

# DYNAMICS OF LEARNING COMPLEX MOTOR SKILLS IN PRESCHOOL CHILDREN

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## Abstract

*The process of motor learning is generally defined by four basic characteristics: 1) a set of inherent events, circumstances or changes in performing certain motor skills; 2) a direct result of exercise or experience; 3) not directly visible but estimated through performance of learned skills; 4) causes a relatively permanent change in the capacity of learned behaviours. At the beginning of artistic gymnastics programmes, a large number of structurally different movement skills are learned. One of them is the cartwheel. The objectives of this study were to determine the dynamics of the learning process and the differences in levels of cartwheel performance in beginner gymnasts both with the right and the left side. Objectivity and sensitivity of the judges have both been analysed; the average score has been determined by calculating the mean value; two-factor 2x6 ANOVA with repeated measures has analysed the significance of the differences in the levels of analysed motor skills in certain points of the treatment. Research showed that the three-month treatment is too short to identify significant improvements in the performance of these skills.*

## INTRODUCTION

Motor skills present the civilization's legacy that allows targeted and effective development of human abilities and characteristics. From the kinesiologocial standpoint, motor skill is a permanent testing of a person's ability to perform a motor task as a result of training and experience (Miletić, 2012.).

A large number of factors (motor skills, prior knowledge, cognitive and conative characteristics, motivation and demands of motor task) affect the process of learning motor skills. During the initial stages of learning, motor skills performance is characterized by a significant malfunction, slowness, unharmony and uncertainty.

To those who learn lack confidence due to which they were hesitant and insecure in their movements. Even in cases when the movement is performed properly, beginners do not perceive the quality of their performance. Through the next (further) period, those who learn, start the processes of removing first major and then the smaller errors in the performance; until they reach the level of a skill on which their performance becomes more accurate and more harmonious (better).

The quality of the performance can be explained through four main indicators: movement of the amplitude of the center of gravity of the body, amplitude between individual body segments, the overall efficiency and the space-time compliance performance (Živčić, 2000). Deviations from those are defined by the Code of Points of the

International Gymnastics Federation (Fédération Internationale de Gymnastique (FIG) and it classifies them as small, medium and large technical and aesthetic errors, and accordingly penalizes them.

Additionally, it is necessary to identify satisfactory reliability parameters of the judges who evaluate levels of acquisition of gymnastic motor skills. By insight in recent databases, the deficit of scientific researches that analyses the effectiveness of controlled and precisely planned process of learning complex motor skills can be observed.

From the standpoint of the complexity of motor skills that exists and which are taught in artistic gymnastics, we can say that all gymnastic programs comprise motor skills of a different complexity: biotic, simple, complicated and complex motor skills (Neljak, 2009). For each of them, according to the opinion of gymnastics experts, there is no single, generally recognized, method of teaching; there is a big difference in access and quality levels to which certain groups of learners are taught.

One of the structurally complex motor skills, which is a part of all beginner gymnastics programs, is the *cartwheel*. Characterized by alternating, rhythmic and dynamic changing of the body support (feet-hands-feet), respectively with shifting of the body from an upright standing through straddle handstand to an upright standing with backs turned opposite to the starting direction.

Accordingly, the primary objective of this study was to determine the dynamics of the learning process of the *cartwheel on the right* and *on the left side*, as a representative of complex motor skills in a beginner's gymnastics program. The secondary objective was to

determine the differences in levels of acquisition of the *cartwheel* performed in different sides.

**METHODS**

**Subjects**

The sample consisted of 17 girls (chronological age 5.65 ± 0.57 years) attendants of the recreational gymnastics program of the Gymnastic Club "Kaštela". All girls were without any aberative changes and written permission from a parent was obtained for their participation in the experiment.

**Variables**

The sample of variables consisted of a gymnastic skill - *cartwheel performed on the right and on the left side*. Through videos, and based on Delaš Kalinski (2009) criteria, 3 licensed gymnastic judges have assessed the level of adoption of these skills, recorded in 6 points during the experimental treatment (initial, 4 transitive and final point).

**Statistical Analysis**

Inter-item correlation (IIR), Cronbach alpha coefficient (Cα), and the normality of distribution through the KS test were calculated. The total result for both analyzed motor skills (*cartwheel on the left side* and *cartwheel on the right side*) in a single point of testing, is obtained by calculating the mean value.

2x6 factorial analysis of variance (ANOVA) with repeted measures on both factors (*side* (left or right) and *treatment* (initial, 4 transitive and final point of testing) and their interactions) was applied to determine

significance of differences in the levels of acquisition of analysed skills in single points of testing. (Partial) η<sup>2</sup> was used for effect size assessment. Data were considered significant if p<.05. All calculations were performed using software package Statistica 12.0. (StatSoft, Tulsa, Oklahoma, USA).

**Description of the experimental treatment**

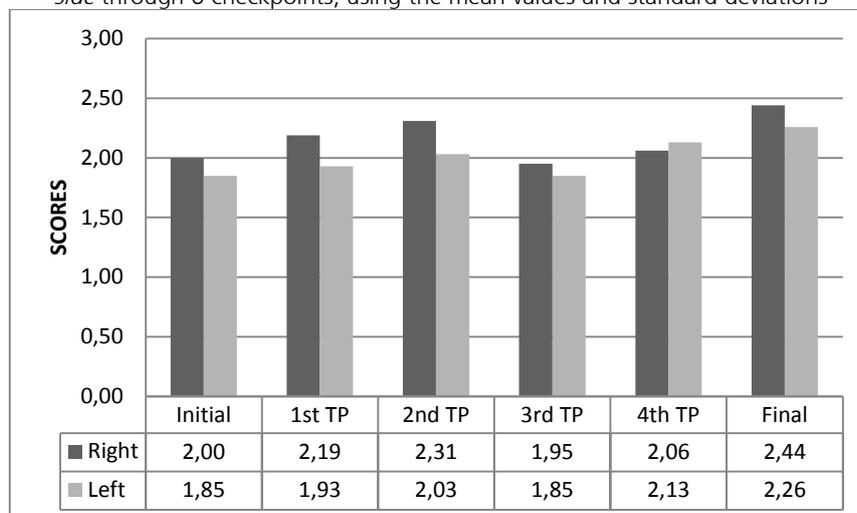
The study was conducted over 12 weeks, 3 times per week for 60 minutes; a total of 34 gymnastics trainings under the guidance of the same coaches and under the same learning conditions. The structure of each training lesson was identical to the structure of the school physical education lessons. In the main part of the lessons, within differently constructed polygons, the *cartwheel on the left* and on *the right side* was taught and performed. The number of repetitions of the skill, during one lesson, ranged from 6-10.

**RESULTS AND DISCUSSION**

The average inter-item correlation between the results of the judges has been identified as very high, in all the reference points, (IIR<sub>INI-FIN</sub>: 0.84 to 0.95). Vaules of Cronbach Alpha coefficient (Cα: 0.94 to 0.98) categorized judges as reliable when assessing the level of analysed skills. Furthermore, the KS test clearly indicates that the results of both analyzed skills significantly don't differ from the normal distribution; indicating a good sensitivity of judges evaluation.

Within graph are shown mean values of analysed skills in all checkpoints (Graph 1).

**Graph 1.** Graphic representation of the dynamics of the learning process of *cartwheel on the left* and on *the right side* through 6 checkpoints, using the mean values and standard deviations



**Legend:** *Right* – performance of the *cartwheel on the right side*, *Left* – performance of the *cartwheel on the left side*, *Initial* – initial checkpoint, *TP* – transitional checkpoint, *FinalN* – final checkpoint

Graph 1 shows that the level of *cartwheel on the left side* and of *cartwheel on the right side* grew from the initial checkpoint to second transitive checkpoint; degenerated in a third transitional checkpoint, and once again continued to grow to the fourth transitional and final checkpoint.

Despite minimal improvements from one checkpoint to another one, a reviewing the progress from the initial to the final checkpoint, we can conclude that there was a numerical increase of approximately 0.50. This is not too big increase, but, when taking into account that a complex motor skills were taught to beginners, we can say that represents progress and confirms the adequacy of applied kinesiological treatment.

Using 2×6 factorial ANOVA with repeated measures on both factors, significant influence of the factors *side* ( $F=0.46$ ;  $p=0.52$ ;  $\eta^2=0.05$ ), *treatment* ( $F=1.14$ ;  $p=0.36$ ;  $\eta^2=0.12$ ), and their *interaction* ( $F=0.00$ ;  $p=0.49$ ;  $\eta^2=0.10$ ) were not determined. As previously stated, although in absolute terms progress has been identified, and the difference between the performance of *cartwheel on the left side* and *on the right side*, it can be seen that significant ( $p > 0.05$ ) effects of factors *side* and *treatment*, as well as their mutual interaction (*side \* treatment*), wasn't determined. Therefore, post-hoc analysis was not applied.

## CONCLUSION

Although it was a three-month treatment, from initial through transitive to the final checkpoint of the learning process, we're determined fairly uniform values of the mean values of *cartwheel on the left side* and *cartwheel on the right side*. It leads to a conclusion that during the analysed period, on the analysed subjects sample, the general structure of the performance of these skills has not changed significantly. For the significant changes to occur obviously a longer training time and higher frequency of repetition of the skills is needed.

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## DINAMIKA PROCESA USVAJANJA KOMPLEKSNIH MOTORIČKIH ZNANJA KOD DJECE PREDŠKOLSKE DOBI

### **Sažetak**

*Proces motoričkog učenja generalno definiraju četiri osnovne karakteristike: 1) ono je skup inherentnih događaja, okolnosti ili promjena u spretnosti izvođenja određenih motoričkih zadataka; 2) ono je izravni rezultat vježbanja ili iskustva; 3) nije vidljivo direktno već ga procjenjujemo kroz izvedbe znanja koja se uče; 4) uzrokuje relativno trajne promjene u kapacitetima naučenih ponašanja. U početničkim programima sportske gimnastike uči se velik broj strukturalno različitih motoričkih znanja. Jedno od njih je premet strance. Ciljevi ovog rada bili su utvrditi dinamiku procesa učenja i razlike u razinama naučenosti premeta strance iz čeonog početnog položaja u desnu i lijevu stranu kod početnica sportske gimnastike. Sudcima su analizirane objektivnost i osjetljivost; prosječni rezultat utvrđen je izračunom aritmetičke sredine; dvofaktorskom 2x6 ANOVA-om s ponovljenim mjerenjima analizirana je značajnost razlika u razinama naučenosti istraživanih motoričkih znanja u pojedinim točkama provjeravanja. Rezultati istraživanja su utvrditi da je tromjesečni tretman prekratak da bi se utvrdili značajniji pomaci u izvedbi ovih znanja.*

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