for estimation of coordination. However, due to insufficient number of indicators this factor cannot be properly defined. At tenth latent dimension, the tests throwing ball in vertical goal with leg PIVCN (.93) have the highest projections. Lower, but also significant saturations on this dimension is noted for the following tests: rolling with ball on floor KOTRT (-.37), deep bend on bench FLDPK (-.36) and walking on upturned Swedish bench RAOSK (-.36). Very high value of projection of the test throwing ball in vertical goal with leg PIVCN (.93) and involvement of tests for coordination, flexibility and balance, are not enough for methodological justification for definition of this tenth isolated factor.

Analyzing the available literature that refers to previous studies for this issue, a factor with similar structure and definition as F2 isolated in our research, named as factor for speed with change of direction or agility is isolated in the researches of Strel & Šturm, 1981 and Rajtmajer, 1997 realized on a sample of 6 and 6,5 year old children. Similar structure as F5 named as coordinated fast movements with legs and trunk is obtained in researches conducted by Dalaš et all (2009) and Popeska, 2009. Repetitive strength as isolated type of strength despite in our study, as a separate factor is also isolated in the studies of Strel & Šturm, 1981 and Rajtmajer, 1997.

Results for the structure of motor space at 7 year old male children, obtained in our research confirm the previous findings. This means that structure of motor space in children is an anthropological subspace that is not precisely structured, is not clearly defined and is insufficiently studied. Obtained results suggest several categories of isolated factors: pure and clearly defined factors, factors defined using topological criteria, factors that are not clearly determined and manifested as integral factors as well as undefined motor factors.

Related to this, static strength (F3), repetitive strength (F6) and balance (F8) in our research are isolated as pure and independent factors. Depending on the dominant parts of the body engaged in the realization of the movement tasks, some of isolated factors in the research were defined using topological criteria. These factors are named as preciseness with throwing objects with hand (F1) and speed of change of direction or agility (F2).

The characteristic of motor development manifested as a tendency of elimination of movements, respectively the characteristics that refers to the direction of manifestation of motor development from general, overall motor behavior and continues toward differenced and specific behavior is likely to be the reason for isolation of mixed factors that are not yet clearly defined. These dimensions are manifested as integrated factors and are named as precise and explosive movements (F4), and coordinated fast movements with legs and trunk (F5). These two latent dimensions are defined based on significant projections of several latent dimensions. This tendency is also confirmed in other similar studies where such factors are mainly named as a general motor factor (Strel& Šturm, 1981; Bala, 1981, 2002; Rausavljević, 1992; Pišot & Planinšec, 2005). In this term, researchers suggest on general functioning of motor abilities, which is understood as function of highest integrative and regulatory mechanisms in CNS when resolving some motor task.

Table 1. Factor analysis of results from motor tests applied at 7 year old children – Promax procedure

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
KOPAL	-0,04	0,01	-0,01	0,12	0,95	0,05	-0,03	-0,04	-0,02	0,06
KOPON	-0,22	-0,15	-0,04	-0,13	0,20	-0,45	-0,17	-0,04	-0,10	-0,09
KOSL 2	-0,45	-0,06	-0,19	-0,09	0,04	0,22	-0,01	0,02	-0,16	0,19
KOTRT	0,10	0,07	-0,16	-0,10	0,03	-0,08	-0,04	-0,05	-0,98	-0,37
BT10LS	-0,01	-0,02	-0,03	0,09	0,95	0,06	-0,05	-0,07	-0,03	0,06
BT4X10	-0,50	-0,01	0,13	0,27	0,21	-0,06	-0,12	0,02	-0,19	0,09
BTZMT	-0,01	0,95	0,05	-0,12	-0,02	0,10	-0,04	-0,14	-0,05	0,02
BSTAR	-0,19	0,91	0,16	0,08	-0,01	0,05	0,02	0,03	-0,07	0,01
BSTAN	0,09	0,02	-0,15	-0,04	0,01	-0,02	0,81	0,08	0,10	0,15
BSTNZ	-0,16	-0,04	0,14	0,13	-0,11	0,15	0,72	0,02	-0,08	-0,28
ESSDM	0,63	-0,03	0,05	0,07	0,02	0,15	0,21	0,01	-0,02	0,01
ESFMST	0,04	-0,13	0,12	0,68	0,06	-0,04	0,24	-0,13	0,27	-0,29
ESFMG	0,22	-0,01	-0,03	0,76	0,19	0,01	0,12	0,03	0,18	-0,08
ES20VS	-0,77	0,03	0,24	0,01	0,04	-0,14	0,11	0,04	0,04	0,01
RSSKL	0,03	0,31	-0,16	0,01	0,05	0,87	0,28	0,05	0,01	0,21
RSPTR	0,08	-0,22	-0,07	-0,08	0,08	0,76	-0,12	0,10	0,10	-0,01
RSITR	0,29	-0,08	0,24	-0,16	0,01	0,41	-0,35	0,04	-0,20	-0,26
RSVKK	-0,52	0,23	0,06	0,01	0,20	-0,03	-0,26	-0,09	0,25	-0,02
SSVZG	0,17	-0,16	0,59	-0,07	0,06	0,10	-0,03	0,00	0,04	-0,13
SSZLM	-0,12	0,20	0,81	-0,14	0,03	0,11	-0,07	0,04	0,23	0,08
SSZLG	-0,12	0,13	0,86	-0,11	-0,10	-0,32	0,01	0,07	-0,02	0,03
FLDPK	0,09	0,10	-0,32	0,08	-0,19	-0,14	-0,23	-0,13	0,27	-0,36
FLRLG	0,22	0,26	0,09	0,22	-0,11	-0,08	-0,31	0,35	0,31	0,01
FLPRP	-0,27	-0,39	0,13	0,22	-0,34	0,22	-0,18	-0,22	0,14	0,28
RAOSK	-0,73	0,21	-0,04	0,00	-0,10	0,22	0,07	-0,19	0,02	-0,36
RASKS	-0,01	-0,06	-0,01	0,05	-0,14	0,14	-0,07	0,82	-0,02	0,11
RASKD	-0,02	-0,07	0,13	0,05	0,03	0,05	0,22	0,82	0,02	-0,15
PIOBS	0,47	-0,13	0,01	-0,06	0,09	0,02	0,04	-0,18	0,41	0,19
PITET	0,66	0,18	0,11	0,25	0,06	0,25	-0,21	-0,09	-0,19	0,00
PITHC	0,40	0,13	0,13	0,31	-0,12	-0,24	0,04	-0,22	-0,23	0,28
PIVCN	0,13	0,03	-0,04	-0,11	0,06	0,10	-0,05	-0,02	0,38	0,93
PVGKS	0,23	0,09	0,16	-0,67	-0,05	0,07	0,19	-0,16	0,05	0,03
PVGDS	0,06	-0,08	0,39	-0,70	0,05	-0,04	0,07	-0,08	0,08	-0,01
Lambda	4,85	2,56	3,38	2,49	3,09	3,16	2,71	1,97	2,22	1,92

The relatively small number of motor tests applied for estimation of one particular motor ability as well as the correlation between the motor abilities manifested in one certain motor test are probably the reason why two of the factors isolated in our research (F9 and F10) remain undefined.

We could explain all manifestations of motor abilities, noted in this chapter, with development changes specific for the children at the age of seven. Intensive development changes and individual tempo of development of children affects to higher variability of obtained results. We could recoup this with unfinished cephalic – caudal and proximal - distal development as well as other ontogenetic characteristics of development such as intemitented development, or development process when certain manifestation of movements appears and disappear. The time of appearance and disappearance of certain motor behavior gradually decreases. Alternately, changes in motor functions, or their appearance and disappearance are the main reason for motor manifestation to study and analyze as a total, not separately. In children, motor abilities are potential and mutually related. In our research, all ten isolated latent dimensions could be grouped and reduced on two latent dimensions: the first one regulated by the mechanism for energetic regulation conducted by explosive, repetitive and static strength and speed. The second dimension is directed by the mechanism for synergetic regulation and regulation of muscle tonus represented with preciseness and balance.

Although tests for assessment of coordination have significant and high projections of the most of the isolated factors, only the coordination as motor ability that is regulated by the mechanism for structuring of the movements is not isolated as a separate factor in this research. In our sample of

seven year old children, coordination is isolated as a mixed or integrated factor with speed, explosive strength and preciseness. This type of manifestation could be explained with several arguments related to the nature of coordination.

When it come to the preciseness as a motor ability isolated in motor space at 7 years old children, it is important to note that despite the tests leading with short stick and leading with short stick that have main influence in determination of this factor, significant impact is also noted for the tests throwing medicine ball 1 kg from standing position and from sitting position. In these tests preciseness and explosive strength affects as integrated ability. A specific type of coordination: coordination eye – arm and eye – leg regulated by the center for perception as well as the emotional condition have a great impact on the manifestation on preciseness as a motor ability (Gajič, 1985).

Presented results, based on a realized survey, leads to the conclusion that most of the fundamental motor abilities exist in the motor space in 7 year old children. These motor abilities are manifested as integrative or a separate ability depending on the complexity of movements, activated body parts, type of muscle work, the technical performance etc.

CONCLUSION

The results on the structure of motor space in seven year old male children confirm the previous findings that suggest that children`s motor space is insufficiently studied. It is a subspace of human anthropologic status that is not precisely structured and it`s not clearly defined. The structure of motor space defined in this study is presented with ten latent dimensions, from which static and repetitive strength and balance are isolated as pure motor dimensions, preciseness with throwing objects with hand and speed with change of direction or agility are defined using topologic criteria, while dimensions named as precise and explosive movements and coordinated fast movements with legs and trunk were manifested as integrative dimensions. Two dimensions remain undefined. Obtained structure of motor space is under the huge influence of development characteristics and changes specific for this period of age.

Motor abilities fortified in this study, as well as the tests for their estimation are very important for PE teaching process since it is a good foundation for proper selection of PE contents and activities according to the determined potentials and abilities of the children. On the other hand, tests applied for estimation of motor abilities with good tests characteristics (Popeska, 2011) are a manner for objective following and evaluation of individual achievements of the children. They are also a manner for objective following and evaluation of effects achieved with realization of PE teaching process, as well as for achievement of functional and educational tasks, innovation and redesign of current PE curricula.

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МОТОРИЧКИТЕ СПОСОБНОСТИ КАЈДЕЦА НА 7 ГОДИШНА ВОЗРАСТ

УДК:796.012.1:373.3-057.874(497.711)
(Оригинален научен труд)

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Абстракт

Моторичките способности, односно структурата на моторичкиот простор се едно од клучните прашања на кинзеиологијата, особено од аспект на наставата по физичко и здравствено образование и барањата за адаптација на содржините по ФЗО на индивидуалните можности на децата во секоја возраст. Оттука, цел на овој труд е да се утврди структурата на моторичкиот простор кај деца на 7 годишна возраст. Истражувањето е реализирано на примерок од 123 испитаници, деца на 7 годишна возраст, ученици во второ одделение во пет основни училишта во Скопје. Применети се 33 моторички тести наменети за проценка на девет моотрички способности. Структурата на моторичкиот простор е утврдена со примена на факторска анализа. Добиените резултати укажуваат на постоење на десет латентни моторички димензии именувани како: : прецизност за исфрлување на предмети со рака, брзина со промена на правецот и насоката на движење или агилност, статичка снага, фактор за прецизни и експлозивни движења, координирани брзи движења со нозете и трупот, репетативна снага, сегментарна брзина со нозете, рамнотежа и два недефинирани фактори (Ф9 и Ф10). Изолираните фактори и нивната манифетсација се условени и се под влијание на развојните карактеристики на децата и спецификностите на развојот во истражуваниот период.

Клучни зборови: *моторички способности, деца на 7 годишна возраст, факторска анализа.*

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