

THE DYNAMIC OF LEARNING TWO MOTOR KNOWLEDGE OF SECONDARY SCHOOL STUDENTS

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Abstract

The aim was to determine whether it was possible for a student that had complete ignorance of the motor knowledge to reach the level of knowing it in ten lessons from level of adoption to automatism. Also, the aim was to determine whether this criterion can indeed be served as a guide for physical education teachers during the evaluation of motor skills. In a sample of 50 participants (10 male students and 40 female students) at Secondary School Krapina, kinesiology process was implemented monitoring dynamical studies of two motor skills. One motor knowledge belonged to the group of more complex ones (lay – up shot) and the other in the group of complex motor skills (hand stand to roll). These participants experienced kinesiology treatment under the same conditions as part of regular physical education (2 times a week for 45 minutes), through ten classes, led by professor of physical education. Based on the results of this research it can be concluded that: for motor knowledge, basketball layup, under the influence of applied Kinesiology treatments in both classes, ten hours were enough for level of adoption to rise from faze of adoption to faze of automatic learning of motor skills between male students from gymnasium and professional high-school ($p=0,45$). Positive impact on attainment was also established on motor skills hand stand to roll int he same two groups ($p=0,77$), which was equivalent to school grade excellent (5). For female students, in both classes ($p=0,17$) it wasn't enough that the level of learning brought to a phase of automatic learning, which was equivalent to school grade very good (4), then it stayed on stabilization level of learning. For both classes there was positive impact on the level of motor skills hand stand to roll ($p=0,84$). General improvement to the phase of automation didn't happened in any class trough ten hours of assessing, which can be attributed to the fact that hand stand to roll belonged to the group of complex motor skills, and also, that the level of previously learned motor skills weren't up to scratch to perform of a given element.

Keywords: *pupils, motor knowledges, dynamics*

Introduction

Motor knowledge represents detailed and well-known part of human knowledge, and can be defined as a process of forming and stabilization of motor skills that allow optimal performance of motor task, which is characterized by movement harmony, minimal energy expenditure and optimal level of achievements (Jarvis, 1999). In school system, in regular plans and programs, there are several number of motor knowledge, which are situated in order of didactic and pedagogy principles, in a way that each motor knowledge has possibilities of horizontal and vertical progression. During the implementation of motor knowledge process, there are several concerns connected with teaching and frequency of repetitions of each motor knowledge. It is well-known that in Republic of Croatia, great number of primary and secondary schools don't have adequate conditions for implementing compulsory timetable of physical education and students come with different prior knowledge. Some students didn't even meet with prescribed contents from previous classes, while others reached phase of automatization. It is not unusual that teachers don't conduct regular professional development, so they can raise the level of teaching. There are limitations about objective way of evaluation the level of learned

knowledge. Along with motor knowledge, learning process is a part of everyday life and is defined as a relative permanent change in behaviour, which comes with exercise or experience (Petz, 2006). Learning of motor knowledge or motor skills (the ability of smooth and harmonic performance - Horga, 2010) takes huge part of everyday learning to master different working operations, skills and habits. One of the crucial part of processing new information represents the process of learning of motor knowledge. It is highly connected with individual mental and motor abilities, previous motor experience and cognitive and conative traits, which bring understanding of movement structure, demanding movement technique, speed and the efficiency of learning. Forming and perfecting motor knowledge is done in a way that information about specific movement, across the sensoric analyzators and afferent neural ways, comes in central nerve system, where the information is translated and "motor transcript" is made. According Honeyburne (2006), the process of learning results with level of coordination, smooth performance, technique precision, control and efficiency of movement. In the process of motor knowledge, no repetition is the same, but the quality keeps getting better and better by using additional information, also with

identifying and correcting motor mistakes (Schmidt i Wrisberg,2000). Each performance is changing through the process of learning, which must be done as a stepwise learning in which the specific characteristics are appreciated. According to Neljak (2010), there are five connected phases or progress periods of student:

1. phase of adoption,
2. phase of initial perfecting,
3. phase of advanced perfecting,
4. phase of stabilization (initial bracing),
5. phase of automatization (final bracing).

Phase of adoption is based on forming basic view of the movement. In this phase student does many mistakes, produces a lot of redundant movements and hires unnecessary muscle structures which doesn't work in coordination. According to Abernethy et al. (1997), this phase lasts between 15-30 h. *Phase of initial perfecting* comes after the first phase, where student managed to connect basic segments of movements to achieve the goal. *Phase of advanced perfecting* characterises total rising of motor movement coordination. There are lot less mistakes, part of the movements are better connected in meaningful structure, and the performance is relaxed. *Phase of stabilization* represents space-time parameter stabilization within the motor task performance, which can be seen in more harmonic and safely performances. Whole process depends on morphological traits and motor abilities of individual. *Phase of automatization* is a final phase of motor learning. Kinematic and kinetic movements are optimal integrated, there is no more conscious control. This phase is characterized by final forming of motor program which lasts for years, but the performance undermines in specific circumstances like fatigue or stress. There are several types of motor knowledge. All motor knowledge that we learn are built on basic motor knowledge, for what we have specific capacity, but we aren't born with them. Human motor knowledge can be classified in three categories: (1) biotic, (2) non-kinesiological and (3) kinesiological. Biotic motor knowledges are phylogenic (innate) determined, while non-kinesiological and kinesiological are onthogenic (developed) determinated knowledge (Kiphard, 1989; Rajtmajer, 1991; Neljak, 2010).

As mentioned before, there are limitations in physical education timetable, like objective ways of evaluation the phase of motor knowledge learning and adequacy between knowledge and student's age.

The aim of this paper was to objectively and in real time conditions answer the question on which level is possible to adopt two motor knowledge during the compulsory physical education timetable. Also, the was to determine whether created grade criteria could serve as a landmark for physical education teachers in their evaluation of motor knowledge.

Methods

Sample of entities

Sample of entities was comprised of 50 students (40 female students and 10 male students), second grades of different study programmes. One class was comprised of language high-school students and the other one of students from professional high-school commercial study programme in Krapina high-school. Chronological age was 16 (± 6 months) years old. Both classes participated in compulsory physical education classes (2 times x 45 minutes), through ten lessons, under the supervision of physical education teacher, under the same conditions and spent experimental kinesiological programme.

Sample of variables

For the purpose of this paper, dynamic of learning two motor knowledge, of which first applied on sport game-basketball (putting the ball into the basket from technique above) and the second one on sport gymnastics (handstand forward roll-linked). Learning evaluation carried out the physical education teachers, through Likert scale with scores 1-5, under the established criteria of grading in ahead.

Testing protocol

The experiment was conducted in the school year 2011/2012. Before that, the grading criteria was made for each education topic separately and teachers were instructed with the criteria and during the grading were independent. The evaluation was done according to week timetable, which was constant for both classes and was conducted in standardized conditions, inside the Krapina high-school gym. Also, students were instructed that they will be evaluated through the whole 10 lessons. All parts of one physical education lesson were satisfied: introductory part, preparation part, main A, main B and ending part. The procedure was conducted in the main A part of the lesson. Before the main A part of the lesson started, through the whole 10 lessons demonstration of both elements was made, also with suggestions on most common element mistakes.

a) Technical description of putting the ball into the basket from technique above

Student led the ball with the dominant hand (for example. right) rectilinear towards the basket. On the distance of 5-6 meters directed it's movement towards the basket under the angle of 45°. After that, student took-off with the left foot and with both hands (fingers spread) grabs the ball, while the view was pointed to the basket. Feet and shoulders were also pointed to the basket without any rotating of the body. After taking-off, student did two steps (right, left). First step was longer, and the second one shorter, and horizontal movement converted into the vertical jump, where also flexed leg was helping. When the ball was on the highest point, continuous movement of stretching shooting hand, and the final impulse and

ball rotation was given from the fist and fingers. The other hand controlled the ball, and during the throw protected the ball from the opponent. Landing part was usually on the bouncing leg (not necessary) and student needed to keep balance.

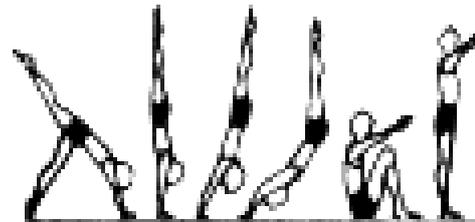


Picture 1. Putting the ball into the basket from technique above

b) Technical description of handstand forward roll-linked

Student stood with both feet on the ground, with hands putting in a great extension. Movement of the hands from the back to the front was followed by putting the dominant foot in front, so student

could come from the initial phase to the handstand. Handstand was characterized with extended hands shoulder width, fingers were spread, turned in front. The participant looked the space between his/her fingers. Trunk muscles were tight. After approximately 2 seconds, gradual flexion of both hands were made, head was put on the chest, back of the head was put on the mat and hands caught lower parts of the both legs. After feet touched the ground, the whole body raised in the vertical position and foot-to-foot stand was the final phase.



Picture 2. Handstand forward roll-linked

	DESCRIPTION	
GRADES/ELEMENTS	Putting the ball into the basket from technique above	Handstand forward roll-linked
Excellent (5)	Whole movement structure is excellent and doesn't deviate from the ideal structure.	There are no technical or aesthetic mistakes. Legs and hands are fully extended, trunk is flat.
Very good (4)	There are a little technical and aesthetic deviations from the ideal position (for example. palm of shooting hand isn't pointed down to the ground after shooting).	There are a little technical and aesthetic mistakes (for example. hands are not fully extended).
Good (3)	Hand and palm movements are too much rough, so ball is not leading, but spanking. Also, palm of shooting hand isn't pointed down to the ground after shooting.	There are significant mistakes (for example. legs are spread, hands and legs are not extended).
Sufficient (2)	There is not fully control on the ball. There are to many mistakes during the whole performance.	Technique is rough and clumsy and significant deviations from the ideal body position.
Insufficient (1)	Student leads the ball in front of, but without suppressing, only hitting.	Student can't do the whole element, even with the help.

Table 1. Criteria for grading both elements

Statistical analysis

The analysis of trend was used for the purpose of this study to determine the differences in the dynamic learning of two motor knowledge of male and female students in high-schools. With the program package Microsoft Excel 2003 and STATISTICA package (StatSoft, ver. 10) all data were analyzed and graphically presented. Differences between groups were determined with Students t-test for independent samples. P value was set up at $p < 0,05$

Results and discussion

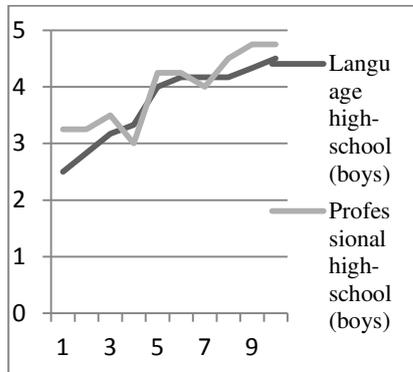
From the graph 1., which showed the dynamic trend of motor knowledge learning (putting the ball into the basket from technique above), it could be

seen that arithmetic means from language high-school boys ranged from 2,50 on the first lesson to

4,50 on the final lesson. Grade *insufficient (1)* was lost on the 5th lesson, while grade *excellent (5)* was showing through the whole 10 lessons, which was the result from previous learnt motor knowledge. The initial phase of this motor knowledge was equivalent of the phase of advanced perfecting, or grade *good (3)*. Students managed to get to the phase of automatization, which was the equivalent of the grade *excellent (5)*. Based on that, 10 lessons were enough that students came from the phase of advanced perfecting to the phase of automatization. Moving to the students (boys) from the professional high-school, school grades ranged from 3,25 on the 1st lesson to 4,57 on the 10th lesson. Level of knowledge was not constant during the whole period, because some students met the element for the first time. Nevertheless, they also

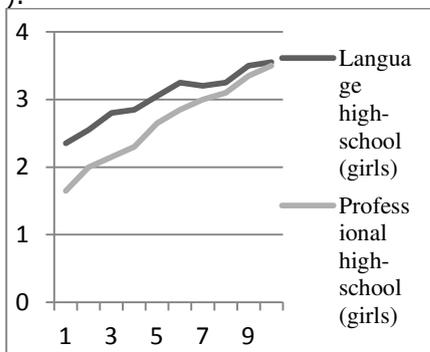
managed to get to the phase of automatization from the phase of advanced perfecting, which meant that 10 lessons were enough for that kind of transition.

No statistical differences were found between two analyzed groups and their 10-lesson achievements ($p=0,45$)



Graph 1. The dynamic trend of motor knowledge learning (putting the ball into the basket from technique above) between male students of two different school programmes

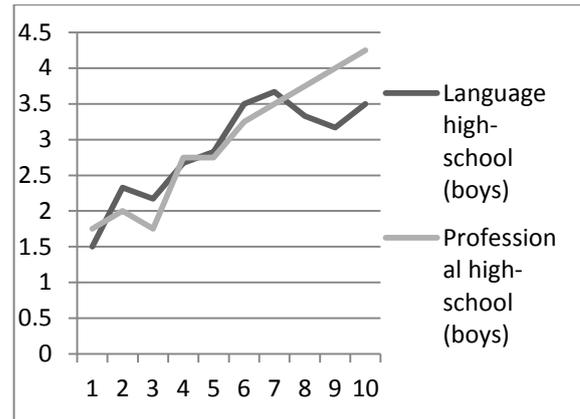
From the graph 2., results showed that arithmetic means of language high-school girls were in range from 2,35 on the 1st lesson to 3,55 on the 10th lesson. Grade *insufficient* (1) was lost on the 6th lesson, while grade *excellent* (5) started to show from the same lesson. It could be concluded that 10 lessons were enough for the phase of stabilization, which was equivalent of the grade *very good* (4). Girls from the professional high-school had their values ranged from 1,65 on the 1st lesson to 3,50 on the 10th lesson. Grade *insufficient* (1) was lost on the 7th lesson, while grade *excellent* (5) started to show on the 6th lesson. In general, 10 lessons wasn't enough for female students from professional high-school to achieve the phase of automatization, but they achieved the phase of stabilization, which was equivalent of grade *very good* (4). From the graph 2., 10 lessons weren't enough for reaching phase of automatization. No statistical differences occurred between two groups ($p=0,17$).



Graph 2. The dynamic trend of motor knowledge learning (putting the ball into the basket from technique above) between female students of two different school programmes

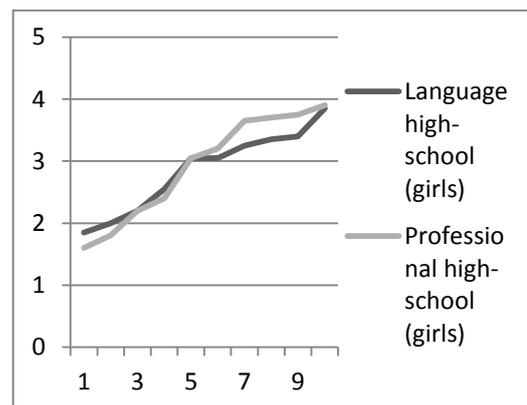
Based on the results from the graph 3., arithmetic means were in range from 1,50 on the 1st lesson to 3,50 on the 10th lesson among male students from language high-school. Grade *unsufficient* (1) was lost

on the 4th grade, while grade *excellent* (5) started to show on the 6th lesson. Students managed to reach the phase of stabilization, which was the equivalent of grade *very good* (4), but didn't manage to reach the phase of automatization. Arithmetic means from boys in professional high-school ranged from 1,75 on the 1st lesson to 4,25 on the 10th lesson. Grade *unsufficient* (1) was lost on the 3rd lesson, while grade *excellent* (5) started to show on the 8th lesson. Results clearly represented that 10 lessons weren't enough for reaching the phase of automatization and the level of knowledge maintained on the phase of stabilization, which was equivalent of grade *very good* (4). No statistical differences were found between two male student groups ($p=0,77$).



Graph 3. The dynamic trend of motor knowledge learning (handstand forward roll-linked) between male students from two different school programmes

Based on results in graph 4., arithmetic means of girls from language high-school ranged from 1,85 on the 1st lesson to 3,85 on the 10th lesson. Grade *insufficient* (1) didn't vanish during whole 10 lesson program, while grade *excellent* (5) started to show on the 4th lesson. It could be concluded that 10 lessons weren't enough for achieving the phase of automatization, only the phase of stabilization, which was the equivalent of grade *very good* (4). Moving to the girls from the professional high-school, arithmetic means ranged from 1,65 on the 1st lesson to 3,50 on the 10th lesson. Grade *insufficient* (1) was lost on the 7th lesson, while grade *excellent* (5) started to show on the 5th lesson. Based on obtained results, female students managed to learn the element to the phase of stabilization, while 10 lessons weren't enough for reaching the phase of automatization. There were no statistical differences between groups in grading criteria ($p=0,84$).



Graph 4. *The dynamic trend of motor knowledge learning (handstand forward roll-linked) between female students of two different school programmes*

Conclusion

From the obtained results, it can be concluded that for the element *putting the ball into the basket from technique above*, 10 lessons were for male students enough for reaching the phase of automatization, which was the equivalent of grade *excellent (5)*. Opposed to that, 10 lessons weren't enough to achieve the phase of automatization among female students, but only to the phase of

stabilization. The element *handstand forward roll-linked* showed positive impact on the level of adoption from the phase of initial perfecting to the phase of stabilization among all classes and sexes. In general, the phase of automatization didn't occur, because this element belongs to grupation of complex motor knowledge and, also, level of previous taught motor knowledge was not on the expected level for performing the element.

It can be concluded that both elements can be perfected through applied kinesiological treatment and criteria of grading during 10 lessons and can be used in school practice.

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DINAMIKA UČENJA DVAJU MOTORIČKIH ZNANJA SREDNJOŠKOLACA

Sažetak

Cilj je bio odrediti je li moguće da student koji je imao potpuno nepoznavanje motoričkih znanja dosegne razinu poznavanja istog u deset lekcija of razine usvajanja do automatizma. Također, cilj je bio odrediti može li ovaj kriterij biti predstavljen kao vodič za učitelje tjelesnog odgoja tijekom procjene motoričkih vještina. U uzorku od 50 sudionika (10 učenika i 40 učenica) u Srednjoj školi Krapina, kineziološki proces pripadao je skupini složenijih (ubacivanje) i drugih u skupini složenih motoričkih vještina (kolut naprijed iz stave na rukama). Ovi sudionici su iskusili kineziološki tretman pod istim uvjetima kao dio uobičajenog tjelesnog odgoja. Zasnvano na rezultatima ovog istraživanja može se zaključiti da: za motorička znanja, košarkaški pogodak ispod koša, pod utjecajem primijenjenog kineziološkog tretmana u oba razreda, deset sati je bilo dovoljno da razina usvajanja naraste sa faze usvajanja na fazu automatskog učenja motoričkih vještina između učenika gimnazije i profesionalne srednje škole ($p=0,45$). Pozitivan utjecaj na postignuće je također ustanovljen za motoričke vještine kolut naprijed iz stave na rukama u dvije iste grupe ($p=0,77$), što je bilo jednako školskoj ocjeni odličan (5). Za učenice, u oba razreda ($p=0,17$) nije bilo dovoljno razinu učenja dovesti do faze automatskog uljenja, što je bilo jednako školskoj ocjeni vrlo dobar (4), zatim je ostalo na stabiliziranoj razini učenja. U oba razreda je postojao pozitivan utjecaj na razinu motoričkih kolut naprijed iz stave na rukama ($p=0,84$). Općeniti napredak do faze automatizacije se nije dogodio ni u jednom razredu kroz deset sati procjenjivanja, što se može pripisati činjenici da je kolut naprijed iz stave na rukama pripadao skupini složenih motoričkih vještina i također da razina prethodno naučenih motoričkih vještina nije bila zadovoljavajuća za izvedbu danog elementa.

Ključne riječi učenici, motorička znanja, dinamika

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