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Teaching strategies for promoting motor creativity and motor skill proficiency in early childhood

Miha Marinšek and Nina Lukman

Faculty of Education, University of Maribor, Maribor, Slovenia

ABSTRACT

Existing research provides ambiguous evidence for associations between motor competency and motor creativity. Therefore, this study examined the association between motor skill proficiency and motor creativity. The Test of Gross Motor Development (second edition) and Bertsch's motor creativity test were used to assess motor skill proficiency and motor creativity among 39 children aged five to six. Results revealed that motor proficiency and motor creativity are not interrelated traits. Therefore, it is necessary to use different teaching strategies to promote these traits. Teaching with direct instructions and reproduction of demonstrated movement is probably the most appropriate to acquaint children with motor skills. Learning through play with less explicit teaching instructions and emphasis on motivating children to find novel and original solutions to the motor tasks is probably more suitable for facilitating motor creativity.

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1. Introduction

Creativity is considered to be a facilitator of human progress in almost every part of human life. However, to reach eminent real-life creativity, everyday creativity (e.g., finding a way to navigate past an obstacle, designing own gifts) is necessary, something that is enabled by creative thinking such as divergent thinking or insight (Kaufman & Beghetto, 2009).

In early childhood, one of the most efficient ways of facilitating creative thinking is through motor activities. Motor creativity can be defined as the ability to produce numerous, original and functional motor responses to a stimulus (Torrents et al., 2021; Wyrick, 1968). In that sense, the motor response can be a new motor pattern that can solve a pre-established problem or express an idea or emotion with the human body. Both cognitive and motor creativity include measures of fluency, flexibility, and originality (Guilford, 1967). Fluency refers to producing many different cognitive or motor solutions; flexibility denotes the capacity to generate solutions that

CONTACT Miha Marinšek miha.marinsek@um.si

pertain to other ideas or movement categories; originality represents the capacity to create novel and unique solutions. Motor creativity and creative thinking share some characteristics; one is the necessity to produce many different solutions to different challenges (Scibinetti et al., 2011). Thus, the notion that children can facilitate creative thinking also through motor activities has a firm foundation. Complex motor task creativity seems sensitive to experience and specific physical education strategies (Memmert, 2007). Additionally, if an individual develops motor creativity in early childhood, he/she can retain it for a very long time (Bournelli & Mountakis, 2008).

The period between two and seven years of age is of particular importance for developing motor skills in the growing child. During this time, the rudimentary, postural, locomotor, and object control skills attained in infancy become refined, and many new skills emerge (Haywood & Getchell, 2009; Seefeldt, 1986). Common everyday creative activities include some motor activity (e.g., dancing, drawing, cooking, playing an instrument). Thus, frequent daily creative activities result in a larger volume of the premotor brain's structures that might lead to higher motor planning ability (Zhu et al., 2016). The latter can help children and adults develop motor skill mastery and create and select novel actions.

Existing research provides ambiguous evidence to associations between motor competency and motor creativity; research showing no association between motor creativity and motor competence (Scibinetti et al., 2011) and research showing a positive association between motor competency and motor fluency (Sturza Milić, 2014) in early childhood. The latter study did not provide data for other dimensions of motor creativity (flexibility and originality). Additionally, both studies used product measures of motor behaviour and did not address the association between process qualities of motor behaviour and motor creativity. Therefore, the present study aimed to explore the relationship between motor skill performance and the three motor creativity dimensions. The eventual relationships would impact teaching strategies used for promoting motor proficiency and motor creativity in young children. Specifically, we examined whether children with superior performance in locomotor and object control skills are more creative in movement and action. We hypothesised that motor performance would be positively associated with all dimensions of motor creativity. The hypothesis was based on the notion that a certain level of motor skill proficiency must be present to enable motor creativity (Bournelli & Mountakis, 2008).

2. Methods

2.1. Participants

Thirty-nine children aged five to six years ($M = 70.23$; $SD = 3.01$ months) participated in the study. The sample comprised of 24 boys (62%) and 15 girls (38%) with an average height of 121.07 cm ($SD = 5.30$) and weight of 22.72 kg ($SD = 3.00$). Institutional review board for preschool education at the Faculty of Education Maribor approved the study protocol (Ref. No. OPV-2020-S1-SK6). Parents signed informed written consent for children's participation in the study prior to the commencement of the study.

Table 1. Classification of participants according to their BMI.

Classification (BMI)	Number (Percentage)
Thinness grade 2	6 (15.4)
Boys	2 (33.3)
Girls	4 (66.7)
Healthy Weight	27 (69.2)
Boys	20 (74.0)
Girls	7 (26.0)
Overweight (including obesity)	6 (15.4)
Boys	2 (33.3)
Girls	4 (66.7)

Note. $\chi^2(2) = 5.826$, $p = .054$; Cut off points: 17 – Thinness grade 2, 18.5 – Healthy weight, ≥25.00 Overweight (including obesity).
Source: Author's calculation.

Previous research (Cheng et al., 2016; Logan et al., 2011; Morgan et al., 2008) proved that excessive weight was associated with lower motor skill proficiency. Therefore, we classified participants according to their body mass index (BMI).

Mostly they were of healthy weight (69.2%) with no deviation from expected distribution, $\chi^2(2) = 5.826$, $p = .054$. The rest of the participants were classified in thinness grade 2 or overweight groups (15.4, respectively) (Table 1).

2.2. Procedures and measures

Two trained assessors, who demonstrated competency in the TGMD-2 assessment protocol and motor creativity assessment before the study, assessed the children. Assessors received two weeks of training. After the training period, the assessors had to reach > 80% agreement with the reference assessor's scores to demonstrate competence.

The Test of Gross Motor Development – Second Edition (TGMD-2) was used as a qualitative assessment of motor skill proficiency. The TGMD-2 is a valid and reliable process-based assessment for children aged 3-10 years, which measures skill performance with movement quality (Ulrich, 2000). Six locomotor and six object control skills were scored on two test trials, with a checklist for each skill. Verbal descriptions and demonstrations of each skill were provided before scoring. Each skill comprises three to five performance criteria, scored as correctly executed (1) or not (0). Raw scores for each child were calculated by summing the correctly performed criteria across two trials for each skill. Raw scores were converted to descriptive ratings, locomotor standard scores (LOC), object control standard scores (OC) and gross motor quotient (GMQ) according to the scoring procedures (Ulrich, 2000). The TGMD-2 showed a high degree of internal consistency (Cronbach's alpha = .83) in our study for all tests, while the subtests' values varied between .75 for the locomotor and .73 for the object control skills. The tests indicated acceptable internal consistency, with Cronbach's alpha value ≥ .70 (Fayers & Machin, 2013).

Bertsch's test was used to measure children's motor creativity (Bertsch, 1983). It is a validated assessment for children, which measures motor creativity in three dimensions: fluency, flexibility, and originality. According to the manual, each child participated individually in the four motor creativity tasks (hoop, ball, bench, floor) in a randomised order during school hours. Cronbach's alpha indicated acceptable degree of internal consistency (Cronbach's alpha = .78), with value ≥ .70 (Fayers & Machin, 2013).

2.3. Statistical analyses

Bivariate Pearson's correlation was computed to identify plausible associations between three motor creativity measures (fluency, flexibility, and originality) and three motor proficiency measures (LOC, OC, GMQ).

Three separate multiple regression analyses were conducted to analyse the predictive value of motor proficiency for fluency, flexibility, and originality. Fluency, flexibility, and originality were used as a criterion variable, and LOC and OC were used as predictors. The VIF value of all predictors was less than 10, pointing out no problems with multicollinearity (Kock & Lynn, 2012). Statistical analysis was conducted with JASP statistical software.

3. Results

Descriptive ratings in Table 2 show that participants in our sample were mostly above average or better in motor skill proficiency (67% of GMQ). Only 2% of participants could be described as below average. OC was performed better as LOC, as more participants performed above average in OC than LOC (49% and 43%, respectively).

Bivariate Pearson's correlation showed insignificant correlation (all $p \geq .055$) between fluency and motor proficiency ($r = .216$ for LOC, $r = -.043$ for OC, $r = .094$ for GMQ), flexibility and motor proficiency ($r = .043$ for LOC, $r = -.310$ for OC, $r = -.165$ for GMQ), and originality and motor proficiency (LOC $r = .191$, OC $r = -.058$, GMQ $r = .070$).

Further, three regression analyses were conducted. None of the three models that were created revealed multicollinearity problems (all VIF < 10); thus, LOC and OC were kept as predictors in all three models.

Model 1 was able to explain 7.5% of the variance in fluency. LOC and OC were not statistically significantly predictive of the fluency, $F\ (2, 36) = 1.457$, $p = 0.246$. Additionally, none of the variables reached a statistically significant predictive value (all $p \geq .100$) (Table 3). Model 2 explained 14.4% of the variance in flexibility and was not statistically significantly predictive, $F\ (2, 36) = 3.035$, $p = 0.061$. LOC did not reach statistically significant predictive value ($p = 0.164$). However, OC reached a statistically significant and negative predictive value ($\beta = -0.430$, $p = 0.019$), pointing

Table 2. Descriptive ratings for Subtest Standard Scores (LOC, OC) and Gross Motor Quotient (GMQ).

Descriptive ratings	GMQ f (%)	LOC f (%)	OC f (%)
Very superior	2 (5)	0 (0)	1 (2)
Superior	10 (26)	6 (15)	4 (10)
Above average	14 (36)	11 (28)	14 (36)
Average	12 (31)	21 (55)	19 (49)
Below average	1 (2)	1 (2)	1 (2)
Poor	0 (0)	0 (0)	0 (0)
Very poor	0 (0)	0 (0)	0 (0)

Source: Author's calculation.

Table 3. Results of multiple regression analysis with fluency, flexibility, and originality as a criterion variable and locomotor standard scores (LOC) and object control standard scores (OC) as predictors.

	Fluency			Flexibility			Originality		
	β	T	p	β	t	p	β	t	p
Constant		0.643	0.524		3.095	0.004		0.563	0.577
LOC	0.308	1.686	0.100	0.250	1.421	0.164	0.285	1.550	0.130
OC	−0.191	−1.045	0.303	−0.430	−2.448	0.019	−0.195	−1.063	0.295
	Model 1, $R^2 = 0.075$			Model 2, $R^2 = 0.144$			Model 3, $R^2 = 0.066$		

Note. LOC – locomotor standard scores; OC –object control standard scores.
Source: Author's calculation.

out that high OC proficiency might predict low flexibility score (Table 3). Model 3 was able to explain 6.6% of the variance in originality. Neither LOC nor OC was able to predict statistically significantly originality score ($p = 0.130$ and $p = 0.295$, respectively) (Table 3).

4. Discussion

The present study results suggest no association between motor skill proficiency and motor creativity in young children, which is in line with previous work from Scibinetti et al. (2011). It seems that we cannot predict creativeness in movement based on children's motor skill proficiency. Motor creativity might have more in common with creative thinking than with motor skilfulness. Significant correlations between fluencies and flexibilities of motor creativity and creative thinking have been previously confirmed (Scibinetti et al., 2011).

Most children can develop a minimal level of motor skill proficiency with free play. The minimal level enables them movement with less advanced patterns that is limited to respond to perturbations (Brian et al., 2020). It is most likely to make creative movement responses less possible and probable. Structured movement activities are therefore needed to develop motor skills to respond to perturbations and find novel ways to address motor problems. In structured classes, teachers must use different teaching strategies and content to balance between facilitating motor proficiency and motor creativity in children. It is unlikely to anticipate that developing motor skills will automatically result in children being more creative.

Physical education classes based predominantly on physical fitness and the reproduction of existing motor skills do not facilitate motor creativity. They influence motor skills and motor abilities, mostly with linear-type progressions (from easier towards more difficult motor skills) considering movement effectiveness. However, motor creativity emerges primarily from activities which promote nonlinear mechanisms (within the child and between the child and environment) and mostly do not consider the movement's effectiveness. Usually, in linear progressions, task constraints (e.g., spatial position, the time sequence of motor actions, rules, etc.) are very narrow. They do not allow children to explore new possibilities of movement.

Consequently, children might be very proficient in complex motor skills but lack motor creativity. Furthermore, using a piece of equipment only for a particular type of movement repeatedly (e.g., using a ball only for passing and dribbling) can limit children's ideas for different uses. Long-term socio-cultural environmental constraints may restrict children's exploratory and creative behaviours (Torrents et al., 2018). These constraints might have influenced the negative association between object control skill proficiency and flexibility in our study. Even if we introduce children to different possibilities of using equipment (e.g., we can walk on the skipping rope, we can jump over it, etc.), this will not stimulate children's motor creativity. It is important to create strategies that will allow children to select motor responses for a given task. Teachers should use strategies such as solving motor problems, limiting movement, changing movements, engaging the imagination, and creating. As a result, these strategies will lead to instructions: find a way … , how could you … , try to perform the movement with or without the use of one … , show me a different/new way of doing it … , imagine that you are … , imitate … , create a whole new movement … , etc.

In contrast, physical education classes, which use an indirect teaching style with critical thinking strategies, can improve children's ability to generate different movement patterns (Cleland, 1994). Teachers should not give children instructions that are too restrictive because they narrow children's focus to only one solution (e.g., saving the ball with both hands) (Memmert, 2007). Instead, they should give instructions that allow individual freedom in playing rules (e.g., saving the ball) and enabling children to find other solutions. Constraints that generate playing scenarios that are too difficult or too easy can reduce creative behaviours. When adding conditions to the task (e.g., limiting the way children can move), releasing other constraints is necessary (e.g., freeing the space restriction); such a constraint modification strategy can foster novel movement possibilities. Teachers can also push children out of their comfort zones, enhancing creative behaviour (Torrents et al., 2021). It is also very likely that introducing creative movement content (e.g., movement activities through play, motivating children to find new ways of moving) will result in motor skill development.

Fluency in creative thinking is a predictor of motor creativity, suggesting that the generation of many thoughts may be a fundamental prerequisite for being creative in movement and action (Scibinetti et al., 2011). Therefore, teachers should use the strategy to stimulate children to think of as many possibilities of overcoming the motor problem as possible, as this will allow them to be creative. Such a strategy would aim to actively inhibit the strong tendency toward producing more common motor responses in children, enabling them to find novel and original motor responses. Usually, motor response planning mainly requires the inhibition of dominant but inappropriate responses, and only to a lesser extent, manipulating working memory strategies to produce novel but sometimes hazardous responses (Pennequin et al., 2010). This mechanism probably originates from human evolution. The automatism of the motor response was probably favoured because of individuals' and species' survival. Teaching to produce numerous and original motor responses to a stimulus can be a strategy to facilitate motor creativity and facilitate creative thoughts. As was mentioned above, there is some proven similarity in the processes responsible for the fluent and flexible production of many creative ideas and movements (Scibinetti et al., 2011).

There are several limitations to our study. First, all the children in our sample were developmentally normal and mostly scored above the average motor performance threshold (only 2% below average). Due to our sample's less variable motor proficiency, we were probably unable to identify the proper relation between motor proficiency and motor creativity. Children below the average motor performance could show a strong and positive correlation with motor creativity (less proficient, less creative) since a certain level of motor skill proficiency must be present to enable motor creativity (Bournelli & Mountakis, 2008). A creative person cannot arise from ignorance. The minimal level of motor skill proficiency that enables motor creativity is yet to be defined. However, our results suggest that the motor skill performance threshold that affects motor (and indirectly also cognitive) creativity is below average on the TGMD-2 scale. Our intuitive guess would be that poor and very poor motor skill performance, according to TGMD-2, would negatively influence the manifestation of motor creativity.

Second, the sample's age range was narrow and limits the conclusion to early childhood, especially considering that motor development is very dynamic in this period. Third, the research design limits us to make casual relationships between motor proficiency and motor creativity. Future research should use a controlled experimental design with modulations of creativity/proficiency intervention programmes.

5. Conclusions

Motor creativity is an independent trait from motor skill proficiency in five- to six-year-old children. Therefore, teachers must facilitate motor creativity with well-considered teaching strategies and content. They must adopt these strategies toward the class objective. In the early phases of motor learning, teaching with direct instructions is probably the most suitable when children are becoming acquainted with the skills. Direct instructions mean teacher-led demonstrations followed by hands-on learning using linear progressions.

Learning through play with less direct teaching interaction with motivating children for solving motor problems is probably more suitable for facilitating motor creativity. Physically active play is an essential promotor of creative behaviour because it allows children to investigate and solve problems. Participation in unstructured and structured play seems critical for motor and cognitive creativity development. These activities have to be carried out in a pleasant environment that allows playfulness, emotional safety, and active involvement of children and teachers as this is a basis for children to be physically creative (Isaksen et al., 2001; Trevlas et al., 2003; Vujičić et al., 2020; 2020).

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Miha Marinšek http://orcid.org/0000-0002-2018-0059

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