

ASSESSMENT OF GYMNASTIC SKILLS AT PHYSICAL EDUCATION – THE CASE OF BACKWARD ROLL

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Abstract

Article presents a model of the assessment of gymnastics skill. The presented task, backward roll, includes descriptions of movement, test criteria with a measurement scale and a description of standards based on the number and type of mistakes. Videotaped student performances (N=36) were evaluated by three external evaluators to assess their level of performance. Differences in performance between genders were tested by using the analysis of the variance. Cronbach's reliability coefficient alpha and a calculation of concordance between respective evaluator's grades and a common test object were used for the evaluation of reliability and objectivity of task. No statistically significant differences between the performance of boys and girls were observed. It can be concluded that the test task is equally suitable for both genders. The reliability and objectivity of assessment were high, which indicates an appropriate selection of test criteria and descriptions. Whilst preparing analytical criteria for the assessment task, teachers should prepare descriptions of movement and clear criteria for different levels of executions. These criteria help both the teacher and the student to gain good insight into the quality of student's knowledge and simultaneously enable a teacher to help the student with further practicing and acquisition of basic motor skills. For formative assessment, it has to be mentioned that the measuring scales and criteria should differ according to the purpose of evaluation, the developmental stage of pupils and the complexity of evaluated movement.

Keywords: *physical education, gymnastics, assessment, test task, metric characteristics.*

INTRODUCTION

Assessment is a broad term defined as a course of action for generating and acquiring information that is used for making decisions about students, programmes and national curricula. Among physical education (PE) teachers, the assessment of students is one of the most troublesome issues they encounter (Carroll, 1994; Kirk, 2001; Kovač, Strel, & Majerič, 2008b; van Vuuren-Cassar, 2010). A considerable number of PE teachers think that with assessment the real value of the subject (i.e. to be physically active, to enjoy

movement) is not being realised, and many of them are opposed the idea of examinable PE altogether because of the difficulties with assessment (Kirk, 2001). Kirk (2001) also believed that PE should be included in assessment, while the exclusion from recording and reporting would have been fatal to PE's continuing existence in the compulsory curriculum, but PE teachers have to rethink some of their conventional assumptions about assessment, particularly assumptions about its purpose and its methods. They had to focus on the positive

educational benefits for students and the professional benefits for teachers.

Good teachers should be skilled not only in instructional methods, but also in evaluation and assessment practices that allow them to gauge individual student learning and adapt activities according to student needs (Colby & Witt, 2000). In such a way, students receive information about their progress in learning; parents also want to know about their children's physical development and motor competences. For PE teachers, the assessment serves an important function in the further process of teaching; they can identify where students have troubles, and they can make the decisions about areas that require further training (Kovač & Novak, 2001).

Numerous authors, whose research deals with the assessment of knowledge (theoretical and performance of different skills) in PE, agree that students' performance and knowledge need to be assessed with deliberation and diverse methods (Brau-Antony & David, 2002; Burton, 1998; Kovač et al., 2008b; Majerič, 2004; Newton & Bowler, 2010; Popham, 2011; Reynolds, Livingston & Wilson, 2010). In addition, the developmental level of students should be considered as well as the type of learning, i.e. the way knowledge is being acquired. In the process of the acquisition and stabilisation of motor skills, teachers can offer efficient support for the further learning of students by providing suitable feedback (Morrow, Jackson, Disch, & Mood, 2005). This is particularly important, as the automatic control of incorrect motor patterns hinders or even prevents the formation of more complex motor structures (Magill, 2004).

Various practices have emerged from among assessment of so-called practical work in PE. Some of the models have included the use of motor skill and fitness tests, while others used tables of points awarded for results in areas such as swimming and athletics, and also the so-called "subjective assessment" of the teacher on matters such as gymnastics, dance and game performance (Brau-Antony

& David, 2002; Estrabaud, Marigneux, & Tixier-Viricel, 2000; Lockwood & Newton, 2004; Popham, 2011). To carry out "subjective assessment" many teachers have used their own professional expertise. They assess students' skills through observation, for example during the game or uncontrolled practising. This type of assessment is undoubtedly economical; however, it has several limitations, as it is usually intuitive and adjusted to the level of knowledge and social relationships of the group; it is also based solely on the experience of the teacher and most often does not conform to educational curriculum, regulations for the evaluation and assessment as well as professional recommendations that suggest assessment with the use of evaluation criteria (Brau-Antony & David, 2002; Estrabaud et al., 2000; Rutar Ilc, 2003; Williams, 1996). Although the criteria for the assessment that is practiced in schools are "written in teachers' minds", they are not shared with students, which is one of the basic conditions of fair evaluation (Quiot, 2003; Rutar Ilc, 2003). Therefore, teachers should prepare and inform the pupils about the clear and precise criteria of evaluation.

Criteria can be very different: they can be based on the description of the execution quality of the movement and the use of acquired skills in real-life specific situation or they can be based on "check-up lists" of errors; they can be simple (two-level: yes/no, acquired/not acquired, safe/dangerous execution) or very precise (multi-level with a description of every level). Complex descriptions in PE allow better insight into the knowledge of an individual student. Such an analytical approach is based on very precise identification of deviations from correct execution. Deviations, also called mistakes, are evaluated according to the magnitude as large (they disturb the movement or make it difficult) or small (they have smaller effect on the correct execution), according to the type as technical mistakes (present in every sport), aesthetic mistakes (e.g. gymnastics, dance) or rhythmic mistakes (dance) (Kovač

et al., 2008b). This kind of assessment can be used for formative purposes. Formative assessment involves providing information to learners in the course of their learning journey so that they remain on or regain the right track (Kirk, 2001). Nevertheless, it is very important that the criteria are modified according to the age of pupils, to contents that are being evaluated and the purpose of evaluation (quick assessment of progression, evaluation of demonstration, and identification of key mistakes) (Kovač et al., 2008b; Newton & Bowler, 2006).

Gymnastic contents have been part of the PE curriculum ever since PE was first introduced in the education system (Kompara & Čuk, 2006). In recent Slovenian PE curricula for the primary school, gymnastics is still one of the most important elements, while it offers a great range of locomotive, stability and body control movements, which are highly important for the development of children (Kovač & Novak, 2001). Gymnastics requires a great diversity of movements: transitions from dynamic to static elements and vice versa, and frequent changes of the body position in space. Successful performance of each element requires accurate muscular activity of specific intensity, through the space and at the right moment (Novak, Kovač, & Čuk, 2008). During the teaching process, teachers should select the appropriate teaching method, recognise mistakes, and give the students appropriate feedback information to improve their movement (Pehkonen, 2011). Practice without feedback information negatively influenced the pupils' outcome in lessons in which teachers remained passive observers (Yerg & Twardy, 1982). For helping PE teachers in the teaching process, different test tasks were prepared and the different methods of descriptions of task were applied (Kovač et al., 2008b). In the analytical method that is the most suitable for formative assessment (Majerič, 2004; Kovač et al., 2008b), each task includes descriptions of movement and clear criteria for different levels of executions

(descriptions of mistakes that students could make during the execution).

In this study, one of the most common gymnastics skills, the backward roll, is presented. We attempt to determine if the construction of task is appropriate for the evaluation of students. Therefore, the measurement characteristics of task and the differences in performance between genders were analysed.

METHODS

The test sample included 36 students (16 boys and 20 girls) enrolled in the eighth grade of primary school. Only healthy boys and girls who were not exempt from physical education for health reasons and whose parents had given their written consent to participate in the measurements were included. Girls were taught by female and boys by male PE teachers.

Instrument. The gymnastic test task was prepared by Kovač and Čuk (2002, in Majerič, 2004). The analytical method of assessment is used. The task includes: a) descriptions of movement and certain mistakes; b) criteria with measurement scale and description of standards.

a) The task is divided into separate phases of movement. Each phase has descriptions of technically appropriate execution and certain mistakes that are most common and can appear during the movement. According to their structure, mistakes can be divided in technical (deviation of technique from ideal execution) and aesthetic (deviation in elegance and poise of execution); according to the severity of deviation, mistakes can be small or large. Small mistakes are mistakes that do not have a significant effect on the execution skill, but rather create a small instability of execution. Large mistakes are those that significantly influence the correct execution or else prevent the pupil from performing a skill.

b) A six-level measurement scale (0 to 5 points) is used. In setting the scale it is

important for the differences in execution at individual levels of the measuring scale are approximately the same (demands have to progress in equal degree from one level to another). Standards are based on the quality of execution with the number and importance of mistakes (small / large) that can appear during the performance.

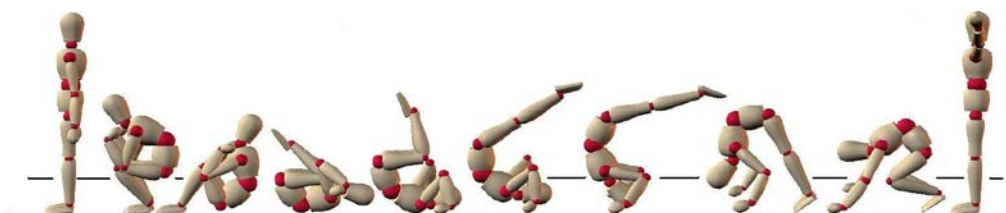
Space. Gym hall, 10 meters × 4 meters.

Accessories. Four mats (2 meters × 1 meter), 6 to 12 cm high; standing board, 10 to 12 cm high.

Set-up: Two mats 6 to 12 cm high, placed one behind the other, touching along shorter side. A pupil who cannot execute a skill on his/her own on mats level with the floor can perform a skill on mats with a downward slope created by placing a higher end of a springboard under the beginning of the first mat.

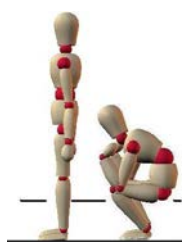
Description of the task and kinogram.

Starting from upright standing position, bending of legs into crouching position then backward roll with bent arms and the support of hands to crouching position, followed by leg extension into a standing upright position with arms sideways.



Description of technique and mistakes

1) Transition from standing position into crouching position



Description.

Pupils crouches with a slight lean forward, bends the arms and places the hands parallel to the shoulders.

Technical mistakes (large).

In transition into crouch and slight forward fold, student supports him/herself with hands.

2) Backward roll to tucked front support



Description.

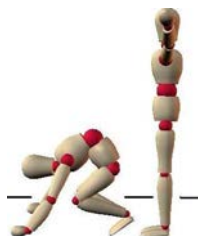
From crouching position sit on the mat as close to the heels as possible and roll backward over the head, shoulders and back in a tight tucked position, chin pressed into chest. Active support with open palms and fingers wide and a strong extension of elbow joint (arms) when crossing the vertical position. Legs either bend or straight.

Technical mistakes (large).

Uncoordinated transition from crouching position into roll (fall backward). Body not completely tucked during the roll. No active support with hands and no extension of elbow. Roll ends in wide straddle tucked front support.

<i>Technical mistakes (small).</i> Transition into crouch is not smooth.	<i>Technical mistakes (small).</i> Transition from crouching position into roll is not smooth. Chin not sufficiently pressed into chest. Hands are not parallel.
<i>Aesthetic mistake (large).</i> Completely relaxed body.	<i>Aesthetic mistake (large).</i> Completely relaxed body and legs. Legs overly widely apart (more than shoulder width).
<i>Aesthetic mistake (small).</i> Slightly relaxed body.	<i>Aesthetic mistake (small).</i> Slightly relaxed body and legs. Legs slightly apart (less than shoulder width). Feet not pointed.

3) From tucked front support lift into standing position, arms beside the ears



<i>Description.</i> After extension of arms fast transition into upright standing position.
<i>Technical mistakes (large).</i> Hands sliding over the mat directly prior to a transition from crouching into standing position.
<i>Technical mistakes (small).</i> Transition from crouching position into standing position is not coordinated.
<i>Aesthetic mistake (large).</i> Completely relaxed body, feet wide apart.
<i>Aesthetic mistake (small).</i> Relaxed body, feet slightly apart.

Criteria

Measurement scale (points)	DESCRIPTION OF STANDARDS
5	Student performs backward roll independently, with reliability, <i>without</i> technical and aesthetic mistakes.
4	Student performs backward roll independently, but not with complete reliability; during the execution he/she makes <i>small</i> technical <i>or</i> aesthetic mistakes.
3	Student performs backward roll independently, but not with complete reliability; during the execution he/she makes <i>one large</i> technical mistake <i>and</i> several <i>small</i> aesthetic mistakes; or several small technical <i>and</i> aesthetic mistakes.
2	Student performs backward roll independently, but not reliably; execution includes large technical <i>and</i> aesthetic mistakes.
1	Pupil performs backward roll in easier conditions or environment (down the slope, over the shoulder, into kneeling or straddle position, with help).
0	Pupil cannot perform backward roll (he rolls backwards, but does not execute rotation around transversal axis).

The data was collected during the regular PE classes. After warming up, the test task was explained and demonstrated to students; then students performed it under the same conditions three times. Their second and third performances were videotaped.

Tasks' performances were evaluated with a unique protocol by three PE teachers. Before the assessment they read the description of task and criteria carefully. Then they independently assessed both performances (36 students, 72 executions) on videotape in normal speed. In the assessment, they were not allowed to stop the tape, watch it in slow motion or watch it more than once. For evaluation, they used points from 0 to 5 according to the above criteria. The better score of each student was used for statistic procedures. After one month, one of the evaluators repeated the evaluation three times in one-day intervals.

The data was processed using the SPSS statistics application for Windows. Factor analysis, Cronbach's reliability coefficient

alpha and calculation of concordance between respective evaluator's grades and the common test object were used for evaluation of reliability and objectivity. To analyse the differences in performance between genders, the analysis of the variance was used. All statistics used an alpha level of $p < 0.05$.

RESULTS AND DISCUSSION

Differences in scores between genders.

The average marks of students were slightly lower than the average of six possible marks on a 0- to 5-point measuring scale. The evaluators did not use the highest and the lowest scores. The distribution of scores was normal. The received scores of girls were slightly higher than boys, but the differences between genders were not statistically significant ($p=.447$). We concluded that the group of students were homogenous and the test task is equally suitable for both genders.

Table 1. *Basic statistic parameters and analyse of variance between the genders.*

	N	AS	SD	SE	mi n	ma x	Bar tt-Sig	F	p
bo	16	1.8	1.1	.27	1	4	.61	.59	.44
ys		1	1					1	7
girl	20	2.1	1.1	.25	1	4			
s		0	0						
tot	36	1.9	1.1	.18	1	4			
al		7	0						

Legend: N – number of students; AS – mean scores; SD – standard deviation; SE – standard error; min – minimum score; max – maximum score; Bartt- Sig - Test of variance homogeneity; F – F-test; p - statistical significant differences

The backward roll is important movement in childhood development, especially for one's orientation in space (it is executed backward, which is an unusual direction of human movement). The average values for executed movement were slightly lower than expected, as the backward roll has been a part of the PE curriculum in all grades of schooling (Kovač & Novak, 2001). Examination of the time allocated for various types of activity throughout the

world reveals how, in practice, competitive sport activities such as ball games and track and field athletics dominate the physical activity experiences of pupils (Hardman, 2008). As open-ended curricula provide teachers with a higher level of autonomy (Colby & Witt, 2000), it often happens that teaching is not systematic. Furthermore, in Slovenia teachers spend too few lessons on gymnastics, which leads to very modest knowledge of gymnastics in students (Bučar

Pajek et al., 2010; Kovač, 2006; Majerič, 2004; Štemberger, 2003).

We have to acknowledge that what students actually do during a lesson is more important than the time allocated for practice (Da Costa & Piéron, 1992; Metzler, 1983; Phillips & Carlisle, 1983). Pehkonen (2011) found that the quality of practice had the highest explanatory power for improving gymnastics skills. Children find it easiest to learn basic gymnastic skills in the first years of school. In Slovenia, PE is taught by general teachers in the first years. Self-evaluation regarding their own competences showed that they had insufficient knowledge in the following areas: how to implement gymnastics and ball games, and how to organize effective PE classes (Kovač, Strel, & Jurak, 2008a). Silverman (1991) also reported that due to the complexity of the PE learning environment, students are engaged in more complex motor activities for less than 30% of class time, and only half of this at a level appropriate to student needs and readiness.

The period between the ages of ten and fifteen is characterised by fast growth, especially of the limbs (Jürimäe & Jürimäe,

2000). Changes to an individual's size and strength will have a pronounced effect on learning (Kirk, 2001; Magill, 1994). The problem occurs when students, due to accelerated development of the body and insufficient strength in the arms and shoulders (Strel, Kovač, & Jurak, 2007), are unable to support their hands during the roll and then move their body around the shoulder or even cannot roll their body back at all. Coping with these changes may be a source of clumsiness as some young people struggle to match their existing skills and their expectations of their competence with changes to their bodies (Kirk, 2001). Regarding planned strategies for the realisation of lessons, teachers have to allow enough time for practising, change the learning environment, and respect the learning needs of their students.

Objectiveness and reliability of assessment. The objectivity of the assessment was examined with measurement compatibility between the scores of single evaluators and the common object of assessment (the first main component of scores of all three evaluators).

Table 2. Correlation between three evaluators and Cronbach's alpha .

evaluator	E ₁	E ₂	E ₃	Cronbach's α
E ₁	1.0			.95
E ₂	.98	1.0		.98
E ₃	.86	.90	1.0	.90

Table 3. First main component.

Component	λ	Cum. % of variance
K₁	2.83	94.21

Correlation between the marks of three evaluators is very high. The first main component has represented slightly more than 94% of total variance of all evaluators, indicating that the selected criteria were appropriate. Despite the fact that one of the evaluators was not a specialist in

gymnastics, all three evaluators marked according to the descriptions of mistakes and described standards for individual measuring level; as a result, a correlation of the marks of individual evaluators with the first main component was very high. Slightly lower consistency among

evaluators was revealed by Majerič, Kovač, Dežman and Strel (2005) when evaluating long jumping with approach (0.84). It can be concluded that with appropriate criteria every PE teacher who is well prepared for the evaluation could objectively evaluate different motor skills.

The reliability of the test assignment was checked using Cronbach's alpha

coefficient by which we examine the internal robustness of marks after several repetitions (Sagadin, 1993). To find out the reliability of the assessment of backward roll, one of the three evaluators assessed all tested individuals three times within three days.

Table 4. Reliability of the assessment.

	Basic statistic parameters					Correlations		
	N	A	S	min	max	Ea	Eb	Ec
		S	D					
Ea	36	2.06	1.15	0	4	1.0		
Eb	36	2.03	1.13	0	5	.95	1.0	
Ec	36	1.97	1.10	0	5	.92	.98	1.0

alpha = .98

Legend: E – evaluator; a – first assessment; b – second assessment; c – third assessment

Very high correlations between the scores point to evaluation with the same criteria at all three times of evaluation, regardless of the one-day interval between each evaluation. The reliability of assessment can be increased through good assessment measures (Marentič Požarnik, 2000). Undoubtedly, the descriptions of technical and aesthetic execution of tasks and the criteria were sufficiently precise for the evaluator to mark the execution similarly at different times. Furthermore, other authors reported the high reliability for assessment of different motor skills with the analytic method of assessment (Majerič, 2004).

Whilst preparing analytical criteria for assessment task, which should be based on the magnitude and frequency of mistakes, teachers should divide individual movement into parts that will allow students to recognise their own mistakes and enable a comparison with correct execution. These criteria help both teacher and the student to gain good insight into the knowledge of the student and at the same time enable a teacher to help the student with further

practice and the acquisition of knowledge (Colby & Witt, 2000; Kovač et al., 2008b; Quiot, 2003). This type is useful mostly for the evaluation and examination of basic movements that are essential for the acquisition of future content (Majerič, 2004) and therefore have to be correctly learned (Burton, 1998; Magill, 2004). Specifically, mistakes in the execution have two-fold effect: first, they prevent the efficiency of future learning; and second, insufficient execution can endanger the safety of a student or even cause an injury.

CONCLUSION

To be effective, teachers need to be responsive to the learning needs of their students through mastering important subject content, integrating concepts and implementing teaching strategies that are responsive to a diversity of students (Dill, 1990; Whipp, 2004). This can only be achieved if the learning process is appropriately organised with a sufficient number of lessons, optimal teaching techniques and appropriate methodical procedures. Good teachers should be skilled

not only in teaching methods, but also in the positive educational benefits of evaluation and assessment practices that allow them to gauge individual student learning and adapt activities according to student needs; learning experiences and assessment tasks must be very closely related, often involving simple or minor modifications between one and the other (Kirk, 2001).

The backward roll is one of the most common items of content in PE in all grades. Bučar et al. (2010) reported that more than 90% of PE teachers implemented this acrobatic element in the last three grades of primary school. By including different rolls in the lessons plan, teachers will be able to improve or at least maintain the level of movement abilities in their students throughout the years. Successful performance of these skills requires accurate muscular activity of specific intensity (muscular strength in arms and shoulders), through the space (coordination in movement backward around the frontal axis) and at the right moment (timing) (Novak et al., 2008). A prepared model task with description of movement and certain mistakes and precise criteria are focused on individual student learning and providing suitable feedback. They serve as important function in the further process of teaching; teachers can identify where students have troubles; therefore, they can further adapt teaching process.

Teachers could also prepare tasks and criteria in a similar way for other motor skills forming part of the curriculum. For formative assessment, it has to be mentioned that the measuring scales and description of standards should differ according to the purpose of evaluation (finding quality, quantity and meaning of knowledge; identification of the importance of mistakes; improvement of teaching methods), the developmental stage of pupils and the complexity of evaluated movement. As every teacher is autonomous in the evaluation process, the analysis of individual criteria will be welcome in the professional evaluation of the aptness of their decisions, as well as in the evaluation and assessment

procedures of practical knowledge of students.

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