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Comparative examination of study aptitudes of kindergarten children as a function of school maturity

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I. Introduction

In these days guiding principles of educational policy encourage lifelong learning having its starting-line at Form 1 of primary school.

I have gained my first hand experience regarding the problems arising during the transition from kindergarten to primary education both as a parent and as a teacher involved in teacher training. The above milestone can most be described by the notion of school maturity, which outlines the level of a certain biological-psychological-social stage of development indicating the child's readiness and maturity for starting the studies organized and conducted by the school.

I have been training lower primary school teachers for 18 years, tutoring subject pedagogy, which has both its theoretical and practical aspects. I participated in a conference organized for kindergarten and primary school teachers in 1997 at the Hungarian University of Physical Education, where the topics discussed by lecturers raised my interest and curiosity and I soon started researching and reading on the problem circle of pre-school education in detail. This activity led me to the conceptual category of school maturity which was soon augmented by my interest of a personal background as after my son was born I began to read children education books on the development of abilities. These two relevant directions and courses of interest joined in my research theme and became the background and study field of my Ph. D. programme (starting in 2000) and thus the topic of my dissertation.

II. Literature Review

The international overview of the education of several foreign countries shows that the general age for enrolment of pupils varies, as it is generally the age of 6 in most countries, but can be 5 or 7 in some others.

In Hungary compulsory education starts in the very year the child turns 6 until the 31st of May and if reaching the level of biological, mental and cognitive as well as psychological development inevitable for school maturity and enrolment he/she can start studies at the primary school from 1st of September of the same calendar year.

According to the relating provision of law the so-called "flexible school entry" enables children to start Form 1 a school-year later in compliance with the child's biological, cognitive and social maturity level. The later school entry may be initiated by the parent(s)

though in most cases it happens upon a trilateral agreement (on the given child's aptitude for school-life) reached by the parent(s) and the experts of the kindergarten and the educational consultant. In Hungary more and more parents take this opportunity and it has become a pedagogical trend to put children into school at the age of 7 or even a few month later.

The above tendency imposes a special burden on the primary school teachers as their pedagogical approach and applicable means of tutorial work require relevant differentiation according to the elder children's needs, which is a complicated task especially for career-starter professionals and for those without necessary background experience. In Hungary kindergarten attendance becomes compulsory one year before school entry.

Defining the level of school maturity became a professional concern even of the most relevant researchers in the first half of the 20th century. Mátyás Éltés (1914), Hildebrand Várkonyi (1936), Ágnes Binet (1947), Pál Gegesi Kiss (1955), Lőrinc-Palkó-Petrován authors (1962), Radnai Béla (1974), Bödör Jenő (1983) have all expounded and defined their thoughts on the issue.

Among the various examination methods of school maturity applied these days mention must be made of the so-called "PREFER" method initiated by József Nagy (1986) and "DIFER" (2003), which is in close connection with the former; the "Complex preventive kindergarten programme" worked out by Katalin Porkolábné Balogh and her working team (1999), the "Kanizsa school maturity examination" (1998), the "State and motor examination test" by Katalin Lakatos (1999), the "Measuring skills in the kindergarten" compiled by Lajos Kelemen and his research team (2001), and "Oviszita" prepared by Tamásné Huszár (2001).

III. Research objectives, focus and hypotheses

III.1. Research objectives

- To disclose possible correlations between psychic functions needed in successful studying and certain motor skills
- To define motor criteria for school maturity and in this context – as an establishment of theoretical principles to be further developed – reaching motion ability examinations to become the integral part of school maturity examinations as opposed to the current practice based on the testing of cognitive abilities exclusively.

III.2. Focus of research

- The subject of my research is the state of certain psychomotor abilities of children reaching the age of school entry / school maturity? / and exploring the correlation between the above abilities.

III.3. Hypotheses

Based on the above described, thus the role of motor abilities in the intellectual development and cognitive activities and also in the prevention and correction of study difficulties, as well as the physiological background of the former and its close interdependence of numerous educational fields I presume that:

The development level of a child's motor skills is closely connected with his/her cognitive abilities and mental status level, thus the child having well-co-ordinated motor abilities (has a good sense of balance and performance of gross and (consequently) fine motor coordination, efficient in eye-hand coordination and pattern copying), has more favourable conditions in school work and more chances to learn much more effectively and easily as well as to become a „better performing” student. According to presumptions children performing better results in motor abilities are those among showing better abilities involved and necessary in studying, such as memory and attention.

1. It is also assumed that the motor performance /mainly coordination abilities/ of children with or without school maturity shows a significant difference in favour of those with school maturity.
2. Supposedly children with school maturity develop faster and the development starts earlier than in case of their peers as they prove to be more mature already in the second (middle) year of the kindergarten in certain performances examined.

I am not going to overlook the fact that the physical and mental development of the child primarily depends on the family and the teaching and educational training at school can not always retrieve for gaps caused by lack of attention and responsibility of the home environment, thus I would not detail the possible reasons behind the good and less successful performances as I wish to handle them as factual information. /A given skilful performance

might as well be due to genetic factors, proper and stimulating environment or participation in any kind of sport activity or dance, training or work-out classes. /

I would also emphasise that – in compliance with those included in my hypothesis – the above does not necessarily mean that the previously mentioned children perform better at school in the traditional sense of the word, though their results in psychic functions laying a special foundation for the learning process such as attention, memory and linking visual and audial information would reach a higher level than that of their peers.

As I have already mentioned before the success of the learning process depends on exceedingly various factors and it would not be wise to come to far-reaching conclusions upon a couple of measured elements. Nevertheless when it comes to developing and improving more and more psychic functions determining the success of the learning process the more chances are available to help our children become a healthily and mentally advanced adult with highly accomplished personality.

IV.1.1. Sampling

We sent letters to 21 kindergartens of Szombathely including the brief overview of the research project and the recommendation of the Head of my department. Upon the favourable reception of 12 kindergartens and making appointments with each, we carried out our survey and measurements with the help of my students training to be lower primary school teachers. Beforehand of course, we asked for the written permission of the parents whose children's abilities we decided to test and measure in the given tasks. During the first phase of testing in 2001 we measured the abilities of 351 children, while in the second phase in 2002 we could test 301 children due to unforeseen circumstances such as absence and moving to other towns, etc.

IV.1.2. The circumstances and the course of research and the completion of the measurements

The surveys have been assessed with the help of the same students after thorough discussions of the tasks to be measured. The research team provided the requisites (stop-

watch, beanbag, task sheets, wooden sticks and beads) needed for the measurements. Both the children and the kindergarten teachers did their best in cooperating.

IV.1.3. Selecting variables

Variables of the **first survey (2001)** and the variables:

- **Verbal memory:** repeating a four-sentence story after listening to it once
Evaluation: based on 9 keywords, each correctly repeated keyword worth 1 point
- **Visual memory:** evocation of a 7-picture table, visual recording and recalling
Evaluation: based on successful evocation and naming of the pictures
- **Attention time and attention errors:** assessed according the attention test by Csinády
Evaluation: performance time of the test and the number of errors
- **Dynamic balance:** walking back and forth on a short gymnastic bench turned upside down with a beanbag to be stepped over in the middle of the distance of the bench
Evaluation: duration of completing the task in seconds
- **Static balance:** standing on one foot while hands resting on the nape and the other leg is drawn up to the knee of the supporting leg
Evaluation: completion of the exercise in seconds and keeping the position until balance is lost / both legs were tested and the better performance was
- **Fine motor coordination:** stringing 10 beads onto a wooden stick
Evaluation: completion of the task in seconds
- **Gross motor coordination:** long jump distance from standing and skipping on both feet
Evaluation: distance in centimetres from the starting line, the highest result of three attempts was recorded

The **second survey (2002)** tests and variables:

The measured tasks are identical to that of the previous year except for the omission of the long jump exercise and the augmentation exercises and measurement of pattern copying and the eye-hand coordination.

- **Pattern copying skills:** a movement reproduction of a 4-cadence gymnastics exercise after watching the performance once.

Evaluation: excellent and faultless performance 2 points, performance with small mistake(s) 1 point, lack of performance or partial performance of the cadences 0 point

- **Eye-hand coordination:** aiming and throwing a small ball 3 times into a gymnastic stool turned upside down from 2 metres of distance

Evaluation: score 2 points, hitting the edge of the stool 1 point, no score 0 point per attempt

V. Discussion of results

The discussion and summary of the results follows the order of the hypothesis items listed above.

Response to Hypothesis 1. The development of a child's motor skills is in close correlation with that of the cognitive skills and psychic development level, thus children with well-coordinated motor skills (having a good sense of balance and performance of gross and (consequently) fine motor coordination, efficient eye-hand coordination and pattern copying), have more favourable conditions in school work, more chances to learn much more effectively and easily and to belong to the group of „better performing” students.

The response to this assumption is based on the chapters including and detailing the correlations among the results of the surveys. The first survey conducted in 2001 (at the age of the second kindergarten or “middle” year) draws attention to the manifold integrated links of the verbal memory and fine motor coordination included in Table 1. summarizing all the results. The nursery rhymes, counting-out rhymes, poems and limericks requiring verbal memory are all necessary and worth teaching in the first and second year of the kindergarten programmes and kindergarten teachers do their best to train young children for memorizing.

Further analyzing the connections according to the sex of the children; it can be ascertained that both in case of girls and boys an important fact has been confirmed, namely that the precondition of high level fine motor coordination lies in the excellent accomplishment of gross motor coordination. The proof of the above mentioned fact is the unambiguous positive correlation connection between the results of the long jump exercise and that of the stringing beads.

The good performance of visual memory is incidental to the lower number of attention error in case of both sexes and it has a logical explanation, since someone with an observant mind has this skill also manifesting when filling in an attention test. The gross motor coordination long jump exercise good result is in positive correlative connection with verbal memory, though I could not find any obvious or rational explanation for their correspondence.

Correlative total	Stringing beads	Static balance	Dynamic balance	Long jump	Attn time	Attn error	Visual memory	Verbal memory
Stringing beads								
Static balance								
Dynamic balance								
Long jump								
Attention time								
Attention error								
Visual memory								
Verbal memory								

Table 1. Correlative matrix, **total**

When analyzing the total, summarized results of the 2002 survey I would like to point out the central role of dynamic balance, fine motor coordination and visual memory due to their extensive and comprehensive connections. There can be found a positive correlative connection between the low number of attention errors and skilful fine motor coordination among the results of both boys and girls. This fact already indicates the readiness for school entry and school maturity. The positive correlative connection between the two types of memory (visual and verbal) can also be explained by the above reason. This finding is in relevant accordance with the concluded positive correlative relations within the group of children with school maturity, where there is a strong link between the fine motor coordination

and the minimal number of attention errors, as well as between the high results of verbal and visual memory.

Variables	Stringing beads	Static balance	Dynamic balance	Attn time	Attn error	Visual memory	Verbal memory	Pattern copying	Aiming
Stringing beads	-								
Static balance		-							
Dynamic balance	*	+	-						
Attention time				-					
Attention error	**				-				
Visual memory	*		*	*	+	-			
Verbal memory						**	-		
Pattern copying			+		+			-	
Aiming	*				*				-

Matures n= 214

Table 2. Correlative interdependence within the school mature group

Within the group of children without school maturity mention must be made of the good dynamic balance results, which are closely linked with the high results of static balance and high level of performance in pattern copying. In this group of children the higher fine motor coordination performance is in line with the good performance of visual memory.

The existence of correlative connections does not presume an indispensable cause and effect connection. There might be a direct relation among the tested factors, but the change of third, outer factor resulting in intertwining results is also possible. The examinations involved two (the memory and the attention) of the psychic functions necessary in successful studying. For both of the formerly mentioned basic psychic functions it is absolutely indispensable to

have the proper sense organ functions. The perceptual study process is the result of a sensomotoric activity by which we gain the necessary experience.

The special motion development programme initiated by Katalin Porkolábné Balogh was mentioned earlier among the learning difficulty research methods. She and her working team find the development of sight, auditive, muscle and tactile sense channels inevitably important besides motion and body image development, while also emphasize the combination and integration ability of all the above channels.

Good performance at school is determined by several factors and the one to be definitely accentuated is the proper level of school maturity. An important element of the school maturity is the adequate and appropriate maturity level of the nervous system. The maturity of the nervous system defines:

- Motor coordination
- The quality and level of cognitive functions (thinking and speaking)
- The social level (manageability, adaptability, co-operation)

The explanation for the correlative connections among the measured factors (psycho-motor abilities) has been found in the fact that the operation of perceptive channels and coordination abilities (psycho-motor abilities) is based on the operation of a system of the same kind – the information receiving and processing system – and so the development of one can logically result in the improvement of the other.

Further common attributes of motion and cognitive functions:

- The organization of memory processes – serial way of thinking
- The attention as the basic condition
- The level of arousal and the identical operation mechanism of the performance
- Piaget's cognitive development theory

Response to Hypothesis 2. According to my assumptions children performing better results in motor abilities have better scores when examining abilities involved and necessary in studying /memory, attention/.

In this case we created groups according to motion performances. We compared the good performing children's results in the given variable according to the assorting variable from the point of view of the dependent variables.

To sum up we can conclude that in most tests the average results of children with good motor performances have exceeded the average results of the other group in nominal value and that from the statistical point of view there has been a considerably significant difference between the performance results regarding attention time, attention errors and verbal memory.

As a final conclusion it is observable – based on the findings previously detailed and proved by data results –, that children with coordinated motion and skilfulness also reach a higher level of operation in psychic functions involved in studying than their peers.

Assorting variables / Dependent variables	Attention time	Attention error	Visual memory	Verbal memory
Fine motor coordination	Better average results	*	Better average results	Better average results
Static balance	Better average results			
Dynamic balance	Better average results	+	Better average results	
Pattern copying	*			
Eye-hand coordination		Better average results	Better average results	*

Table 3. Comparison of performance results in motor tests

Response to Hypothesis 3. I presume that the motor performance of children with or without school maturity /mainly the coordination abilities/ shows a significant difference in favour of the children reaching the level of school maturity.

According to the summarized results of the measurements children with school maturity have reached significantly better results in fine motor coordination tasks, dynamic balance and had relevantly less (considerably significant) attention errors. As far as memory (visual, verbal) is concerned they showed tendency-like better results than their peers without school maturity. In differentiating results according to sex, boys proved to be performing better in motor tasks

(fine motor coordination, static and dynamic balance) than their peers of the group without school maturity while girls reached better performance in attention as a basic psychic function.

The originally proposed hypothesis proves to be right and clearly shows the already existing difference between boys and girls regarding the development process of abilities. According to the classic experiment of Bakonyi (1960) the boys made a different type of free motion (stronger and more intense movements) than girls and boys apt to move for a longer period of time. Girls tend to like motion with middle intensity and require more relaxation between motion periods than boys. The above observations are conclusions of rather social than biological reasons and may derive from the behaviour patterns of sexes already manifesting at this age.

	Immature n = 86	School mature n = 214	The change
Fine motor coordination	39,65 sec	35,93 sec	significant *
Static balance	30,72 sec	36,67 sec	-
Dynamic balance	17,40 sec	14,37 sec	significant *
Attention time	42,94 sec	43,65 sec	-
Attention error	0,872 pcs	0,449 pcs	considerably significant **
Visual memory	5,314 pcs	5,556 pcs	tendency +
Verbal memory	5,895 pcs	6,509 pcs	tendency +
Pattern copying	1,349 point	1,322 point	-
Eye-hand coordination	3,581 point	3,757 point	-

Table 4. Summary and comparison of groups with and without school maturity according to the measured factors

Response to Hypothesis 4. Supposedly children with school maturity develop faster and the development starts earlier than in case of their peers as they prove to be more mature already in the second (middle) year of the kindergarten in certain performances examined.

The performance of the group with school maturity proved to be better in a considerably significant extent than their results in the previous year. When analyzing the performance of the group without school maturity it is verifiable that they needed remarkably

shorter time period to fill in the attention test and the number of errors decreased in a tendency-like change. Their visual memory performance also improved to a great extent and also their fine motor coordination in a tendency-like change.

It can be laid down as a fact that the development of the children with school maturity is more balanced, faster as they reached the readiness for school sooner and showed a more intensive progress.

Measured variables/ groups	Children without school maturity	Children with school maturity
Fine motor coordination	tendency-like change	considerably significant change
Static balance	-	considerably significant change
Dynamic balance	-	considerably significant change
Attention time	considerably significant change	considerably significant change
Attention error	tendency-like change	considerably significant change
Visual memory	considerably significant change	considerably significant change
Verbal memory	-	considerably significant change

Table 9. Summary table: The extent of progress

VI.1. Practical significance of the recorded results

The summary of the conclusions regarding school maturity is as follows:

Analyzing the motor performance of children with school maturity it can be ascertained that dynamic balance, fine motor coordination hand movements and visual memory play crucial role due to their complex relations and connections (positive correlative relations). The

interdependence between the level of fine motor coordination and the low number of attention errors also deserves special attention as well as the connection between the results of visual and verbal memory.

Children with school maturity are characterized by a higher level of operation of certain basic psychic functions exceeding that of their peers when having a better performance in motor test. The motor performance of children with school maturity – mainly their coordination abilities – is significantly better than the motor performance of the group of children without school maturity. The progress of children with school maturity is more intense and has a faster pace than those without school maturity.

Based on all the above conclusions it is right and proper to urge **the involvement of motor tests in school maturity examinations as their organic compound**, as it has been obviously proved that children's motor profile and the basic psychic functions inevitably determining the study process are interlinked and incidental.

The examinations and measurements provide an excellent opportunity to test and observe children during motion which is an activity they like, are enthusiastic about and do with special devotion. The so-called ONP (Kindergarten Education Programme) includes several task segments such as defining the actual development level of children, the selection of the examination or measurement method. The method of educational and knowledge level measurement was the focus of attention in the circles of teachers over the past years. What is to be measured in the process of development? And how? And by what means? Pedagogical experts and psychologists involved in the theme have recognized the danger of different tests and searched for new ways of kindergarten measurements and found interesting methods of the issue. They used the integrative approach of interview, talking and observation in working out different examinations to define the characteristics and attributes of certain age groups regarding knowledge, experience, behaviour, social skills, emotions and motion. The measurements mentioned in the studies have the great advantage of having been prepared for teachers with relevant experience. In order to receive results suitable for evaluation, children should not be tested in their peer groups, though isolation can not provide realistic answers. The motor tests introduced and discussed in my dissertation was found to be suitable for both tracking children's individual development process – integrated in their kindergarten activities – and in examining the readiness for school work (though not exclusively). The above described tests are suitable for measuring performance in interrelation with other measured fields as we all know that the readiness for school life depends on various conditions of the child's biological, intellectual and social maturity.

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