

The Effect of Different Instructions in a General Motor Competence and Perceived Competence of Children

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Abstract

This study aimed to evaluate the effect of different instructions in a general motor competence and perceived athletic competence of children. 63 scholars (mean age=8.20; SD=0.30) were divided into 3 groups: instruction about the quality of movement, instruction about environmental cues, and control group. At pre and posttest, motor competence was assessed as the process (TGMD-2) and as the product of movement (MAT) and transformed in general Motor Competence (z score). Perceived athletic competence was evaluated by SPPC questionnaire. As motor competence, the results showed a significant difference from pre to posttest, revealing an improvement for environmental cues group; as perceived athletic competence, only girls of this group improved. Intergroup comparisons showed that there were significant differences for motor competence, being environmental cues group better than the quality of movement group and control group, however, were observed no intergroup differences for perceived athletic competence. The instruction about environmental cues improved motor competence and perceived athletic competence of children.

Keywords: physical education; teaching; gender; children.

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1. Introduction

Practice is considered an essential element for achieving adequate levels of motor competence (MC), which is the ability of motor skills performance at an optimum and sufficient level to solve motor problems (Keogh, 1977; Manoel, 1994). Individuals who have no opportunity to practice, instruction and encouragement during childhood, may not acquire the necessary incentives to show good levels of MC throughout all lifespan (Gallahue, Ozmun & Goodway, 2013) and, also, may not develop an accurate sense of his physical and athletic abilities, or his perception in sports, including outdoor games named perceived athletic competence (PAC), an important element of individual's global perceived competence and self-esteem (Harter, 1985; 2012a). In summary, MC and PAC both appear depend on the conditions in which the motor practices are provided, mainly on the stage of childhood.

In this perspective, intervention programs with motor skills become crucial to assist in motor development process since they provide opportunities for planned and systematic practices (Logan, Robinson, Wilson, & Lucas, 2011). Intervention programs have several components such as duration, frequency, type of instruction and assessment that can be manipulated in search of greater efficiency. The type of instruction offered to children in these interventions is a factor that requires further investigation since the instruction is an essential element of learning about the pre-practice information given to the learner (Schmidt & Lee, 2005), acting as a task constraint (Newell, 1986) which can to optimize the motor performance. In this study were investigated two types of instruction commonly presented in Physical Education classes: the directed instruction to quality of movement and instruction directed to the achievement of environmental goals.

The instruction about the quality of movement instructs more detailed the particular motor skill, and also constraints the criteria and conditions for obtaining techniques for performing this skill. Tani (1989) states that when dealing with the learning of motor skills, an instructional plan must contain the purpose of the task, the task specification (what to do) and how to perform a task (how to do). In this way learners are delimited about the movement pattern that they should perform.

The learner's attention is directed to the mode of task performance, requiring an internal focus of attention by the learner, which seems to affect performance positively (James, 2012).

Literature has also highlighted the positive effects of instructions that direct the attention of learners for the movement effects or for the environmental cues. According to Magill (2000) and Wulf & Prinz (2001) environmental cues is the type of instruction directed to environmental equipments and materials, such as cones and bows, which seems to require an external focus of attention by the learner. Especially on the instruction about environmental cues, by modifying the environment, the task is also modified. The teacher uses the environmental cues by manipulating the constraints of the task, in order to change the learner's perception by restricting environment/task to encourage the learner to establish a more advanced and efficient skill (Sweeting & Rink, 1999).

The type of assessment of these programs is another factor that needs to be better investigated. Discussions in literature have questioned the limitations of only process measures (quality of motor action) and only product of movement measures (result of motor action on environment) (Logan et al., 2011; Stodden et al., 2008). According to Stodden et al. (2008), both types of assessment address important and complementary aspects. In this perspective, the present study suggests a general assessment of MC operationally evaluated as the combination of process and product of movement measures.

The PAC is a variable that deserves be more investigated in learning studies, in view at active and healthy motor development. According to Villwock & Valentini (2007) the persistence in motor activities and the proper perceived competence are guaranteed on opportunities of participation in quality programs that provide the challenge in the exploitation of movements. Furthermore, Stodden et al. (2008) argue that the development of skills and motor skills is important to make sure the issue to encourage or discourage physical activity levels of individuals and believe that over time these variables are mediated by other factors such as perceived competence. Emphasizing the PAC variable can influence the motor performance and physical activity levels of children.

Many studies also have shown the influence of the sex on MC and PAC of children (Valentini & Rudisill, 2004; Villwock & Valentini, 2007; Afonso et al., 2009; Spessato et al., 2012). Bardid et al. (2013) valued the effect of an intervention in pre-school children with risk of motor delays and realized that the effect was specific to the sex, since only the girls improved their performances in object control skills, what reveals the necessity of investigating these variables according to the sex.

In summary, some results from the literature (Aleixo & Vieira, 2012; James, 2012; Publio, Tani, & Manoel, 1995) suggest that the instruction about the quality of movement can positively affect MC and perhaps, indirectly, that perceived competence. On the other hand, based on several studies, the instruction about environmental cues is more effective for MC or PAC (Apache, 2005; Bardid, Descamps, Verhoeven, De Pooter, Lenoir, & D'Hondt, 2013; Silva, Contreira, Beltrame, & Sperandio, 2011). Based on the Constraints Model (Newell, 1986), anyone of these types of instruction can lead to an optimal MC or PAC, which are behavior variables extremely affected by intervention programs. However, we can hypothesize a better effect for the instruction about environmental cues because it induces an external focus of attention, what can be a functional constraint (Wulf, Mcnevin, & Shea, 2001) that benefit MC and also PAC.

Anyway, it is unknown whether intervention programs with instruction based on the quality of movement or environmental cues would cause different effects on overall MC (process and product measures) and PAC of children. Thus, this study aimed to investigate the effect of two different instructions in a general motor competence and perceived athletic competence of children, according to the sex.

2. Materials and Method

2.1 Design of study

This is a quasi-experimental study with pre and post-intervention (Thomas, Nelson, & Silverman, 2012). All ethical issues were approved by the Local Ethics Committee, parents, and participants.

2.2 Participants

The sample consisted of 63 Brazilian children (mean age = 8.20; SD = 0.30 for boys and girls) from an elementary school located in the northeastern part of the country. For more details about the sample, see table 01. Children who met the following criteria were included: a) be between 7 and 8 years of age; b) volunteer to participate in research; c) have the consent term signed by parents or guardians; and d) have no physical and/or mental health problems that prevent testing. Children who were excluded from the sample: a) had not performed the tests (motor competence and/or perceived athletic competence) at pre or post-intervention; b) did not attend three consecutive days or four alternate days of practice; and c) abstained from participating for any reason.

From the total number of students, 9 were not included as subjects in sample by not attending the research's conditions, such as: 5 students were out of age range and 4 parents did not allow their children to participate. Of the 73 possible students, 9 were not sampled because of these conditions, in other words, they were not assessed by MC or PAC, but participated in the interventions because they took place at the time intended for Physical Education lessons with graduated professors. Thus, 64 children were sampled but 01 discontinued participation justifying his departure due to health problems, so, the present study recorded a total of 63 participants.

2.3 Experimental and control groups

In this quasi-experimental study, three classrooms of third grade children were randomly drawn among three groups (instruction about quality of movement, instruction about environmental cues and control group). By using classrooms to compose the groups, children from each classroom only had contact with the type of instruction selected, since the intervention ran during the time of Physical Education lessons.

2.4 Procedures

Before the beginning of the intervention, the authors of this research constructed the complete programs of the two experimental groups and submitted to the analysis of two Physical Education teachers, specialists in Motor Behavior area.

The author set programs under consultation from experts. Thus, was performed the face validity of the type of instructions to ensure that the programs, operationally, met the theoretical assumptions that differentiated them. For intervention phase, the sample was subdivided into three groups, two experimental groups and one control group. Children were assessed at pre-intervention phase in the following variables: a) Socio-demographic: age and gender; b) Anthropometric: using measures of body mass (kg) and height (meters) for subsequent calculation of Body Mass Index (BMI); c) MC: through the Test of Gross Motor Development - 2 - TGMD-2 (Ulrich, 2000) and Motor Ability Test - MAT (Ikeda & Aoyagy, 2009); d) PAC: through Self-Perception Profile for Children - SPPC (Harter, 1985).

2.5 Intervention characteristics

The motor intervention was taken in a period of six weeks and two weekly sessions, totaling 12 meetings per group which lasted 50 minutes each; this period, called intervention phase, was divided into: a) 5 minutes for explanation of lesson objectives, b) 40 minutes of specific activities for each intervention, c) 5 minutes of questions about the lesson. Thus, the total time duration of intervention was 600 minutes. The intervention groups had lessons with specific instruction for each intervention at the time intended for Physical Education lessons. The instructions were provided from the trained researchers in specific interventions. Thus, only the control group participated in usual Physical Education lessons during this period of six weeks.

For a better comprehension of the different types of instruction, we exemplified the long jump lesson of each: in the context of quality of movement, it was provided verbal instructions such as: "Look at where you want to go: upward and forward; Get ready to take off: squatting and swinging your arms back and up; Extend your arms up when you are in the air; Jump as far as you can; Flex your knees on landing; And landing with both feet at the same time". When instructing this same skill in the context of environmental cues the instructor: asked for the children to jump imitating a frog (relay); defined a space where they cannot touch/fall (like a river), and ask them to "jump the river" and fall with both feet on a mat half a meter away; Then add arcs in place of departure (2 arcs per pupil - one for each foot) and circles drawn with chalk on the arrival place; and ask the children to jump from one point to another;

Finally, put a rope suspended in the "middle of the river," and ask the children to touch with both hands on the rope before passing to the other side. At the end of the intervention phase, the MC and PAC tests were reapplied, which were called post-intervention phase.

2.6 Instruments

The performance in fundamental motor skills as the process of movement was measured by the Test of Gross Motor Development (TGMD-2) (Ulrich, 2000). This test showed satisfactory levels of content validity ($\alpha = .93$ for clarity and $\alpha = .91$ for pertinence) and reliability (test-retest of locomotor $r = .83$ and object control test $r = .91$) for Brazilian children (Valentini, 2012). It is divided into two subtests that assess six locomotor skills (run, gallop, hop, jump over obstacles, horizontal jump, and slide sideways) and six object control skills (strike, dribble, catch, kick, overhand throw, and underhand roll). The performance measure is the sum of the points in the two trials of each skill, the total score of each subtest (locomotor and object control) and general motor coefficient (which is the sum of the two subtests).

In pursuit of greater reliability during the evaluation of the data, only the author of the study knew which child belonged to which group. Moreover, researchers who applied the intervention were not the same to decode data, and those responsible for decoding, evaluated different children in pre and post-intervention phase (draw). In cases of disagreement, two decoders reviewed together and entered into consensus. The Concordance between Observers (CBO) was 0.87 (Thomas et al., 2012).

The performance of gross motor skills as the product of movement was measured by a battery of tests (Motor Ability Test - MAT) proposed by Ikeda & Aoyagi (2009). The agreement between the evaluators was calculated in a pilot study, with acceptable reliability levels above 80%. The following tasks are arranged and their related performance measures: (1) 25 m run: time in seconds running full speed, 25 meters away; (2) tennis ball throw: distance in meters from the shot of a tennis ball (overhand throw); (3) standing broad jump: distance in centimeters of jumping; (4) vertical jump: distance reached in centimeters when jumping from a standing position; (5) jump over and crawl under: duration of time (in seconds) to jump over and crawl under a 30 cm-high elastic string (3 times).

The general motor coefficient of the TGMD-2 was transformed into z-score to form the total z-score TGMD-2. Then, each of the 5 tasks of the MAT were also transformed into z-scores and summed afterwards, yielding the total z-score MAT. Finally, the overall MC was a result of the sum of the total TGMD-2 and MAT z-scores.

To assess perceived athletic competence the Self-Perception Profile for Children - SPPC (Harter, 1985) was applied. It is composed of six subscales, five specific areas (scholastic competence, social acceptance, athletic competence, physical appearance and behavioral conduct) and one globally (self-esteem). Each subscale has 6 questions (total 36 questions), organized in alternative answers structure in the type Likert scale 1-4 points (being number 4 the best score). For this research, we used only the sum of domain perception athletic competence (PAC), which could range from 6 to 24 points. It is an instrument that was validated for Brazilian children for Content Validity Coefficient (CVC) = .68 to .89 (especially for PAC .77 for clarity and .86 for pertinence) beyond of reliability that ranging $r = .50$ to $.70$ (specially for PAC .60) by Valentini, Villwock, Vieira, Vieira, & Barbosa (2010).

2.7 Data Analysis

Initially, we tested data normality using Shapiro-Wilk test. After verifying the absence of normal data distribution, we used non-parametric statistical tests. The Wilcoxon test assessed the differences within groups (intervention effect) and Kruskal-Wallis test was used to assess the differences between the groups (effect of instruction). U Mann-Whitney test was performed as *post hoc* test. The r can be calculated by an equation which converts the z-score for an estimate of effect size ($r = z$ divided by the square root of N) (Rosenthal, 1991). The Cohen's classification was used to denote the effect size: $r = 0.10$ (small effect); $r = 0.30$ (medium effect); and $r = 0.50$ (large effect) (Cohen, 1988).

3. Results

The Table 01 summarizes the characteristics of the sample. The results showed no significant differences between groups for any of these variables ($p > 0.05$).

Table 01: Quantitative (N), median (Med) and inter quartile range (IQR) of age, body mass, height and Body Mass Index (BMI) in boys, girls and total of children in quality of movement group, environmental cues group and control group.

	Quality of movement group			Environmental cues group			Control group		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
	n=11	n=11	N=22	n=13	n=10	N=23	n=9	n=9	N=18
	Med (IQR)			Med (IQR)			Med (IQR)		
Age (years)	8.4 (0.5)	8.1 (0.5)	8.2 (0.5)	8.1 (0.3)	8.0 (0.4)	8.1 (0.3)	8.3 (0.3)	8.2 (0.6)	8.2 (0.4)
Body mass (kg)	30.7 (12.0)	28.5 (13.5)	30.3 (13.0)	27.6 (9.8)	34.1 (18.5)	31.6 (15.6)	26.2 (7.8)	31.9 (10.7)	26.5 (12.5)
Height (m)	1.3 (0.8)	1.3 (0.5)	1.3 (0.0)	1.3 (0.1)	1.3 (0.6)	1.3 (0.1)	1.2 (0.8)	1.3 (0.8)	1.2 (0.0)
BMI (kg/m ²)	17.3 (5.1)	16.4 (7.6)	17.2 (5.6)	17.0 (3.7)	18.9 (9.5)	17.3 (7.0)	15.5 (4.8)	18.9 (4.3)	16.7 (4.7)

Table 02 includes the results of intra group comparisons for MC from pre to posttest. There was a statistically significant difference within environmental cues group ($p = 0.01$), which improved their performance from pre to post-intervention. Table 03 presents the results of intra group comparisons to PAC. There was a significant statistical difference for girls in environmental cues group ($p = 0.01$), which improved their performance from pre to post-intervention time.

Table 02: Delta from pre to posttest (Δ) of Motor Competence. Value of the Wilcoxon test (T), Significance level (p) and effect size (r) of boys, girls, and total of children in quality of movement group, environmental cues group and control group in pre and posttest.

Motor Competence	Quality of movement group				Environmental cues group				Control group			
	Δ	T	p	r	Δ	T	p	r	Δ	T	p	r
Boys	-12.99	6.0	0.07	-0.40	-5.36	3.0	0.07	-0.42	-1.15	3.6	0.65	-0.12
Girls	-34.14	6.0	0.82	-0.57	6.45	5.7	0.12	0.31	-18.54	4.5	0.12	-0.37
Total	-47.13	9.3	0.10	-0.25	1.09	8.0	0.01*	0.37	-19.69	9.0	0.18	-0.23

*Statistically significant intergroup difference pre and post intervention ($p \leq 0.05$).

Table 03: Delta from pre to posttest (Δ) of Perceived Athletic Competence (PAC). Value of the Wilcoxon test (T), significance level (p) and effect size (r) of boys, girls and total number of children in quality of movement group, environmental cues group and control group in pre and posttest.

Perceived Athletic Competence	Quality of movement group				Environmental cues group				Control group			
	Δ	T	p	r	Δ	T	p	r	Δ	T	p	r
Boys	-4.00	4.8	0.85	-0.04	7.00	3.1	0.23	-0.27	13.00	3.6	0.17	-0.32
Girls	17.00	5.0	0.24	-0.25	4.00	6.5	0.01*	-0.50	0.00	3.6	0.62	-0.12
Total	13.00	8.2	0.36	-0.13	3.00	10.6	0.24	-0.17	13.00	8.3	0.60	-0.09

*Statistically significant intergroup difference pre and post intervention ($p \leq 0.05$). Significant differences were observed between groups for MC ($p = 0.01$), however, no differences were observed between groups for PAC ($p = 0.67$). Table 04 shows the results of *post hoc* (U Mann-Whitney test) for MC. The results showed significant differences between quality of movement group and environmental cues group and between environmental cues group and control group; in both comparisons, environmental cues group got superior performance.

Table 04: Significance level (p) and effect size (r) of the delta of the three intergroup comparisons in Motor Competence (MC) boys, girls and total number of children in quality of movement group, environmental cues group and control group.

Motor Competence	Quality of movement group x Environmental cues group		Quality of movement group x Control group		Environmental cues group x Control group	
	p	r	p	r	p	r
	Boys	0.04*	-0.38	0.07	-0.33	0.42
Girls	0.00*	-0.50	0.32	-0.10	0.00*	-0.49
Total	0.00*	-0.44	0.08	-0.22	0.05*	-0.25

*Statistically significant difference between groups ($p \leq 0.05$).

4. Discussion

This study aimed to investigate the effect of two different types of instruction on MC and PAC of middle childhood children. Initially, we will discuss the results about the effects of intervention programs on MC; then the results regarding the effects of instructions on MC and PAC. Finally, will be highlighted the educational implications and future research.

4.1 Effects of intervention programs on MC

The findings of this study corroborate results of previous investigations regarding the positive effects of motor intervention programs on MC (Breslin, Murphy, Mckee, Delaney, & Dempster, 2012; Goodway & Branta, 2003; Kane & Bell, 2009; Logan et al., 2011; Matvienko & Ahrabi-Fard, 2010; Valentini & Rudisill, 2004). According to King-Thomas (1987), intervention programs with motor activities seem to serve well for building more advanced movements while also developing new strategies of movements, and it seemed to positively influence the MC of children in this study. The same benefits were not achieved by the control group (CG), which showed no significant improvement from pre to posttest.

Some fundamental characteristics, such as minimum weekly frequency and total duration, must be obeyed in intervention programs so that it has positive results (Goodway & Branta, 2003; Kane & Bell, 2009; Logan et al., 2011). Also, the supervision by expert seems to be fundamental to the positive effects on MC (Lemos, Avigo, & Barela, 2012).

However, it seems obvious that motor intervention programs should cause positive changes in motor behavior, some intervention studies showed no such effects in MC (Breslin et al., 2012; Iversen, Ellertsen, Tytlandsvik, & Nødland, 2005; Miyahara & Wafer, 2004; Miyahara, Yamaguchi, & Green, 2008; Miyahara, Schreiber, & Green, 2011). Results of this study go beyond to suggest that some characteristics of the instructions on intervention programs appear to be more effective than others for middle childhood children MC.

4.2 Effects of instructions on MC

In the present study, the group with instruction about the quality of movement showed no improvements on MC, with similar performance to the control group. There was significant statistic improvement only in the group with instruction about environmental cues.

The results concerning the positive effect of instruction about environmental cues on MC are consistent with results of previous studies investigating similar instructions to those in this study. Apache (2005) and Bardid et al. (2013) assessed the effects of intervention programs that used activity-based instruction in children, that is, instruction in which the teacher should encourage exploration and problem solving, rather than instructing on form of execution. These studies and the present investigation share the similarity of having the instructional focus directed to environment (external focus of attention). The results of this study also corroborate other in adults, in which instructional model was the induction of an external focus of attention through the tactic (Broek, Boen, Claessens, Fleys, & Ceux, 2011).

In view of the Constraints Model (Newell, 1986), constraints from the environment, the organism, and the task are boundaries or characteristics that limit the motor action. Before being obstacles, constraints can be understood as a solution to the system of action since they act defining the probability of some (and not others) occurring action (Newell, 1986). Thus, the constraints can be thought of as functional constraints to the human motor system, favoring the organization of action.

Such constraints interact dynamically and this interaction changes over time (Davids, Button, & Bennett, 2008), since the constraints tend to have their own development paths (Ulrich, 2007), consequently, they may cause different effects on motor development. According to Ulrich (2007), constraints are the key factors for those who wish to intervene or facilitate the acquisition of motor skills through opportunities that induce changes in motor behavior. The instruction in intervention programs can focus on any particular constraint. Thus, this research looked at organismic constraints (focus about quality of movement) or constraints of the task (focus about environmental cues) at the different types of instruction.

An instruction from the constraints of the task, in which environmental structure was manipulated, had better effect for MC of boys and girls of middle childhood.

In the instruction about environmental cues, the teacher should design the environment through the constraints of the task to obtain good performance in some motor skill without necessarily focusing the student cognitively on the process characteristics inherent in this performance (Sweeting & Rink, 1999). In other words, change the physical arrangements of the task and instruct the children to focus attention on these arrangements. This seems to be the type of constraint able to cause a change in organization of practitioner's motor actions, toward the achievement of more mature/functional movement patterns.

The results of this study disagree with some investigations, in which the instruction about the quality of movement (internal focus of attention) had the best effect on motor performance (Aleixo & Vieira, 2012; James, 2012; Publio et al., 1995), and these differences may be related to the research method used. Indeed, unlike the present study that used a full program of instruction with several fundamental motor skills, a couple of studies have focused on specific performance of artistic gymnastics skills (Aleixo & Vieira, 2012; Publio et al., 1995), or investigated the performance on a single task never undertaken before by the subjects (sit in two different positions), performed at the laboratory (James, 2012). In these studies, the requirements concerning the difficulty of performance or the novelty of the task performance may suffer a positive effect on an instruction specifying the process (quality of movement).

Another methodological issue that deserves attention is that such investigations evaluated learner's motor performance by the process (Aleixo & Vieira, 2012; Publio et al., 1995), or by the product of the movement (James, 2012), while this study used a combination of process and product measures. One plausible explanation for the best performance in group with instruction about environmental cues is that this type of instruction induces an external focus of attention, which seems to benefit motor performance and learning (Peh, Chow, & Davids, 2011; Wulf & Prinz, 2001; Wulf, Shea, & Lewthwaite, 2010). Wulf, Mcnevin, & Shea (2001), considering the limitations of human attentional capacity, proposed the Constrained Action Hypothesis to explain how the attentional focus can have an effect on the organization of the movement.

This hypothesis proposes that there is a negative effect on the organization of the movement when attention is directed to an internal focus of attention (body movements), but when attention is directed to external events (in this case, environmental cues) the effect is positive. For these authors, automatic cognitive processes can suffer degradation if new information needs to be processed by the executive system. The results obtained in this study confirm the Constrained Action Hypothesis (Wulf et al., 2001).

In fact, the group with instruction about the quality of movement showed no significant changes in motor behavior. In this case, when the individuals direct attention to the quality of movement (internal focus of attention) to control a motor skill they exert their actions in a relatively conscious manner, which may have interfered with the process of "natural" control, as proposed by Wulf, et al. (2001). In the present study, it is understood that the constraint generated by the instruction about the quality of movement, inducing an internal focus of attention, was a type of non-functional constraint for competence in fundamental motor skills.

Conversely, the instruction about environmental cues, inducing an external focus of attention, allows automatic control processes to regulate the movements, which facilitates performance (Wulf & Prinz, 2001). So, it can be suggested that the instruction that induced an external focus of attention was a functional constraint for the action system, operating some positive changes on MC of these middle childhood children.

4.3 Effects of instructions on PAC

On the PAC, results showed that girls from the group with instruction about environmental cues obtained a significant improvement. According to Schmidt & Lee (2005), learners judge themselves not on the basis of their performance improvement "how to do" but based on "what" effectively they can accomplish. In this perspective, the instruction about the quality of the movement (realize "how" they performed motor actions) may not have facilitated the girls to realize good enough, and so the treatment with instruction about the quality of the movement did not have the expected effect. However, in a group with instruction about the environmental cues, girls may have felt competent and motivated to fulfill environmental targets (realize "what" they did) without worrying effectively about the quality of motor action.

In this study, girls seemed to be particularly affected in their PAC. Although the study of Bardid et al. (2013) had been conducted with preschoolers at risk for motor delays, and did not aim to evaluate the children's PAC, they assessed the children's MC and showed that the effect of intervention similarly appeared to be specific to gender, because only girls improved their performance in object control skills. The gender difference in PAC may be associated with certain cultural issues. Boys generally receive greater incentive to motor practice (Gallahue et al., 2013) and, therefore, more often tend to perceive more athletically competent than girls (Harter, 2012b).

A significant improvement from pre to posttest only for girls from the group with instruction about environmental cues can be considered a result of the intervention, mainly due to an effect size considered large. One may suggest that boys, by testing them more times in performing gross motor skills, already have a better perception of their motor skills, which does not occur with girls unless they have an opportunity and deliberate practice. Indeed, as the PAC, girls suffered a greater impact than boys to be subjected to a program of instruction about environmental cues, with an external focus of attention.

4.4 Limitations and educational implications of this study and future research

Even though the findings from this study have significant educational implications for our children and could have those with the same characteristics (e.g. age, ethnics, school grade etc), the small and specific population did not allow the results to be widespread. Nevertheless this study provide basis in order that the Physical Education professional may offer practices and appropriate reinforcements, looking to positively affect both motor competence and perceived athletic competence of children especially by instruction about environmental cues using different strategies and resources in the lessons. However, Physical Education professionals should remember that the particular context could require a different type of instruction or mixed instructions to be effective. Future research should examine the effect of these different types of instruction in various ethnic groups across a variety of ages. Finally, children need to be tracked longitudinally to examine the influence of such interventions on lifelong development.

5. Conclusion

According to the results of this study, instruction about environmental cues improved motor competence and perceived athletic competence of middle childhood children. Considering the gender, girls had their motor competence and perceived athletic competence especially affected by the instruction about environmental cues. Specifically with respect to motor competence, the instruction about environmental cues was more effective than instruction about the quality of movement and the control group.

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