

Validation of an Instrument to Measure the Variability of Fundamental Movement Choreography

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Creativity is a key and crucial competence in education. As several scientific publications have shown the positive effects of physical activity on creativity (Blanchette et al., 2005; Colzato et al., 2013; Santos et al., 2016 cited in Ruiz-Ariza et al., 2017), the role of physical education has been valorised in the field of creativity development (Sturza, 2014). Fundamental movement is essential to physical education lessons, providing teachers with a versatile tool to foster creativity. Different assessment procedures are crucial to measure the success of the learning process. We have not found an established and standardised protocol that objectively provides feedback on creative teaching-learning processes in PE lessons. Creative ideas can arise during the design of fundamental movement exercise sequences, and therefore, we have developed a set of criteria for evaluating the design of fundamental movement sequences. The study aims to present the criteria system and its validation.

Keywords: creativity, fundamental movement, validity, scoring system

Introduction – developing creativity in PE lessons

Creativity is an important personality trait in the 21st century, and experts consider it to be the most useful human skill in the long term (Ferenczi-Salamon, 2018). Therefore, it is no coincidence that creativity is considered a general educational goal in education policy (Eszterág, 2008). In contrast to different definitions of creativity, from the students' point of view, it is not primarily the creation of a creative product itself that is important, but rather the knowledge and skills acquired in the process (Lin, 2011). Based on this context, teachers should focus on the development of creative processes in their teaching activities, and creative pedagogy as a learning model can help with this. According to Lin's (2011) the three-dimensional model, the key factors of creative pedagogy are creative teaching (interesting, imaginative pedagogical practice of the teacher), teaching creativity (developing students' creative thinking and behaviour), and creative learning (active learning process of students). In addition to being an important pedagogical environment for the development of creativity, physical education (PE) classes are important (Phillip, 1969; Stinson, 1975 cited in Neville & Makopoulou, 2020), as they provide a great platform for the dimensions of creative pedagogy (Lin, 2011). Since physical education classes do not take place in the usual classroom settings, it is possible to use as many collaborative methods and student-centred methods (such as exploratory learning, project method, tasks supporting autonomy) that contribute to the success of the creative learning process. The variation of funda-

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mental movements using some learner-centred teaching methods can provide opportunities for developing creativity and creative activities at all ages (e.g. by designing independent exercise sequences or using alternative tools for postural correction and strengthening according to the objectives). For the effectiveness of learning creativity, PE teachers need to focus on creating a positive, inclusive atmosphere so that students feel confident to express their ideas and thoughts among themselves (Mikó & Kovács, 2023).

For teachers, including PE teachers, pedagogical evaluation is an important factor, since in addition to assessing students, it can sometimes report on the success of creativity development methods and programs, which makes education more efficient (Starko, 2018). In this regard, it is important to review the creativity tests used at the national and state levels.

Measuring creativity

Since creativity is a complex phenomenon, it is worth considering which aspect of creativity is to be measured before choosing the right test or procedure. The object of investigation may be the evaluation of the creative product, the analysis of the creative process or the creative personality (Pásztor, 2015). Since Lin (2011) and other experts (Planna, 2019; Beghetto & Kaufmann, 2010; Motan, 2010; Craft, 2003; cited in Oppici et al., 2020) recommend the conscious development of creative processes in education, procedures for this purpose should be considered by educators. Tests for process assessment primarily use tasks that focus on solving open-ended problems and providing multiple answer options (Starko, 2018), so divergent thinking plays a central role in the tasks. Divergent thinking is one of the determining cognitive factors of the emergence of creative thoughts, and identifying the presence and absence of this potential may be the primary goal in education (Pásztor, 2015).

To date, most tests that measure creative processes focus on divergent thinking. A critical review by Long et al. (2022) points out that 50% of creativity tests used in education are aimed at measuring divergent thinking. The most well-known and widely used of these is the Torrance Tests of Creative Thinking (TTCT – Torrance, 1966). The Torrance test includes various verbal and nonverbal, open-ended exercises, such as answering and solving questions related to the development and practical use of various subjects. In addition to this test, another well-known test is the Wallach-Kogan Creativity Test (WKCT – Wallach & Kogan, 1965). The Wallach-Kogan test is based on similar principles to the Torrance test, but it also includes other tasks, such as listing as many round things as possible, analyzing the relationships between certain objects, and deciphering the meanings of various abstract patterns. In addition to the Hungarian adaptations of the above-mentioned tests (Barkóczi & Zétényi, 1981; Zétényi, 1989), creativity tests have also been developed, such as the MON-DALK test (National Talent Center & OKT-Full Kft, 2018 cited in Katona & Szitó, 2021), the Tóth Creativity Estimation Scale (Tóth & Király, 2006), and progress has also been made in measuring divergent thinking in a computer environment (Pásztor, 2015).

In order to gain a more valid approach for measuring creativity, it is useful to employ the characteristics of the given content area in measurement situations (Rusch et al., 1964). After the importance of physical education in the field of creativity development increased (Sturza, 2014), the concept of motor creativity was introduced (Domínguez et al., 2014). Various tests of motor creativity have been created to examine creative thoughts and ideas that can be expressed not only cognitively, but also through the movement of the body. These tests include Test of Motor Creativity (Wyrick, 1968), the Bertsch Test (Bertsch, 1983), the Divergent Movement Ability (Johnson 1977, modified by Cleland & Gallahue 1993; Cleland, 1994), and the well-known Thinking Creatively in Action and Movement (Torrance, 1981). Motor creativity tests generally assess the var-

ied and unique rider's response to a stimulus (Wyrick, 1983). Like verbal and visual methods, the tests are based on measuring divergent thinking (fluency, flexibility, originality). Most of the tasks ask participants to move in the given space in different ways, to get an object from point A to point B along different solutions, or to represent the movement of an animal/object/phenomenon. They observe the rate at which thoughts flow (fluency), how many solutions are created to a given problem (flexibility), and how unique the given solution is (originality) (Lee et al., 2023).

The problem of subjectivity often arises in connection with creativity tests (Field & Field, 2020). In the case of motor tests, the practical solutions to the tests also have a risk of subjective judgement. While some researchers report a significant relationship between measurement results of subjective and objective methods (Janssen, 2000; Scott & Bruce, 1994 cited in Field & Field 2020), the opposite is also found in the literature (Oldham & Cummings, 1996, cited in Field & Field, 2020). These hypotheses have inspired us to create a motor scoring system that objectively provides feedback on both current creative state and developmental effectiveness by designing fundamental movement sequences.

Presentation of criteria evaluating fundamental movement sequences

Our criteria are based on (1.) the elements of fundamental movement, and (2.) Rudolf Laban's Motion Analysis System (LRMR – Laban, 1947).

1. Fundamental movement is an essential part of physical education, which accompanies students every day for 12 grades. The role and purpose of fundamental movement have constantly changed and adapted over the past 100 years adjusting to the education and educational content of that time. For today's educational purposes, it is recommended to use fundamental movement to develop creativity as well, as its inexhaustible range offers great opportunities for creative design. In addition:

- According to Seeling (2012, cited in Papaleontiou-Louca et al., 2014), in order to be creative, one must have a basic and deep knowledge as a starting point. Since fundamental movement is the alpha and omega of all movements, it can provide, both the teachers and students with basic knowledge for planning and compiling creative exercises sequences.
- The promotion of creativity needs to be encouraged daily in educational practice (Beghetto & Kaufmann, 2014). In Hungary, daily physical education provides a great opportunity for fundamental movement to appear in every lesson.
- Through alternative uses of fundamental movement (Mikó & Kovács, 2023), the delivery of the curriculum to students can become varied.

2. Rudolf Laban's Movement Analysis System is regularly published in Anglo-Saxon physical education literature. The System shows from 4 aspects (body, space, dynamics, connection) how many ways a given movement can be composed (Gyulavári, 2012). The system interprets movements based on the following categories: "What?" moves, i.e., it shows the relationship between the body and body parts during movement. It takes into account "Where?" the body moves, which illustrates the characteristics related to space. It describes "How?" the body can move: here we are talking about dynamic characteristics; and it describes how the body can move in connection with "What, to whom?" (Gyulavári, 2012). According to Langton (2007), the System provides a framework that can be applied to several forms of movement sequences. Laban's work has inspired many professionals, and in recent decades several dance programs have also been developed for use in preschool and school settings to develop creativity (Chen & Cone, 2003; Lai Keun & Hunt, 2006; Neville & Makopolou, 2020).

Laban's work and fundamental movement inspired us to create a set of criteria to measure the variety of self-assembled exercise chains. Our scoring system is based on the scoring of movement analysis and aesthetic sports (gymnastics, aerobics, synchronised swimming, figure skating). We chose these sports because most of the competitions are scored on the elements of the movement analysis system and also on the fundamental movement elements used in the rings (e.g. use of available space, execution of exercises, harmonious linking, level changes). Based on our practical experience, we have given fewer points for the more frequently used elements and more points for the less frequently used elements. The criteria and scores for the items were based on our preliminary results from a survey of physical education teachers (Mikó & Kovács, 2021). Based on our preliminary results, we defined seven evaluation criteria in our finalised criteria: timing of exercises, level changes, directions, asymmetric positions, positional movements, tools used and tempo changes (Table 1).

Items	Score
4 bars exercise sequence	1
2 bars exercise sequence	2
changes of level	2
Asymmetric simple positions	1
Asymmetric complex positions	2
Changes of direction	2
Changes of place	2
Device use	2
Music use	2
Change of pace	2

Table 1.: Criteria for the evaluation of fundamental movement sequences (own editing)

The criteria are primarily intended for the evaluation of fundamental movement exercise sequences, as the teacher can quickly and easily integrate the design of the sequences. As Table 1. shows, evaluation does not reward the quality of implementation, but the unconventional application of previously learned elements. The more items that appear during the exercises, the more diverse and creative can be the sequences of the exercises.

Validation of criteria

The usefulness of a measurement instrument is manifested in the fact that it makes it possible to identify, quantify and judge what is to be measured. In order to meet these conditions, measurement instruments and methods must meet various validation and reliability requirements (Starko, 2018). For most motor creativity tests, inter-rater reliability is an important consideration. Related procedures answer the extent to which evaluators give the same score to the same variable (McHugh, 2012). Intra-class correlation is used to establish validity in most motor tests (Lee et al., 2023). Positive results can be influenced by the detailed and accurate scoring guidance for a given measurement tool (Strako, 2017) and the value of internal consistency (Cronbach alpha), which indicates whether evaluators interpreted the evaluation of the same item in a similar way.

In-class correlation is necessary whenever scoring relies on individual expertise or judgement. Interestingly, Lee et al. (2023) in their study of motor creativity tests, find that most motor tests do not go through validity and reliability procedures.

In terms of our own criteria, the first step was to verify the validity of our scoring system and to determine whether the applicability of our measuring tool could be established based on evaluations provided by independent experts.

The objective of the study is to validate a set of criteria for evaluating the fundamental movement sequence, which will objectively measure the creative learning process of students.

Questions

1. Is the applicability of the new measurement instrument established on the basis of an assessment by independent experts?
2. Is the guidance properly interpreted by the invited evaluators?

Material and methods

The research was conducted with the permission of ELTE PPK KEB (2021/583-3). To carry out the validation, we asked 65 university students (men=23; women=59; average age=20.77 years) to compile a 32-bit fundamental movement exercise sequence after being briefed on the evaluation criteria. Before designing the exercise chain, we introduced the items of the criteria and encouraged participants to try to use as many of them as possible in the exercise chain. It was important to say that there is no right or wrong solution and to let their imagination run wild. Half an hour was provided for the planning of the exercise sequences. During the planning process, it was ensured not to put time pressure on the participants, as this can be a barrier to creative thoughts (Davies et al., 2013). Three of the recorded exercise were selected for evaluation by five independent experts/PE teachers (men=2; women=3; average age=40.8 years) according to the developed criteria. For evaluation, 3 sequences were selected: the number one sequence of exercises consisted of simpler exercises, which contained fewer items, and the number two and three exercise sequences were more complex, with several items appearing at the same time during some movements. For a valid evaluation, we sent out a guide where the elements of the criteria were explained in more detail. In addition to Chronbach's Alpha, we used the Intra Class Correlation (two-way mixed – absolute agreement) method for the certificate of suitability. The level of significance was determined as $p < 0.05$. To perform the calculations, we used the IBM SPSS 29.0 suite.

At the end of the procedure, the PE teachers were asked to complete an open-ended questionnaire. The questions aimed to assess the comprehensibility of the guidelines, the difficulty of the evaluating process such as understanding the protocol, and difficulties of evaluation. They were also asked to share whether they had any further suggestions regarding the criteria and guide.

Results

During the internal consistency analysis, results higher than expected (0.7) were obtained for all three exercise sequences (Chr α : 0.964, 0.992 and 0.990, respectively), based on which the evaluators' scores are well matched, so further statistical analyses can be carried out with the data.

The results of Intra Class Correlation showed a value ($p < 0.05$) higher than the aptitude level (0.81) based on the scores given by the evaluators (Table 2).

Intra-class correlation Total number of movement sequences	
ICC	Sig.
0.960	<.001
0.991	<.001
0.990	<.001

Table 2: Results of the intra-class correlation in case of movement sequences (own ed.)

Items within the class were also separately correlated, and based on the results, each item's score was higher than the eligibility level (0.81) ($p < 0.05$) (McMillan & Schumacher, 2014). The difference in changes of level was higher, but even this reaches the level of eligibility (Table 3).

Intra-class correlation Items of movement sequences		
Item	ICC	Sig.
Changes of level	0.897	<.010
Asymmetric simple positions	0.945	<.001
Asymmetric complex positions	0.973	<.001
Changes of direction	0.989	<.001
Changes of place	0.960	<.001
Changes of pace	0.908	<.041

Table 3: Results of the in-class correlation study among items (own ed.)

Based on feedback from reviewers (Figure 1.), the item description guidelines were easy to understand, simple and transparent. In the case of the change of pace, there was uncertainty based on one of the feedback, so it is worth clarifying its interpretation in the future.

Figure 1: Feedback from evaluators (own ed.)

In addition to the questions, the evaluators were also given the opportunity to express their personal views on the evaluation and their practical experiences (Figure 2.).

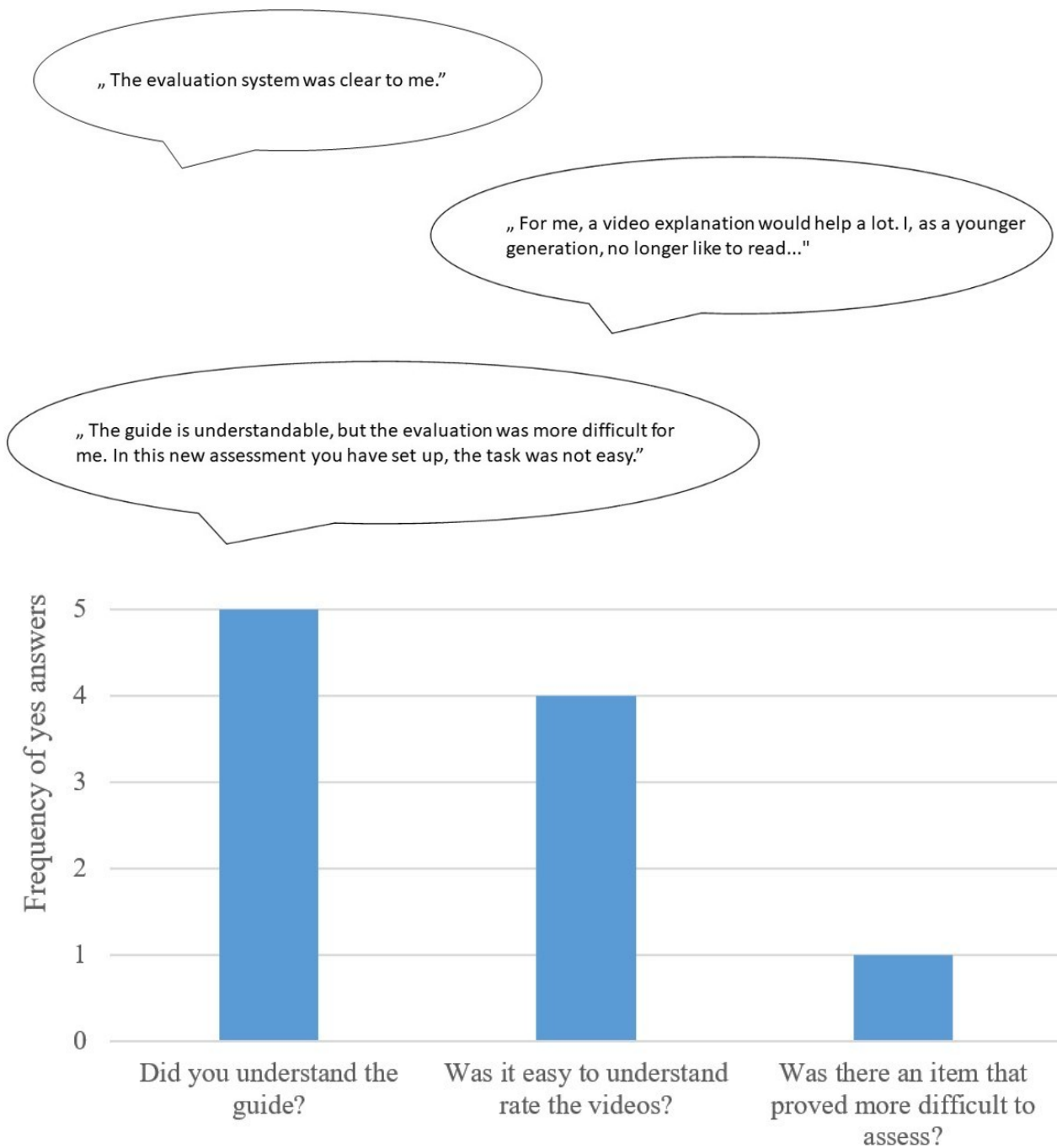


Figure 2: Personal opinions of evaluators (own ed.)

Summary

This study presents an instrument that provides objective feedback on creative learning processes through the design of fundamental movement sequences. Before developing the framework, the test protocols and evaluation criteria of several motor creativity tests were studied. Most motor creativity tests assess and explore components of divergent thinking. These include fluency (total number of responses), flexibility (variability of responses) and originality (novelty of solution). In several cases, experts found high correlations between these indicators, so the question arose several times whether they really represent different meanings (Hocevar, 1978; Clapham, 1998; Zétényi, 2010 cited in Field & Field, 2022). Concerns and difficulties in measuring fluency have also been reported in the literature (Plucker & Renzulli, 1999; Plucker 1998 cited in Starko, 2018). Our criteria focus on the flexible use of the variational range of fundamental movement, providing an opportunity to create a unique flow of the sequence. The overall score of the sequences indicates that divergent thinking is reflected in the design process.

We received feedback from the evaluation colleagues of our study on the practical application of the criteria (Figure 2). One young colleague commented that a video guide would have helped his work better because of his learning method. It is interesting to note, that one of the young colleagues recommended a video manual. Literature supports (Konrádné, 2010 cited in Pócsik, 2014) that members of generations Y and Z prefer different visual, audio and video information to textual content. Generation Z is already represented among teachers, and therefore it is worth considering this proposal. All reviewers said the guidance was understandable, but the scoring was not simple at first in practice. It is true that our criteria, together with the application of creative pedagogy as a learning model in education, require a change of attitude on the part of teachers, which does not always prove to be an easy task. According to our personal experience, even to this day, fundamental movement among professionals primarily means the inevitable warm-up of movements. It would be important for PE teachers to approach the possibilities of fundamental movement from a different perspective and challenge using its range of variations to promote students' creative thinking.

In the future, our instrument will be further validated by correlating it with other creativity tests and tests of motor creativity.

Recommendation

We recommend our criteria primarily for feedback on students' individual learning process. With regard to Lin's (2012) three-dimensional model, not only do our criteria provide information about the success of teaching creativity but can also be used to teach creativity and learn creativity. For educators, the criteria can serve as a tool to plan alternative possibilities of fundamental movement sequences with equipment (such as circuit training, musical gymnastics exercises, and dance choreography), and they can easily be integrated into the lesson either as individual or sequences of design activity.

As explained above, the criteria are partly based on Rudolf Laban's movement analysis system. Laban's system can help students to create creative movement links and shorter sequences of exercises (Pignitzkyné & Lévai, 2014). The teacher can guide students to do this by using exercises that build on the different items of the Laban system. Some examples of each item are:

1. **Body parts:** Through discovery learning, students will recognize that a single movement can be conveyed in a multitude of ways, contingent upon the bodily part, which starts or ends the movement. Additionally, students will discover how one movement can express several feelings and moods.
2. **General space:** It is recommended that students utilize the full extent of available space, incorporating a diverse range of routes and modes of travel.
3. **Dynamics:** The amount of effort and the pace (fast versus slow) at which a movement is performed not only results in creative solutions but is also one of the most visible forms of self-expression.
4. **Connection:** The free use of sports equipment (ball, scarf, hula hoop, etc.), including music, provides students with the opportunity to engage with their preferred tools and express themselves.

The above-mentioned Laban items may be taught in either an individual or a small group setting. Our framework can be used as a great tool for the teacher to evaluate the fundamental movement sequence that the children created, at the beginning and end of the teaching unit, in order to get feedback on the effectiveness of the teaching.

Langton (2007) believes that Laban's system provides a framework that can be applied to a range of physical activities and movement forms, not only fundamental movement but also other types of movement activities, such as teaching the technical elements of sports games. From this point of view, it is recommended not only to physical education teachers but also to coaches and sports professionals, especially those who consider it important to develop creativity in their teaching and who wish to verify the effectiveness of the methods they use.

Limitation

The limitation of our study is that the students in the study are sports students, for whom fundamental movement is a more present part of their everyday life. In the future, we would like to carry out the study among students of other disciplines.

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Gimnasztika gyakorlatláncok tervezésének változatosságát mérő tesztrendszer vizsgálata

A kreatitásnak mint kulcskompetenciának egyre nagyobb a jelentősége az oktatásban. Mivel több tudományos publikáció született a fizikai aktivitás kreativitásra gyakorolt pozitív hatásairól (Blanchette et al., 2005; Colzato et al., 2013; Santos et al., 2016 idézi Ruiz-Ariza et al., 2017), a testnevelés szerepe felértékelődött a kreativitás fejlesztésének területén (Sturza, 2014). A testnevelésórák elhagyhatatlan eleme a gimnasztika, egy olyan eszköz a testnevelők kezében, amelynek változatos felhasználása által a kreativitás fejleszthető. A tanulási folyamat sikerességének mérésére a különböző értékelési eljárások alkalmazása a legcélravezetőbb. Jelenleg nem találtunk olyan kidolgozott és egységes protokollt, amely objektív visszajelzést adna a kreatív tanítási-tanulási folyamatokról a testnevelésórán. Gimnasztika gyakorlatsorok tervezése során kreatív ötletek merülhetnek fel, így létrehoztunk egy szempontrendszert a gimnasztika gyakorlatsorok tervezésének értékelésére. Tanulmányunk célja e szempontrendszer és validálási munkálatainak bemutatása.

Kulcsszavak: *kreativitás, gimnasztika, érvényesség, pontozórendszer*