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## ORIGINAL

### DESIGN AND VALIDATION OF AN INSTRUMENT TO ASSESS MOTOR CREATIVITY IN ADOLESCENTS

### DISEÑO Y VALIDACIÓN DE UN INSTRUMENTO DE MEDICIÓN DE LA CREATIVIDAD MOTRIZ EN ADOLESCENTES

Méndez–Martínez, E.<sup>1</sup> & Fernández–Río, J.<sup>2</sup>

<sup>1</sup> Doctoral Student, Faculty of Teacher Training and Education. University of Oviedo (Spain)  
[UO63901@uniovi.es](mailto:UO63901@uniovi.es)

<sup>2</sup> PhD. Faculty of Teacher Training and Education. University of Oviedo (Spain)  
[javier.rio@uniovi.es](mailto:javier.rio@uniovi.es)

**Spanish-English translator:** Fernández-Río, J., [javier.rio@uniovi.es](mailto:javier.rio@uniovi.es)

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#### ABSTRACT

The goal was to design and validate a Motor Creativity Assessment Instrument (ICM) in adolescents: a single-task test that evaluates this variable, and four of its dimensions, Flow, Flexibility, Imagination and Originality, through body expression. Three hundred and twelve secondary students (11-16 years) were randomly divided in two groups to undertake two independent tests (test-1, test-2). Six experts on creativity participated in the validation process. The instrument's reliability was obtained through the inter-observer agreement, using the Intraclass Correlation Coefficient on both tests, and obtaining scores almost perfect in all cases (0.81-1.00). Internal, response, content and construct validity were also assessed, obtaining positive results in all of them. The ICM has been proven an adequate, easy-to-implement instrument to assess motor creativity in adolescents; a very important variable in Physical Education and Sport.

**KEY WORDS:** Motor creativity, body expression, secondary education

## RESUMEN

El objetivo fue diseñar y validar un instrumento de medición de la Creatividad Motriz (ICM) en adolescentes: test de una sola tarea que evalúa dicha variable y cuatro dimensiones, Fluidez, Flexibilidad, Imaginación y Originalidad, mediante la expresión corporal. 312 estudiantes de Educación Secundaria (11-16 años) fueron divididos en dos grupos para realizar dos tests independientes (test-1, test-2). 6 expertos en creatividad participaron en el proceso de validación. La fiabilidad se obtuvo a través de la concordancia inter-observador de los expertos mediante el Coeficiente de Correlación Interclase en los dos tests, obteniéndose valores casi perfectos en todos los casos (0.81-1.00). Se estudió la validez interna, de respuesta, de contenido y de constructo del instrumento, obteniéndose resultados totalmente favorables. El ICM se ha mostrado un instrumento adecuado y fácil de implementar para medir la Creatividad Motriz en adolescentes; variable muy importante dentro del ámbito de la Educación Física y el deporte.

**PALABRAS CLAVE:** Creatividad motriz, expresión corporal, educación secundaria

## 1. INTRODUCTION

### 1.1. CREATIVITY AND MOTOR CREATIVITY

For some years, predominant economic systems have demanded creative people to stimulate production (Robinson, 2015), and times of crisis have also been the most creative. Therefore, the concept of creativity has been limited to the ability to solve problems and to adapt to new situations (Karaca & Aral, 2017). It is a conception that sometimes can be closer to ingenuity than to creativity. The idea of creativity usually includes the aforementioned abilities, but it should be extended to others such as biological character (Sturza, 2014), experimental and playful, or the potential to see reality from multiple points of view, and consequently to doubt them (Goleman, Kaufman, & Ray, 2016), making freedom possible (Chomsky, 2016).

Unfortunately, the educational system tends to eliminate spontaneity (Rämä, Kontu, & Pirttimaa, 2014), which is the first step of the creative process. Physical Education has been designated as a privileged area to preserve it, given its potential for teamwork or creative environments (Sturza, 2014), both essential for its development. Therefore, since the mid-twentieth century Physical Education became interested in Creativity, and the concept of Motor Creativity was introduced (Domínguez, Díaz & Martínez, 2014), which can be defined as the resolution of a problem and an idea or feeling expression through the body (Karaca & Aral, 2017). Some authors still match creativity with motor creativity, since there is no abundant research on this subject (Moraru, Memmert & Van der Kamp, 2016). According to Selinsky (2017), movement is a key element to study and understand humans.

## 1.2. DIMENSIONS OF MOTOR CREATIVITY

Guilford (1967) was the first one to distinguish different dimensions in Motor Creativity: Fluency, Flexibility, Originality and Elaboration (Karaca & Aral, 2017; Sturza, 2014). Subsequently, various authors modified these dimensions by eliminating some and/or including new ones such as variety, inventiveness, openness, redefinition, etc. (De la Torre, 2000), divergence (Johnson, 1977; Cleland & Gallahue, 1993; Cleland, 1994), risk and complexity predisposition (Sherrill, 1979) or imagination (Sherrill, 1979; Torrance, 1981). In the present study, it was decided to include three classic dimensions of creativity (fluency, flexibility and originality) because they are present in almost all motor creativity (Bertsch, 1983; Brennan, 1983; De la Torre, 2000; Doddos, 1973; Dominguez et al., 2014; Glover, 1974; Sherrill, 1983; Sherrill, Lubin & Routon, 1979) and creativity assessment instruments (De la Torre & Violant, 2006). A fourth dimension, imagination, was included because there is a close link between imagination and creativity (Wu & Albanese, 2013), and it is also present in various motor creativity (Sherrill, 1979; Torrance, 1981) and creativity instruments (De la Torre & Violant, 2006).

Fluency has been defined as the ability to produce the greatest number of different responses to a situation or problem (Maldonado, Dell'Orco, & Esposito, 2016). Flexibility refers to the variety and heterogeneity of the ideas produced without rigidity or mental tension (Maldonado et al., 2016). Imagination is the ability to express different messages or ideas through movement (Martínez & Díaz, 2006). Finally, Originality is defined as the unusual nature of a response (Domínguez, Díaz, & Martínez, 2014).

## 1.3. MOTOR CREATIVITY ASSESSMENT TESTS

Over the last 50 years different tests have been developed to assess motor creativity and its different dimensions. The most representative are included in table 1. None of these tests were designed and validated for adolescents. In addition, all but one of them is composed of different tasks that make its implementation long and complex, making it impossible to conduct it in a single session with a large number of people.

**Table 1.** Motor Creativity assessment tests.

Author	Dimensions	Name
Bertsch (1983)	Fluency, Flexibility and Originality	Motor creativity test
Beveridge (1974)	Fluency and Originality	Motor creativity test of Beveridge (MCTB)
Brennan (1983)	Fluency, Flexibility and Originality	Test of Creative Motor Performance
De la Torre (2000)	Fluency, Variety, Originality, Inventive, open-mindedness, Redefinition, etc.	Dynamics Expression Creativity
Doddos (1973)	Fluency, Flexibility, Originality and Elaboration	Creativity Assessment Model
Glover (1974)	Fluency, Flexibility, Originality and Elaboration	Motor Creativity Test (MCT)

Johnson (1977), modified by Cleland & Gallahue (1993) and Cleland (1994)	Fluency, Flexibility and Divergence	Divergent Movement Ability (DMA) test
Sherrill (1983)	Fluency, Flexibility, Originality, Elaboration, Risk predisposition, Complexity predisposition and Imagination	Creative process behaviour, <i>adapted from</i> Comprehensive Creative Model by E. Williams
Sherrill, Lubin & Routon (1979)	Fluency, Flexibility, Originality and Elaboration	TWO Motor Creativity Rating Scale (MCRS)
Torrance (1981), modified by Domínguez et al. (2014)	Fluency, Originality and Imagination	Torrance Test of Thinking Creatively in Action and Movement
Wyrrick (1968)	Fluency, Originality and Creativity	Test of Motor Creativity

Based on the aforementioned, the main goal of the present research was to design and validate an easy-to-implement instrument to assess motor creativity and its dimensions: Fluency, Flexibility, Imagination and Originality, in a wide sample of Secondary Education students.

## 2. METHOD

### 2.1. PARTICIPANTS

Three hundred and twelve Secondary Education students (11-16 years), 158 men and 154 women enrolled in a school located in the North of Spain, agreed to participate. Convenience sampling was used. All of the students' guardians were informed of the study, and a signed written consent was obtained from all of them.

### 2.2. TEST

It consists of a single task to assess students' Motor Creativity through body expression. It measures the four dimensions previously introduced independently: (1) Fluency, (2) Flexibility, (3) Imagination, and (4) Originality.

#### **Process**

Several phases were followed to design and validate the test:

Phase 1. All existing Motor Creativity known tests were reviewed (see Table 1).

Phase 2. Based on the previous review, a new test with scientific rigor and that could be easily implemented in all kind of individuals and in a short period of time was developed. A classic body expression game was chosen the task to perform: "stick transformation". In the test, the participant must transform a "stick", showing as many different uses as possible within a minute (the answer "a stick" or the repetition of the same answer is not considered valid).

Phase 3. A group of six experts was created to validate the test: three had Drama College Degrees (one of them was also a Physical Education specialist), one was a Primary School teacher and a Master in Theatre in Education, one was a Primary School teacher, a College Professor in Theatre in Education in different countries, and one was a professional actor. All of them had more than 10 years of teaching experience in creativity and Theatre in Education contexts. This group developed initial criteria to assess the proposed test that measures motor creativity and four of its variables: Fluency, Flexibility, Imagination and Originality.

Phase 4. A pilot test was conducted in nine participants (11-18 years) with little experience on body expression. Results were assessed by the six experts following the initial assessment criteria. This assessment produced several modifications in the original version of the test; being the most significant the increase from 8 to 14 categories in the variable Flexibility.

Phase 5. A second pilot test was conducted in 18 participants (19-39 years) with experience in performing arts and creativity. Again, the six experts assessed the participants' responses using the second version of the tool. Again, this assessment led to new modifications: the most significant was participants' possible lexical limitation and the significant increase of the terms in the variable originality. With these changes, the assessment criteria final version was obtained (table 2).

Phase 6. Test-1 was conducted in 160 Secondary Education students from the initial sample. Once more, results were assessed by the six experts using the latest version of the assessment criteria. All tests were recorded for assessment. After this phase, the six experts elaborated a document to simplify the evaluation of the originality variable (the number of terms was again increased).

Phase 7. Test-2 was conducted in the 152 remaining Secondary Education students from the initial sample. Once again, results were assessed by the six experts using the final version of the assessment criteria (Table 2). The number of terms included in the originality variable changed minimally. Phases 6 and 7 were carried out using the Content Block V "Body Activities of Rhythm and Expression", of the Physical Education curriculum.

### ***Spatial arrangements***

The test was conducted in three different spaces:

Space 1: participants waited for the signal to access to the testing room under the supervision of the Physical Education teacher.

Space 2: a closed and separated room from space 1 was used to conduct the test (the goal to make impossible to listen to previous tests); participants exited this room through a door different from the entrance to avoid any contact between participants.

Space 3: a room where participants were conducted after the test to avoid contact with students who had not performed.

All the tests were recorded with a Canon 550D camera placed on a tripod, located 6 meters away from the stick that was on the floor perpendicular to the camera (test assessment was made using the video recorded). It should be noted that the video recording is inherent to assess Motor Creativity through this test (to use correctly the different scales and categories).

### Test protocol

- 1º.- All participants were informed of the test's general procedures in a class.
- 2º.- Under the Physical Education teacher supervision, the participants moved to space 1 to wait their turn.
- 3º.- One by one, they entered and listened to the instructions to perform the test: "Stand behind that stick. That is a stick, but what else could it be? You have a minute to show everything that it could be. The more you do the better. You can talk, of course, but more than explaining what comes to your mind, do it: perform, play, have fun. The time, which is a minute, begins now".
- 4º.- The signal (beep), which marked the end of the test, served to transfer the participant to space 2, through a different access door, and a new participant accessed from space 1.

During the test, the teacher fixed his gaze on the camera viewfinder to avoid any kind of feedback to the participant.

### Test assessment criteria

It is a qualitative-quantitative motor creativity assessment test. Therefore, it includes observation and objective task execution following instructions and assessment criteria (Table 2). Participants are asked to transform a stick; consequently, when the participant proposes "a stick" as an idea, it will not be a valid response. Participants' lexical limitations should not reduce their test results. Thus, if they say: "a stick to support you", it will be understood that they are talking about a walking tick, "a stick to hit" will be a club, and "a stick from which a beggar hangs his bundle", despite being a stick, implies a creative work and it should be valid, because in the participants' minds there has been a transformation of the object. All the evaluations are recorded in the document: "Assessment sheet" (Figure 1).

**Table 2.** Assessment criteria.

1	Fluency	Summatory of all participants' responses in the box TOTAL1
		All the participants' responses will be included, even if they resemble others; i.e., if the participant says: "pencil, marker, highlighter ...", the three solutions will be noted and they will count as "3" in fluency
2	Flexibility	If possible, the evaluator will define with a single word the participant's response; i.e.: a sword can be shown in many different ways: through words, using the hands, using the body as part of a story ... in all cases it will be noted: "sword"
		Summatory of all categories (from 1 to 14) that the subject produces in TOTAL2 box (i.e., if the student has responses of 4 different categories, he/she will score "4")
		Only one category will be indicated for each participant's response; if it is not clear, the evaluator will decide the prevalent (see table 3: Flexibility's categories)



1	Items that are manipulable with hands	Sword, guitar, broom, javelin, arrow, etc. As well as fixed elements such as a pull-up bar, stripper pole ...
2	Items approximately rectangular and nearly two-dimensional on which you can stand and where displacement is not involved	Sofa, mattress, bench, pillow, step, floor, etc.
3	An item you mount and it transports you	Motorbike, horse *, trapeze, broom, (witch's broom **), etc.  * Horse is a living being (category 6) and also transports you (category 3), so the evaluator must interpret which is the predominant use between these two options: whether the horse is a character (the subject feeds him/her, or cries because he/she is dying, etc. it would be category 6), or if the animal is just an object used to transport the participant (category 3) ** It is not necessary for the participant to mime the action of climbing on the broom; if the participant just says: "the broom of a witch", or "a motorcycle" even if he/she does not ride them, the response will be assessed as category 3 of flexibility (another question is the Imagination variable score)
4	An item using a different stick's size <i>(the item is much smaller or much larger than the size of the stick)</i>	Stick, tampon, spoon, cotton buds ...  To include a response in this category, the idea must be clearly presented; i.e., an arrow or a spyglass despite being smaller than the stick, the changes are not significant enough to understand that in the participant's mind the flexibility has changed
5	Flexible element <i>(The stick is given a feature it does not have: flexibility)</i>	Skipping rope, hose, hair, snake *  * As indicated before, if a "snake" is more important as a living being, for example, it itches the subject, it will be scored as category 6
6	Alive <i>(it is or it can be animated; works like a character)</i>	A person, a dog that you feed, a horse you talk to ...  A tree, in spite of having life, does not work as a character, unless it is considered an "oracle", a wise tree which one consults (it could be category 1 or 4)

PENDING PRESS

7	Part of a whole (The stick is used to show something bigger)	Corner of a building, door frame, ship railing, clock hand*  *Again, the category is decided based on what the evaluator thinks is the predominant use in the participant's mind: if the participant says: "clock hand", it will be considered category 1, if he/she is just imagining that the stick is a clock's hand, but if the stick is used to show a whole clock, then it will be considered category 7
8	Following a story (continuation of the previous idea)	If the participant shows a telescope saying: "Come on, let's paddle to the island" and then continues the story then the second proposal will be considered as category 8 of flexibility regardless of the category of the initial proposal
9	Concept	Line of life, love, a look, a memory, etc.
10	Symbol and geometric shape	Triangle, square, peace symbol, anarchy symbol, etc.
11	Completed with the body or parts of the body	The body is necessary to communicate the idea such as sting, wooden leg or parts of the body are named: leg, arm ...
12	Projection	Light beam, look, laser beam, bullet trajectory, spit ...
13	Proposal as a result of the stick's movement	Crown, wings, shopping bags ... There is no relationship between the stick's shape and the given proposal (the stick is unnecessary, you could represent the proposal without it)
14	Other	Any response not included in the previous categories

**Table 4.** Imagination scale.

Since it is a motor assessment instrument, evaluators will avoid subjective evaluations like: "I believe that the participant is imagining ...", and the evaluation will be limited to what PARTICIPANT IS DOING, following these indications:	
1 point	It is explained ONLY using words, the body DOES NOT intervene or the action is inadequate
2 points	If it is denoted a small communication INTENT; the actions are not completed and/or are carried out with very little conviction and/or concentration
3 points	If the proposal is transmitted clearly; the actions are completed, but the representation is not done with total conviction and/or concentration
4 points	If the proposal is transmitted clearly; the actions are completed and the representation is made with total conviction and/or concentration, but without the added unnecessary elements to understand it *  *a ball in connection to a bat or a piece of bread dough in connection to a rolling pin, for example, will be considered necessary elements to transmit the idea and score 4 points

5 points	<p>Besides transmitting the proposal clearly, an unnecessary element to understand it is ADDED *</p> <p>* if the participant uses a spoon to eat soup, and pretends that he/she burns his/her mouth or if the participant represents a sword, and he/she adds enemies saying: "On guard, cowards!", for example</p>
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As already mentioned, Originality is defined as the unusual nature of a response (Domínguez et al., 2014) and its estimation is made by comparing individual responses with those produced by his/her reference group. In Test-2, (152 subjects, 6 evaluators/experts, 912 responses) response percentages were calculated and the values were obtained using the following procedure: (1) each expert copied all the proposals of all the subjects without pointing who did what; (2) all the answers collected by all the experts were copied into a new document; (3) finally, the proposals were grouped and the repetitions of each of them were counted (Table 5).

**Table 5.** Originality scale.

	Response percentages	Test-2 results
1 point (x1)	10 % or more	Solution offered by 91 participants or more
2 points (x2)	5-9.99 %	Solution offered by 46-90 participants
3 points (x3)	2.5-4.99 %	Solution offered by 23-45 participants
4 points (x4)	1.25-2.49 %	Solution offered by 11-22 participants
5 points (x5)	0-1.24 %	Solution offered by 10 participants or less

**Figure 2.** Originality values.

1 point	flag	broom	golf	microphone	gymnastics pole	10% or more
	walking stick	sword	hockey	dance stick		
	bat	mop	javelin	umbrella	oar	
	martial arts stick	long hook	spear	pole		
	horse	thick stick	juggle	weights	pipeline	
2 points	handrail		shotgun		table leg	5 – 9,99%
	fishing rod		axe		post	
	broom witch		shovel		chair	
3 points	tree	ladle	line	ice axe	lightsaber	2.5 – 4.99%
	hoe	pull-up bar	crutch	goal	selfie	
	blind cane	streetlight	balance stick	door	fork	
	pen	katana	parquet	racket	unicorn	
	toothbrush	pencil	chair leg	rake	rod won	
4 points	skipping rope	limbo bar	pick	double oar	wand	1,25 – 2,49%
	friend	plug	lamp	dancing couple	snake	
	bow	stairs	window cleaner	wooden leg	surfboard	
	harpoon	shelving	hand (watch)	ball	billiard cue	
	vaccum cleaner	heater	blanket	piñata	tripod	
	drumstick	arrow	hammer	chinese dish	elephant trunk	
	cotton swab	foil	mast	striptease bar	trunk	
	cable	fluorescent tube	construction material	pointer	tube	
	spyglass	hand hook	table	branch	fence	
	picture	guitar	measuring tape	dustpan	fan	
	knife	propeller	dust mop	present	shoe	
	rope	helicopter	mortar	roller		
tightrope	bone (toy dog)	toothpick	painter roller			
5 points	everything not previously named					0 – 1,24%

**Reliability**

Regarding the test's reliability, it was not possible to assess its internal consistency because it was a single-task test, nor its temporal stability. The reasons were that a retest with the same participants was considered inappropriate; the results will be biased when re-evaluating creative responses of a task already done (creativity's assessment would be compromised). Therefore, the experts' inter-observer concordance in test-1 and test-2 was obtained using the Interclass Correlation Coefficient (ICC) of all the assessed variables (Table 7). The ICC values are considered poor = <0.00, light = 0.00-0.20, reasonable = 0.21-0.40, moderate = 0.41-0.60, considerable = 0.61-0.80 and almost perfect = 0.81-1.00 (McMillan & Schumacher, 2014). In this case, all the results were almost perfect, showing the test's high reliability.

**Table 7.** Test-1 & test-2 Creativity Intraclass Correlation Coefficient (ICC).

TEST-1		TEST-2	
Variable	ICC	Variable	ICC
Fluency	0,996*	Fluency	0,997*
Flexibility	0,982*	Flexibility	0,991*
Imagination	0,973*	Imagination	0,992*
Originality	0,971*	Originality	0,989*
<b>MOTOR CREATIVITY</b>	<b>0,995*</b>	<b>MOTOR CREATIVITY</b>	<b>0,997*</b>

Note: \*significance  $p < 0.001$

### Validity

The test's internal validity was obtained using its apparent validity or experts' validity (McMillan & Schumacher, 2014), based on the opinion of 6 experts, all of them related to Physical Education and/or Theatre in Education and more than 10 years of professional experience. The results were entirely positive.

The tests' content validity was obtained through its rational analysis (McMillan & Schumacher, 2014), assessing the adequacy and intelligibility of the participants' guidelines and the evaluators' instructions by the same 6 experts, resulting in positive scores.

Subsequently, the response validity was determined (McMillan & Schumacher, 2014) through interviews with the first two pilot tests' participants about the comprehension and development of the test. The information collected indicated a high level of understanding that, nonetheless, served to qualify the test development.

Finally, the test's construct validity was determined by the 6 mentioned experts (McMillan & Schumacher, 2014); the selected task and the assessment method were considered unanimously as adequate to assess Motor Creativity.

## 4. DISCUSSION

The fundamental aim of the present research was to design and validate a Motor Creativity assessment test (ICM), and its fundamental variables, Fluency, Flexibility, Imagination and Originality, in a wide sample of Secondary Education students. The results showed that the objective has been achieved satisfactorily.

Not having found validated tests for Secondary Education students and considering the high application time of the existing tests in other samples, this test is relevant because of two characteristics: First, it is a validated test for secondary education students, but that could be applied to all kinds of participants. Second, the test consists of a single task that allows its implementation in a single session with a big sample, as well as the measurement of 5 variables (fluency, flexibility, originality, imagination and motor creativity) using only one minute per subject, which makes it especially attractive in educational contexts.

The internal and external validity of the instrument was assessed to increase its reliability, being fundamental the pilot tests, as well as the experts' judgment whose number was slightly higher than in other related studies (Serra-Olivares & García- López, 2016); Qualitative contributions of this kind of individuals are considered very important in the design of assessment instruments. The pertinence of the construct was verified by the absence of worries in the experts' opinions in relation to the assessment criteria, and by the verification that the test's performance guidelines were understood by all 312 participants. Since the goal was to measure each participants' creativity, it was decided not to perform a re-test, anticipating a non-representative difference in the results. Also, given that it is a one task test, assessment of its internal consistency was ruled out. "Near perfect" results were obtained (McMillan & Schumacher, 2014) in the Interclass Correlation Coefficient in the two tests: the first (Test-1) with 160 participants and results higher than .97 in the 5 variables; and the second (Test-2) with 152 participants, with results higher than .98 in the 5 variables. These results were higher than those obtained in similar tests (Costa e Silva et al., 2017; Sánchez-Alcaraz, Henarejos, Gómez-Mármol & Paredes, 2016) and they show the adequacy of the current test.

Most motor creativity assessment instruments were designed for children and Special Educational Needs samples, such as those from Cleland and Gallahue (1993), Cleland (1994), Johnson (1977), Sherrill, Lubin and Routon (1979) and Torrance (1981). The Bertch test (1983) was designed for students in the first level of primary school; the Brennan test (1983) for participants with previous specific knowledge; the Wyrlick test (1968) for university students. Finally, De la Torre (2000), Daddos (1973) and Sherrill (1983) tests are theoretical instruments, not practical. On the other hand, only the Creativity Measurement Scale (Sherrill, Lubin and Routon, 1979) has a single task, 5 minutes of implementation and with absolute freedom criteria, which makes the answers difficult to encode. The rest of the tests reviewed are made up of several tasks, from 8 in the Bertch test (1983) to perform necessarily in several days, until 3 in the Johnson test (1977). Finally, the Wyrlick (1968), Brennan (1983) and Johnson (1977) tests have a complex application. For all these reasons, the interest of the presented test is confirmed. It has been validated in a large sample of high school students through a one-minute test of a single task, which facilitates its implementation.

The present research also has some limitations. First, the results obtained are a consequence of the participants' geographical origin (e.g., frequent occurrence of the response: "umbrella" in people from the north of Spain where it usually

rains). On the other hand, the instructions to perform the test says: "you can use the word". The voice is considered part of the body (Berry, 2013) with the aim of not excluding the possibility of imagined characters, stories, etc. Future investigations might consider prohibit the use of words, so that expressive responsibility was on the physical solely. Finally, it should be remembered the historical difficulty (Karak & Aral, 2017) to assess creativity and motor creativity, so it is advisable to use several assessment tests to triangulate the collected data.

In conclusion, the results observed in this study, and its comparison with those obtained in similar researches, support the construct validity of the ICM, which shows adequate psychometric properties for its implementation with participants related to and not related to body expression and creativity contexts in secondary schools.

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