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Original Article

MOTOR INTERVENTION EFFECTIVENESS ON CHILDREN DAILY ROUTINE, MOTOR, HEALTH, AND PSYCHOSOCIAL PARAMETERS

EFICÁCIA DA INTERVENÇÃO MOTORA NA ROTINA DIÁRIA, E EM PARÂMETROS MOTORES, DE SAÚDE E PSICOSSOCIAL DE CRIANÇAS

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RESUMO

Para crianças com atrasos motores, a eficácia da intervenção motora em relação à rotina, autoconceito e engajamento tem sido pouco estudada. Diferenças específicas de sexo ainda carecem de evidências. Este estudo examina a eficácia da intervenção motora com o Clima para a Maestria (MC) na rotina diária de meninas e meninos, e no desempenho motor, IMC, autoconceito e engajamento; e, as diferenças entre sexo nessas variáveis. Crianças com atrasos motores foram alocadas aleatoriamente no Grupo MC ou Grupo de Comparação. Avaliamos a rotina em casa, competência percebida, aceitação social e autoestima global, IMC, habilidades motoras, e engajamento na aula. Os resultados mostraram que meninas e meninos aumentaram o tempo de brincar e os escores motores, as percepções de competência cognitiva e motora, a aceitação social, o autovalor global e o engajamento com sucesso; e diminuíram o tempo assistindo TV, e as brincadeiras livres, o mudar a tarefa, e as distrações e os conflitos na aula. Conclui-ise que a intervenção MC foi eficaz em promover o desempenho de meninas e meninos.

Palavras-chave: Desenvolvimento infantil. Atraso no desenvolvimento. Intervenção.

ABSTRACT

For children with motor delays, the intervention effectiveness regarding children's routine, overall self-perceptions, and engagement in the lessons, have been understudied. Furthermore, specific sex differences still lack evidence. This study examines the effectiveness of mastery Climate (MC) motor intervention on girls' and boys' daily routine, motor performance, BMI, self-perceptions, and engagement, and the sex differences across these variables. Children with motor delays were randomly assigned to MC Group or Comparison Group. We assessed children's routine at home; perceived competence, social acceptance, and global self-worth; BMI; motor skills; and qualitative engagement in the lesson. Results show girls and boys increased the playtime, motor scores, perceptions of cognitive and motor competence, social acceptance, global self-worth, and engagement with success in the lessons; and, decreased TV time and free play, changing tasks, distraction, and conflicts in the lesson. In conclusion the MC intervention was effective in fostering girl's and boys' achievement.

Keywords: Child developmental. Motor delays. Intervention.

Introduction

Motor delays are reported across countries, despite the differences in opportunities and socioeconomic status[1-3]. The effects accountable for the enduring reports of delays are not entirely understood. Lack of opportunities[4], cultural values[5], and socioeconomic status[6,7] are plausible explanations for those rates. Sex also plays a role; girls often demonstrate lower motor performance than boys[8,9]. It has been suggested that girls are less encouraged to engage in physical activity and sports programs, which negatively affects their ball and locomotor skills proficiency[5,7,9]; however, we still lack the understanding of how these differences are emphasized for boys and girls in the daily routine at home and during physical education lessons. To better understand the sex differences in motor engagement and the more unsatisfactory performance for girls[5,7,9], at this young age, we need to address the daily routine at home and children's patterns of engagement in motor settings.

Furthermore, for children with delays, the intervention effectiveness for motor performance has been reported[10]. The outcomes for sex, in those programs, have been understudied, and the results are controversial. Similar benefits for boys and girls[11,12] as well a sex effect[13,14] have been reported. The factors related to the contradictory results are not fully

explained, and the restrict number of studies difficult the observation of specify motor trend trajectories for boys and girls along the interventions. Besides, most of the intervention studies reported a beneficial impact on motor scores; however, the intervention benefits into daily routine[15] and the qualitative pattern of lessons' engagement for girls and boys have been unheeded.

Besides, although self-perceptions have been the focus of intervention[16-18], the benefits for girls and boys were not reported; studies focus only on perceived physical competence. Considering that interventions may have an impact on several domains of a child's behavior, it is necessary to examine its impact on global self-perceptions. This study examines the effectiveness of mastery Climate (MC) motor intervention on girls' and boys' daily routine, motor performance, BMI, global self-perceptions, and engagement, and the sex differences across the variables. We hypothesized girls and boys in the MC would demonstrate positive and similar patterns of improvement in motor scores, self-perceptions, and engagement, as well as the reduction in BMI and screen time at home, from pre- to post-test.

Methods

Participants

To be eligible for the study, the child should be from a low-income family, attending the first grades in public schools, and showed motor delay or risk of delays (scored ≤ 35th percentile on the Test of Gross Motor Development - TGMD-2[19]. A total of 120 children were referred to the study; 100 children (M = 7.01 years old, SD= .70), from six schools, met the inclusion criteria. The university ethical committee approved the study. Parents signed the informed consent, and children verbally agree to participate.

Instruments

Daily Routine. We adapted the home questionnaire[20]; and, use to assess the: time spend daily using a computer, watching TV, and playing for five consecutive weekdays; school transportation; physical spaces to play; frequent activities and games; and, parents and siblings' physical activities. The parents completed the questionnaire.

Self-perceptions of competence and acceptance. The Pictorial Scale of Perceived Competence and Social Acceptance[21], validated for Brazilian children[22], were used. The subscales scores for motor and cognitive competence, social acceptance, and global self-worth were used; two trained professionals (physical education teachers and master students) conducted the assessment.

Motor Skills. The TGMD-2[19] validated for Brazilian children[23] was used to assess fundamental motor skills. The raw scores for the Locomotor (LOC) and Object Control (OC) subtests, as well as the scores for each skill (sum of the two trials), were used. The test was conducted individually by a trained professional (physical education teacher and master student); all tests were video recorded to further coding. Two independent raters coded children's performance; inter-rater reliability was high (LOC .93; OC .92).

Body Mass Index. Height was measured while the child stood straight with the assessor adjusting the horizontal lever using a portable stadiometer to the apex of the skull. Weight was measured using an electronic calibrated scale. Two trained professionals (physical education teachers and master students) conducted the assessment.

Engagement in the lesson. MCG girls' and boys' engagement was coded using an observational procedure[24]. Engagement with-success (i.e., child engaged in motor activity and accomplish the task) and without-success (i.e., child engage in the tasks but made mistakes in the action process or product), Free-play (i.e., child engages in activities non-relevant to the lesson 's objectives), changing-tasks (i.e., child identified the task and chose to practice other

skills), organizing equipment (i.e., care of equipment), distractions (i.e., talk with others), and conflicts (i.e., enrolled in events that cause harm) behaviors were coded. Several cameras were used. Six lessons (initial and final weeks) were recorded by two trained examiners (physical education teachers, one master and one doctoral student) using a checklist; inter-rater reliability was high (.97). The coded started as the child begins the practice in the stations, and the examiner observed the child for four minutes. Every four minutes, the observation restarts with another child.

The two independent raters for motor performance and the two independent raters for engagement behaviors were blinded for each other assessment, intervention period of assessment (pre-or post-tests), and children's groups (mastery climate or comparison groups). They also did not participate in the intervention in any period (planning nor execution).

Procedures

Children, boys and girls, were randomly assigned to MC Group (MCG: N = 50) or Comparison Group (CG: N = 50) using the research randomizer online program; 22 children discontinued participation along the intervention. A physical education teacher was responsible for intervention delivery. Children in the intervention group participated in a 28-week motor intervention focus on mastery climate (56 sessions/2 times per week/90 minutes each); children in the comparison group attended to the physical education regular lessons. For both groups, the primary research called the parents every week, asking about sport and physical activity enrollment; none of the children attended after-school sports programs before or along the intervention period. Research' design is presented in Figure 1.

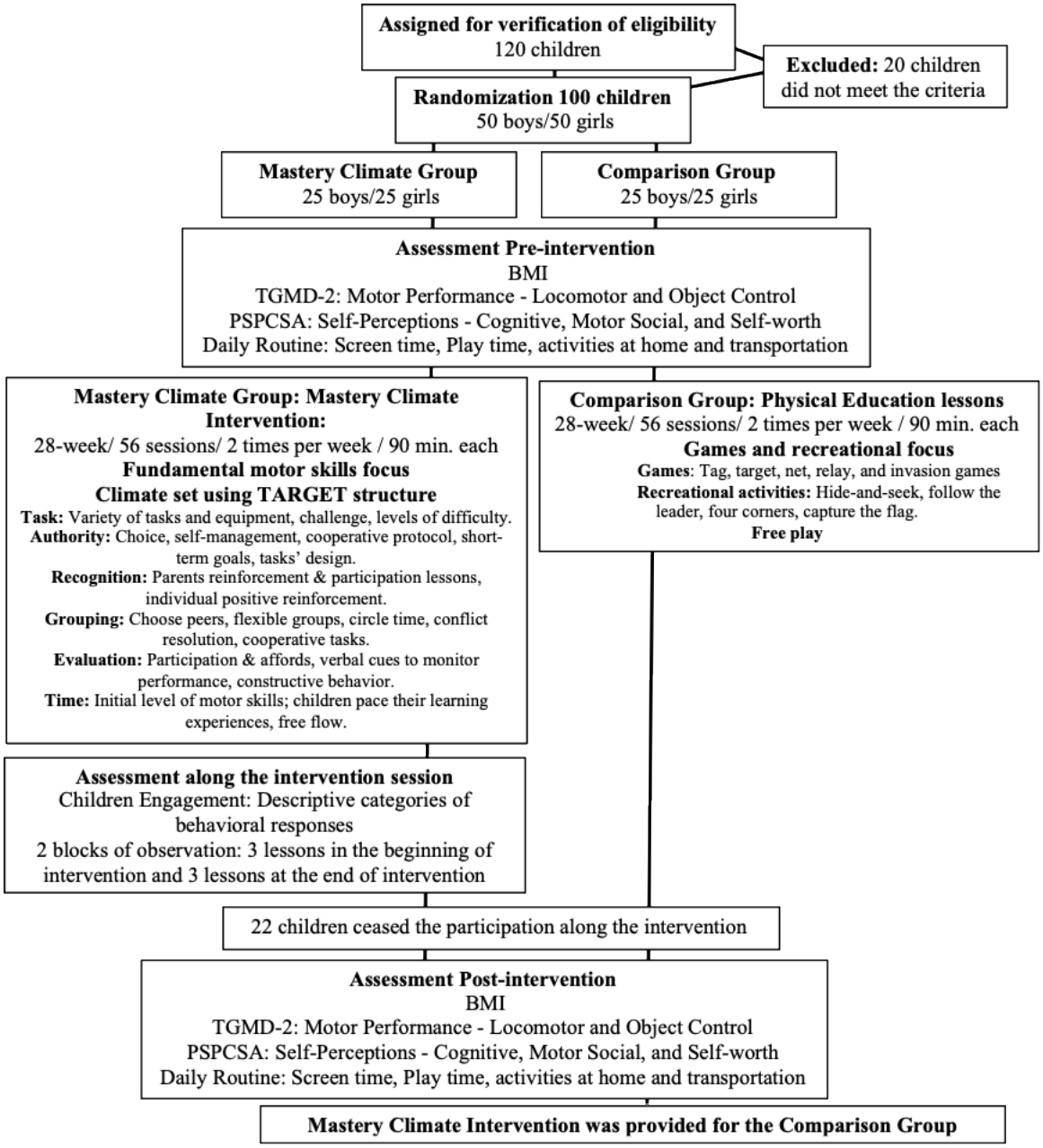

Figure 1. Research design
Source: The authors

The intervention's lessons were planned consistent within the MC strategies and the TARGET structure (Task, Authority, Recognition, Grouping, Evaluation, Time)[17,18]. A variety of appropriate motor tasks were implemented organized in stations, challenge pathways, and small and large group games. Each station had several levels of difficulty within the tasks and various equipment to accommodate children's range of skill levels. Children were challenged to move along the stations using locomotor skills (i.e., jump, slide, hop, skype, leap). Children choose from different levels of task' difficulty within the stations. Children self-manage their time in each station and actively participated in the process of establishing individual and group responsibilities, individual short-term goals, new tasks to be used in the lesson, activities with given equipment, and task' levels of difficulty.

The teacher sends home notes to home about the child's progress and encourages the parents to use this information to acknowledge children's efforts and to practice with their child.

Children received positive reinforcement and praise. Parents were invited to participate in the lessons on several occasions to practice motor skills; parents' availability was accommodated according to their work schedule. Children had the opportunity to choose peers and to practice in small heterogeneous groups. During the practice in stations, the groups were flexible since children choose the stations and when to move. Several strategies were used to improve peer interactions (i.e., circle time, interpersonal conflict resolution, cooperative peer activities). The children were instructed to cooperate, care, and respect individual differences and feelings.

The teacher provided individual and group evaluations related to children's participation and positive behavior. Verbal cues were daily reinforced, and children were encouraged to use it to guide the acquisition of more proficient skills. The teacher encouraged children to keep focus and assess their attitudes toward learning. The number of stations allocated for each skill was based on the initial level of children's motor performance. Although children had choices related to which station they would practice, when necessary, the teacher organized the flow of children away from completely occupied stations to reduce waiting time.

Intervention lessons focus initially on body and space awareness, directions, and locomotor skills. Then, the teacher instructed the motor tasks in each station, focus on balance, locomotor, and ball skills. Children were encouraged to use verbal cues to guide motor practice. The teacher walked around the stations providing instruction, feedback, and modeling paired with cue words. The last activities incorporating the skills learned in traveling challenges and games and circle time with reinforcement about children's achievements and behaviors.

The comparison group participated in the teachers' regular physical education lessons in their schools. The activities consisted of tag, target, net, relay, and invasion games. Other children's activities, such as hide-and-seek, follow the leader, four corners, capture the flag, and free play, were often promoted. The lessons had a prevalent recreational approach. Teachers instructed the games at the beginning of each session and provided the equipment to play the games, control for behavior, and provided instruction about the games if necessary. The primary research observed four physical education lessons, for each child, along the study 28 weeks period, to describe the predominant focus of physical education lessons.

Statistical analysis

The routine' frequencies were analysed using Chi2 and Macnemar's tests. A 2 x 2 x 2 ANOVAs, with repeated measures on the time factor (pre- to post-test) were used to examine the intervention's influence on children's outcomes. A 2 x 2 ANOVAs with a repeated measure on the time factor was used to analyse the boys and girls in the engagement. Partial eta squared was used as the index of effect size ($\eta 2$: small .01, moderate .06, large .14) were adopted for the ANOVAS. Post hoc tests were reported for the significant interactions with Cohen's d as the index of effect size (d: small .20, medium .50, large .80, very large 1.20, huge 2.00).

Results

Children routine

The results showed that girls and boys, at the pre- ($p = .242$) and post- ($p = .553$) tests walked or rode bicycles to school; no time effect was found ($p > .050$). Draw & read were the regular activities, less prevalent for the boys in the MCG in the pre-test ($p = .021$); no time effect was found ($p = .236$) and from pre to post-test ($p > .050$). More boys than girls use computer at pre- ($p = .046$) and post- ($p = .046$) tests; no time effect was found ($p > .050$). The number of girls and boys enrolled in house chores was similar at pre- ($p = .075$) and post- ($p = .134$) tests; no changes were found from pre- to post-tests ($p > .050$).

No differences were found for play in backyard at pre-test ($p = .780$), post-test ($p = .780$), and from pre- to post-test ($p > .050$). Children were allowed to go to nearby parks, and

no differences were found at pre-test ($p = .789$). At the post-test, more girls and boys in MCG were allowed to go to the parks ($p < .0001$) and increases in frequencies from pre- to post-test ($p < .0001$) were found for MCG. Children in the CG frequently play in empty lots at pre-test ($p = .014$) and post-test ($p = .014$); no changes were found from pre to post-tests ($p > .050$).

Boys rode bikes more frequently at pre-test ($p = .008$). At the post-test, the frequencies increased for the girls in the MCG ($p = .008$); groups were similar at the post-test ($p = .115$). A higher number of boys reported to run (pre-test: $p = .034$; post-test: $p = .004$) and play with balls (pre-test: $p = .001$; post-test: $p = .013$) than girls. The frequencies of run increased from pre- to post-tests for the girls in the MCG ($p = .002$). Girls reported higher prevalence in dance and sing activities (pre-test: $p < .00001$; post-test: $p < .00001$) and jump rope (pre-test: $p < .0000$; post-test: $p < .00001$); no changes pre- to post-tests were found ($p > .050$).

No differences were found for the frequencies that fathers (pre-test: $p = .193$; post-test: $p = .142$) exercised. For the mothers (pre-test: $p = .551$) and siblings (pre-test: $p = .141$), frequencies were similar in the pre-test; at the post-test the frequencies increased for the MCG mothers ($p = .003$) and siblings ($p = .002$); positive changes from pre- to post-tests were found for mothers (Boys: $p = .004$; Girls: $p = .007$) and siblings (Boys: $p = .009$: Girls: $p = .046$). The routine frequencies are present in Table 1.

Table 1. Children activities at home & family exercise routine: N(%)for girls and boys at MCG and CG

Children activities at home & Family exercise routine		**Girls** n(%)				**Boys** n(%)			
		MCG		**CG#**		**MCG**		**CG#**	
		Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Mobility to school	Car/bus	9(45.0)	8(40.0)	4(22.2)	4(22.2)	8(44.4)	6(33.3)	4(22.2)	4(22.2)
	Walking/bike	11(55.0)	12(60.0)	14(77.8)	14(77.8)	10(55.6)	12(66.7)	14(77.8)	14(77.8)
Use computer home	Yes	11(55.0)	11(55.0)	6(30.0)	6(30.0)	12(66.7)	12(66.7)	14(77.8)	14(77.8)
	No	9(45.0)	9(45.0)	12(60.0)	12(60.0)	6(33.3)	6(33.3)	4(22.2)	4(22.2)
Draw & Read books	Yes	18(90.0)	19(95.0)	17(94.4)	17(94.4)	9(50.0)	15(83.3)	18(100)	18(100)
	No	2(10.0)	1(5.0)	1(5.6)	1(5.6)	9(50.0)	3(16.7)	0	0
House' chores	Usually	12(60.0)	15(75.0)	12(66.7)	13(72.2)	4(22.2)	8(44.4)	8(44.4)	10(55.6)
	Never	8(40.0)	5(25.0)	6(33.3)	5(25.5)	14(77.8)	10(55.6)	10(55.6)	8(40.0)
Space to play at home	Backyard	18(90.0)	18(90.0)	15(83.3)	15(83.3)	15(83.3)	14(77.8)	15(83.3)	15(83.3)
	Inside home	2(10.0)	2(10.0)	3(16.7)	3(16.7)	3(16.7)	4(22.2)	3(16.7)	3(16.7)
Space to play near home	Empty lots	0	0	3(16.7)	3(16.7)	0	0	5(27.8)	5(27.8)
	Not allowed	20(100.0)	20(100.0)	15(83.3)	15(83.3)	18(100.0)	18(100.0)	13(72.2)	13(72.2)
Public space to play	Nearby parks	2(10.0)	16	3(16.7)	3(16.7)	3(16.7)	16	4(22.2)	4(22.2)
	Not allowed	18(90.0)	4	15(83.3)	15(83.3)	15(83.3)	2	14(77.8)	14(77.8)
Run	2 /3 times/week	6(30.0)	16(80.0)	7(38.9)	8(44.4)	13(72.2)	18(100)	13(72.2)	11(61.1)
	None	14(70.0)	4(20.0)	11(61.1)	10(55.6)	5(27.8)	0	5(27.8)	7(38.9)
Play ball	Every day	-	1(5.0)	-	-	3(16.7)	4(22.2)	5(27.8)	6(33.3)
	2 /3 times/week	10(50.0)	19(95.0)	12(66.7)	15(83.3)	13(72.2)	13(72.2)	13(72.2)	12(66.7)
	None	10(50.0)	-	6(33.3)	3(16.7)	2(11.1)	1(5.6)	0	0
Dance & Circle Sing Games	2 /3 times/week	10(50.0)	11(55.0)	14(77.8)	15(83.3)	0	0	0	0
	None	10(50.0)	9(45.0)	4(22.2)	3(16.7)	18(100)	18(100)	18(100)	18(100)
Jump rope	2 /3 times/week	12(60.0)	19(95.0)	7(38.9)	8(44.4)	0(0)	15(83.3)	1(5.6)	1(5.6)
	None	8(40.0)	1(5.0)	11(61.1)	10(55.6)	18(100)	3(16.7)	17(94.4)	17(94.4)
Ride Bike	2 /3 times/week	13(65.0)	18(90.0)	10(55.6)	11(61.1)	15(83.3)	16(89.9)	15(83.3)	15(83.3)
	None	7(35.0)	2(10.0)	8(44.4)	7(38.9)	3(16.7)	2(11.1)	3(16.7)	3(16.7)
Father' Exercise routine	2 / 3 times /week	2(10.0)	3(15.0)	-	-	-	-	2(11.1)	2(11.1)
	Weekend	2(10.0)	2(10.0)	5(27.8)	4(22.2)	4(22.2)	5(27.8)	7(38.9)	7(38.9)
	None	16(80.0)	15(75.0)	13(72.2)	14(77.8)	14(77.8)	13(72.2)	9(50.0)	9(50.0)
Mother' Exercise routine	2 / 3 times /week	4(20.0)	13(65.0)	1(5.6)	3(16.7)	5(27.8)	10(55.6)	1(5.6)	2(11.1)
	Weekend	3(15.0)	3(15.0)	3(16.7)	3(16.7)	6(33.3)	2(11.1)	6(33.3)	7(38.9)
	None	13(65.0)	4(20.0)	14(77.8)	12(66.7)	4(16.7)	6(33.3)	11(61.1)	9(50.0)
Brothers & Sisters' Exercise routine##	2 / 3 times /week	10(50.0)	15(75.0)	2(11.1)	4(22.2)	5(27.8)	13(72.2)	2(11.1)	3(16.7)
	Weekend	3(15.0)	1(5.0)	4(22.2)	3(16.7)	6(33.3)	1(5.6.)	6(33.3)	7(38.9)
	None	4(20.0)	1(15.0)	9(50.0)	8(44.4)	4(22.2)	1(5.6)	8(44.4)	6(33.3)

Source: The authors

Children play, computer and TV time

Playtime. A significant group by time interaction was found, $F(3, 70) = 10.84$, $p < .0001$, $\eta 2 = .32$, with a large effect size. Playtime was similar at the pre-test ($F(3, 70) = .36$, $p = .782$). and significant different at the post-test ($F(3, 70) = 6.43$, $p = .001$). At the post-test, MCG girls and boys spent more time playing than the CG, with large effect sizes. For MCG girls and boys, playtime increased from pre- to post-test, no changes were observed in the CG.

Computer time. A non-significant group by time interaction was found ($F(3, 68) = 2.42$, $p = .073$, $\eta 2 = .10$). The time effect was significant ($F(1, 68) = 10.23$, $p = .002$, $\eta 2 = .13$); for boys in the MCG the time using the computer decreased from pre- to post-tests.

TV time. A significant group by time interaction was found ($F(3, 70) = 13.26$, $p < .0001$, $\eta 2 = .36$) with large effect size. The TV time was similar at the pre-test ($F(3, 70) = .75$, $p = .526$) and different at the post-test ($F(3, 70) = 9.20$, $p < .0001$). MCG girls and boys spent less time watching TV than the CG at the post-test, with a large and very large effect size. For MCG girls and boys, the time watching TV decreased from pre- to post-test; no changes were observed in the CG. Daily play, the screen time by groups is presented in Figure 2.

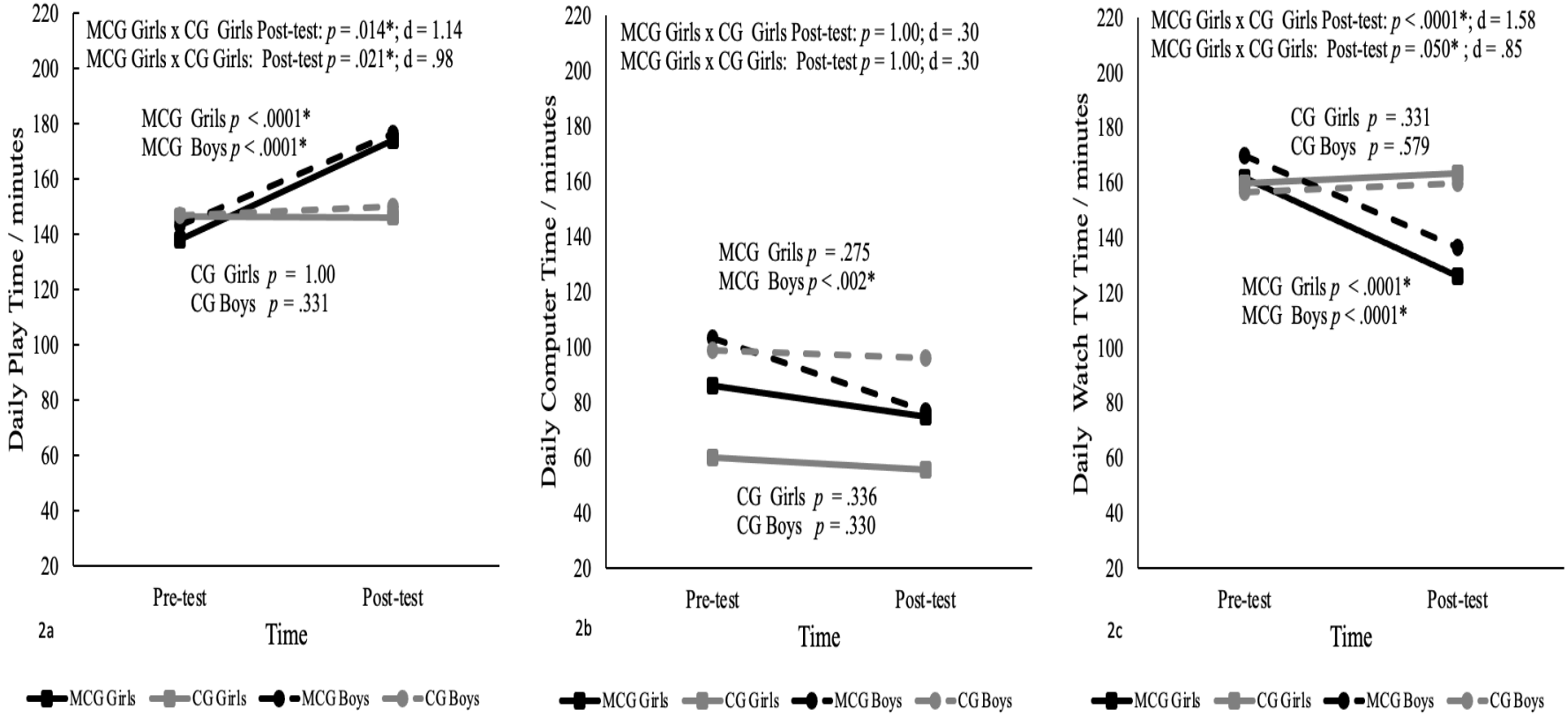

Figure 2. Daily playtime (2a), computer time (2b), and TV time (2c) for girls and boys at MCG & CG
Source: The authors

Body Mass Index and Motor Performance

Body Mass Index. A significant group by time interaction was found ($F(1, 74) = 3.54$, $p = .019$, $\eta 2 = .13$) with a moderate effect size. BMI scores were similar at the pre- ($F(3, 74) = 1.92$, $p = .134$) and post- ($F(3, 74) = .81$, $p = .493$) tests. For MCG, girls and boys, a reduction in BMI was found; no changes were for the CG.

Locomotor Skills. A significant group by time interaction was found ($F(3, 74) = 18.16$, $p < .0001$, $\eta 2 = .42$) with a large effect size. LOC performance was significant different at the pre-test ($F(3, 74) = 6.27$, $p = .001$) and post-test ($F(3, 74) = 57.07$, $p < .0001$). At the pre- and post-test, girls in the MCG showed higher scores than girls in the CG, with large effect sizes. In the post-test, boys in the MCG showed higher scores than boys CG, with very large effect sizes. For all groups, LOC scores increased from pre- to post-test.

Object control skills. A significant group by time interaction was found ($F(3, 74) = 25.43$, $p < .0001$, $\eta 2 = .51$) with a large effect size. OC scores were similar at the pre-test ($F(3, 74) = 2.49$, $p = .067$) and significant different at the post-test ($F(3, 74) = 53.90$, $p < .0001$). MCG girls and boys showed higher scores compared to CG, with very large effect sizes. For all groups, OC scores increase from pre- to post-test. BMI, Locomotor and object control skill for girls and boys at MCG & CG are presented in Figure 3.

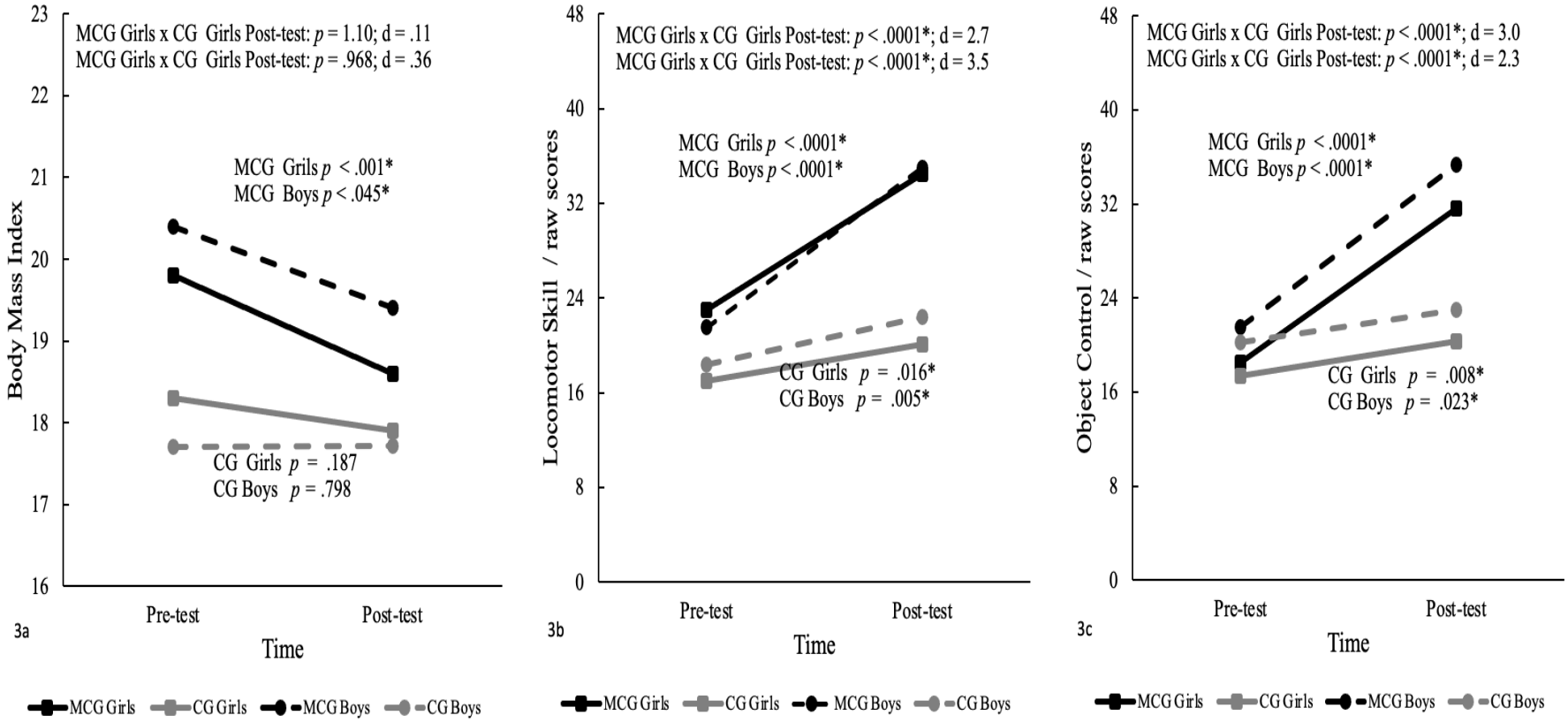

Figure 3. BMI, Locomotor (3a) and object control (3b) skill and BMI for girls and boys at MCG & CG
Source: The authors

Individual Skills. Significant group by time interactions were found ($p < .05$). Girls and boys in the MCG showed higher performance in all skills at the post-test than the CG, with medium to huge effect sizes. Increases in scores from pre- to post-test were found for most MCG skills, with two exceptions (girls: strike; boys: catch). For the CG, fewer improvements were found for girls (run, hop, bounce, throw) and boys (run, gallop, hop, bounce). Table 2 provides the results for the TGMD-2 skills.

Table 2. TGMD-2 Skills: Descriptive scores, independent and dependent t-tests for girls and boys at the MCG & CG

TGND-3 Skills		Girls M(SD)				Boys M(SD)				Girls X Boys			
		MCG	CG	*Between Groups*		MCG	CG	*Between Groups*		MCG		CG	
		Pre	Pre	*p*	d	Pre	Pre	*p*	d	*p*	d	*P*	d
Run	Pre	2.8(1.8)	.80(1.2)	< .0001*	1.3$^{###}$	3.1(1.6)	1.9(1.3)	.116	.85	1.00	.18	.104	.90
	Post	4.4(1.3)	2.6(1.2)	.001*	1.5$^{###}$	5.5(1.4)	3.5(1.4)	< .0001*	1.5$^{###}$	.108	.84	.274	.71
Within group p		.001*	< .0001*			< .0001*	.001*						
Gallop	Pre	4.7(1.9)	3.4(1.7)	.184	.74	3.9(2.3)	3.4(1.4)	1.00	.27	1.00	.39	1.00	0
	Post	6.1(1.2)	3.6(2.0)	< .0001*	2.1$^{####}$	6.2(1.3)	4.3(1.6)	.004*	1.3$^{###}$	1.00	.52	.819	.40
Within group p		.022*	.606			.001*	.038*						
Hop	Pre	3.0(1.9)	2.5(1.6)	1.00	.03	2.8(1.6)	2.5(1.7)	1.00	.19	1.00	.12	1.00	0
	Post	6.0(1.4)	3.6(1.6)	< .0001*	1.6$^{###}$	6.4(1.6)	3.5(1.5)	< .0001*	1.9$^{###}$	1.00	.27	1.00	.07
Within group p		< .0001*	.012*			< .0001*	.011*						
Leap	Pre	3.2(1.7)	2.6(1.3)	100	.04	3.4(1.2)	3.1(1.3)	1.00	.25	1.00	.14	1.00	.40
	Post	4.7(1.1)	3.2(1.2)	< .0001*	1.3$^{###}$	4.5(.78)	3.2(1.2)	.002*	1.3$^{###}$	1.00	.21	1.00	0
Within group p		.003*	.079			.005*	.895						
Jump	Pre	4.6(1.9)	3.2(1.3)	.033	.87	3.7(1.4)	3.0(1.5)	1.00	.50	.412	.55	.010	.15
	Post	6.9(1.2)	3.0(1.3)	< .0001*	3.2$^{####}$	6.1(1.3)	3.8(1.8)	< .0001*	1.5$^{###}$	.572	.66	.495	.52
Within group p		< .0001*	.470			< .0001*	.109						
Slide	Pre	4.7(2.0)	4.4(1.5)	1.00	.17	4.6(2.0)	4.6(2.1)	1.00	0	1.00	.05	1.00	.17
	Post	6.3(1.2)	4.3(1.8)	.001*	1.7$^{###}$	6.3(1.0)	4.1(2.1)	.001*	1.4$^{###}$	1.00	0	1.00	.11
Within group p		.005*	.830			.001*	.163						
Δ Scores		1.6(2.3)	-.10(2.0)	.035*	.71$^{#}$	1.7(1.8)	-.50(1.5)	.006*	1.1$^{##}$	1.00	.05	1.00	0
Strike	Pre	4.4(1.9)	3.9(1.3)	1.00	.31	4.8(2.2)	4.8(1.6)	1.00	0	1.00	.02	.569	.64
	Post	5.4(1.6)	4.9(1.8)	1.00	.30	7.1(1.6)	5.7(1.9)	.087	.82	.026*	1.1$^{##}$	.894	.44
Within group p		.105	.031*			< .0001*	.105						
Bounce	Pre	1.6(2.0)	.90(1.2)	1.00	.38	2.2(2.3)	.80(1.2)	.106	.79	1.00	.29	1.00	.09
	Post	4.6(1.7)	1.7(1.6)	< .0001*	1.8$^{###}$	5.9(1.3)	2.1(1.7)	< .0001*	2.6$^{####}$	.085	.88	1.00	.25
Within group p		< .0001*	.028*			< .0001*	.007*						
Catch	Pre	3.2(1.7)	2.7(1.5)	1.00	.32	3.9(1.2)	2.7(1.7)	.093	.84	1.00	.48	1.00	0
	Post	5.2(.79)	2.9(1.2)	< .0001*	2.3$^{###}$	4.7(1.2)	2.6(.93)	< .0001*	2.0$^{####}$	.578	.51	1.00	.29
Within group p		< .0001*	.697			.103	.883						
Kick	Pre	4.1(1.2)	4.7(1.6)	.716	.44	4.6(.98)	5.1(.93)	.797	.54	1.00	.47	1.00	.31
	Post	5.4(.89)	4.5(1.3)	.040*	.84$^{#}$	6.0(.72)	4.9(1.3)	.014*	1.1$^{##}$	.526	.76	1.00	.32
Within group p		.002*	.587			< .0001*	.551						
Throw	Pre	1.8(2.2)	.80(.95)	.547	.60	3.1(2.4)	1.8(1.3)	.235	1.2	.193	.58	.459	.62
	Post	4.1(1.6)	1.5(1.1)	< .0001*	1.9$^{##}$	4.4(1.6)	2.2(1.6)	< .0001*	1.4$^{####}$	1.00	.19	.850	.52
Within group p		.004*	.031*			.024*	.376						
Roll	Pre	3.1(1.9)	4.4(1.5)	.011*	.78	2.9(1.8)	4.8(1.5)	.004*	1.2$^{###}$	1.00	.11	1.00	.27
	Post	6.8(.95)	5.0(1.5)	.001*	1.5$^{##}$	7.0(1.0)	5.3(2.0)	.003*	1.1$^{##}$	1.00	.21	1.00	.17
Within group p		< .0001*	.214			< .0001*	.242						

Source: The authors

Self-perceptions

Perceived Cognitive Competence (PCC). A significant group by time interaction was found (F(3, 74) = 3.46, p = .021, η2 = .12) with a moderate effect size. PCC was similar at the pre-test (F(3, 74) = 1.10, p = .354) and post-test (F(3, 74) = 1.05, p = .377). For MCG, girls and boys, and girls in the CG, PCC increased; no changes were found for the boys in the CG.

Perceived Social Acceptance (PSA). A significant group by time interaction was found (F(3, 74) = 4.92, p = .004, η2 = .17) with a large effect size. PSA was similar at the pre-test (F(3, 74) = 1.71, p = .172) and post-test (F(3, 74) = 1.75, p = .165). For MCG, girls and boys, PSA increased from pre- to post-tests; no changes for the CG.

Perceived Physical Competence (PPC). A significant group by time interaction was found (F(1, 74) = 13.95, p < .0001, η2 = .36) with a large effect size. PPC was similar at the pre-test (F(3, 74) = 1.18, p = .323) and different at the post-test (F(3, 74) = 3.83, p = .013). Girls in the MCG showed higher PPC scores than the CG. For the MCG girls and boys, and girls in the CG, the PPC increased from pre- to post-tests; no changes were for the boys CG.

Global Self-Perception. A significant interaction was found (F(3, 74) = 11.73, p < .0001, η2 = .32), with a large effect size. Scores were similar at the pre-test (F(3, 74) = 1.29, p = .283) and different at the post-test (F(3, 74) = 2.81, p = .045); no other differences were found. For the MCG girls and boys, and CG-girls, PCC increases in time effect were found; no changes were found for the CG-boys. Self-perceptions scores are presented in Figure 4.

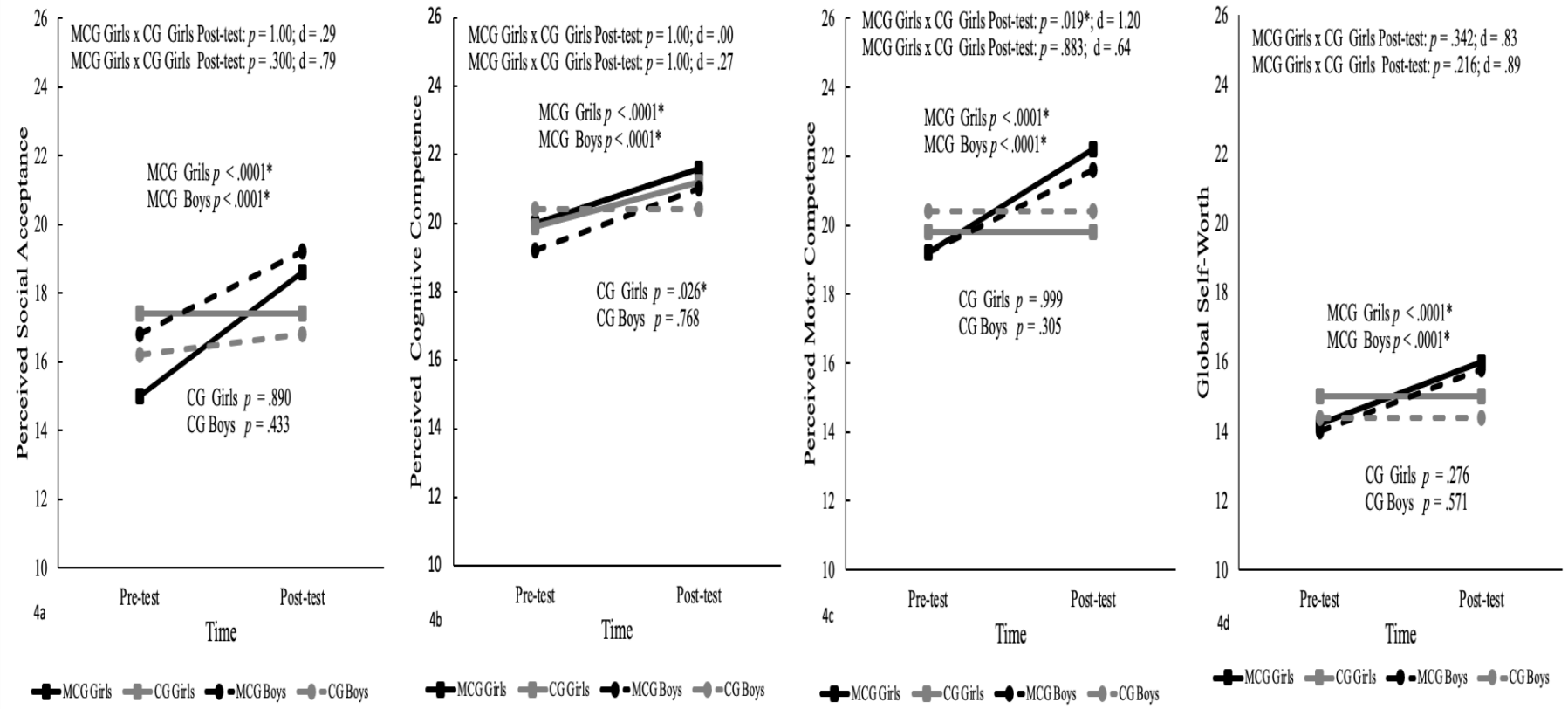

Figure 4. Self-perceptions of social acceptance (5a), cognitive competence (5b), motor competence (5c), and global self-worth (5d) for girls and boys at MCG & CG

Source: The authors

Engagement in context: Mastery Climate Group

Engagement with- and without-success. A non-significant interaction for engagement with-success ($F(1, 36) = .06$, $p = .801$, $\eta 2 = .002$) and without-success ($F(1, 36) = .48$, $p = .492$, $\eta 2 = .01$), were found. The time main effect for the engagement without-success was also non-significant ($F(1, 36) = 1.25$, $p = .270$, $\eta 2 = .03$). The time effect for engagement with-success was significant **(**$F(1, 36) = 356.16$, $p < .0001$, $\eta 2 = .91$) with a large effect size. Increases from pre- to post-test were found for engagement with-success for boy and girls.

Free-play and changing-tasks. Non-significant interactions for free-play ($F(1, 36) = 1.75$, $p = .194$, $\eta 2 = .05$) and changing-tasks ($F(1, 36) = 1.36$, $p = .251$, $\eta 2 = .04$) were found. The time effect for free-play ($F(1, 36) = 12.16$, $p = .001$, $\eta 2 = .25$) and changing-tasks (F**(**$1, 36) = 31.85$, $p < .0001$, $\eta 2 = .47$) were significant, with large effect sizes. Free-play decreased for the boys; changing-tasks decreased for boys and girls from pre- to post-test.

Organizing equipment, distractions and conflicts. Non-significant sex by time interactions for organizing-equipment ($F(1, 36) = 3.95$, $p = .054$, $\eta 2 = .09$), distraction **(**$F(1, 36) = .59$, $p = .448$, $\eta 2 = .02$), and conflicts **(**$F(1, 36) = .005$, $p = .946$, $\eta 2 = .00$) were found. The time factor were significant for the three behaviors (organizing-equipment: $F(1, 36) = 3.95$, $p < .0001$, $\eta 2 = .44$; distractions: $F(1, 36) = 65.76$, $p < .0001$, $\eta 2 = .65$; conflicts: $F(1, 36) = 7.75$, $p = .009$, $\eta 2 = .18$), with small to large effect sizes. Decreases in these behaviors were found for the girls; for boys the decreases were in organizing-equipment and distractions. Table 3 show the results for engagement.

Table 3. Motor engagement within the context: MCG girls' and boys'comparisons

TGMD-2 & Motor Engagement	**Mastery Climate M(SD) & Statics Results**			**Between groups**	
		Girls	**Boys**	*p*	Cohen's D
Appropriate motor engagement: Success	Pre	.25(.55)	.50(.62)	.195	.44
	Post	5.9(1.2)	6.0(2.3)	.868	.06
	Within group *p*	< .0001*	< .0001*	-	-
Appropriate motor engagement: Without success	Pre	5.9(1.3)	5.2(2.4)	.254	.39
	Post	4.9(1.6)	4.9(2.0)	.993	.01
	Within group *p*	.089	.815	-	-
Non- appropriate motor engagement: Free Play	Pre	.60(.88)	.89(1.1)	.370	.30
	Post	.25(.55)	.11(.32)	.356	.32
	Within group *p*	.069	.012*	-	-
Non-appropriate motor engagement: Changing Tasks	Pre	1.5(1.0)	1.9(1.0)	309	.35
	Post	.60(.75)	.44(.78)	.537	.22
	Within group *p*	.002*	< .0001*	-	-
Non-engage in motor tasks: Organizing equipment	Pre	1.6(1.1)	.77(.88)	.013*	.88#
	Post	.20(.52)	.11(.32)	.538	.21
	Within group *p*	< .0001*	.014*	-	-
Inappropriate behavior: Distractions	Pre	1.8(1.4)	2.3(1.6)	.333	.33
	Post	.10(.31)	.22(.43)	.315	.33
	Within group *p*	< .0001*	< .0001*	-	-
Inappropriate behavior: Conflicts	Pre	.40(.82)	.33(.77)	.798	.09
	Post	.05(.22)	.00(.00)	.350	.32
	Within group *p*	.049*	.083	-	-

Note: Cohen' D; * Significant result; # large effect size; --- interaction groups x time were nonsignificant
Source: The authors

Discussion

Children routine at home & play, computer and TV time

The social-cultural context in which a child is reared and the expected roles for them,

favoring specific skills and impairing others[5,9,25], it was observed regarding the use of the computer and bikes. More boys were allowed to use the parents' or relatives' computers to play games and to rode bikes on the streets. More boys run and play with balls, whereas girls dance, sing, and jump rope at home. Interestingly, at the post-test, playtime increases for girls and boys in the MCG; more girls in the MCG were allowed to rode bikes and ran in the streets near the house; the time spent on computers decreased for boys in the MCG.

Nevertheless, the combined TV and computer time, around 3 to 4 hours daily, was almost two times higher than the recommendations of no more than two hours watching TV and using other electronic media daily[26]. Although decreases were observed for MCG children, it was not enough to meet the health recommendations; and considering that all children attending the intervention showed motor delays, the time in front of the TV should be used to promote development.

A higher number of girls were enrolled in house chores; however, the differences were non-significant, contrary to previous studies. Girls, from vulnerable families, are usually more enrolled in house' chores[6,27] and had less time to play[7] than boys. This trend was not found in our study. It is essential to acknowledge that children in the present study were younger than those in previous studies[27]. A plausible explanation for the differences may be this phenomenon later in childhood. Another interesting finding was that the mothers and siblings of the children in MCG exercised more along with the intervention. The explanations were related to walking to take the children to the program and exercise at the university campus while waiting to take the children back home.

BMI and Motor development

Regarding BMI, the scores were similar across groups at the pre and post-tests; however, a reduction in BMI was observed for boys and girls in the mastery climate. Reduction in BMI for boys and girls has not been yet reported due to the mastery climate intervention, which limited our ability to compare to previous studies. However, previous home base and school intervention programs[12,15] have provided evidence for a positive effect on boys' and girls' health (i.e., daily physical activity, participation). Here we extended the previous studies by providing evidence that the motor skills intervention positively impacts another health parameter, children's BMI.

Regarding moto performance, equality of opportunities to develop in childhood should be a priority, but it not necessarily occurs in children from low-income families; the majority of the children showed delays. Vulnerable children attend schools with restricted physical space, inadequate resources, and crowded classrooms; they also lived in homes with restricted indoor and outdoor space[7,25]. Previously similar prevalence of delays was reported to be related to those disadvantaged educational, social, and family constraints resulting in a lack of motor experiences[25,28]. However, contrary to the studies that report lower motor scores for girls[3,7], our study found similar scores.

We found improvement for motor skills from pre- to post-tests for all groups. However, the scores at post-test were higher for boys and girls in the MCG than CG, aligned with previous intervention studies[11,12,17,18,29,30]. Nevertheless, gains were similar for girls and boys; the equality of opportunities in the setting plays an essential role in this result.

Furthermore, sex comparisons showed no differences in the LOC scores, similar to previous studies[31]. Regarding OC skills although most studies report higher scores for boys[3,8,9], our results showed similar performance. Although not common, this result was aligned with previous results reported for Greek children[31]. Very often, the sex differences are related to types of opportunities offered to boys and girls to develop within a culture and economic resources available[7,25]. Here, although we provided evidence for sex differences in children's routine, those differences seem not to affect the girls and boys differently, regarding motor

scores.

Self-perceptions

The experience of cumulative success in the intervention was crucial in determining the positive changes in children's self-perception. Very early children become increasingly responsive to failure[32], especially girls[33] and experiences of real successes are necessary to foster positive self-perceptions. Children in MCG increased self-perceptions, whereas, for CG, overall, no changes were observed. Previous MC intervention studies reported its positive impact on perceived physical competence[16,18]. Here, we added to the current knowledge by providing evidence for the positive impact of the MC intervention on perceived cognitive and motor competence, social acceptance, and global self-worth.

In the present study, no sex differences were found in any self-perception domains. Improvements were similar for boys and girls, similar to previous studies that report no sex factor for all domains in groups with similar age[34,35]. Most studies assessing perceived physical competence showed higher scores for boys[36,37] or no differences between boys and girls[38,39]. Cultural expectancies, social role attribution, and child-rearing are possible factors related to those inconsistencies and may be considered in future studies. Nevertheless, future research may need to consider the magnitude of the sex effect, since very often effect sizes are not provided.

Children's achievements efforts are related to their perceptions of their competence[33-35]. The intervention effects on perceived competence, social acceptance, and global perceptions are promising results, especially considering how critically important it is to foster a positive and accurate sense of self-worth during childhood. It may be even more relevant if we consider that children from low-income families rely on a more fragile system to support their achievements.

Girls and boys in the MC: Engagement during lessons

Regarding engagement, we hypothesized that girls' and boys' behavior in the lesson would be similar since the MC implemented in the lessons was child-centered, and children guided their choices of difficulties according to their proficiency levels, and praise and reinforcement were individual. The results showed no sex interaction, confirming our hypothesis. Success in the tasks increased for girls and boys; the tasks were novel, playful, and challenge, characteristics necessary to attract children's attention, keep them interested enough to mastery the tasks, and consequently learn[40].

Non-appropriate engagement (changing-tasks, distraction) decreased for girls and boys, free play decreased for boys, and conflict decreased for girls. The protocol established in cooperation with children play a role in these unwanted behaviors; children provided insights into the rules, rehearsal those combinations, and adopted them over the intervention period. This factor was critical to behavioral changes. However, it is essential to highlight that the climate approach per se kept children on tasks, reduce lines and time waiting for equipment, and consequently reduce distraction, free play, and conflicts[40].

Study strength and limitations

The present study advances in the previous study by investigating the boys' and girls' environment by assessing the daily routine; we also could quantify the time spent on screen and playing at home, two factors that show the strength and the originality of the study. Furthermore, we provided evidence that mastery climate positively affects overall self-perceptions and BMI; previous studies were limited to physical self-perceptions, and no report, to the authors' knowledge, was found to reduce BMI in mastery climate approaches. We also provided evidence for the quality of motor engagement in the lessons; just a few studies

addressed this relevant factor to motor performance, another strength of the present study. The present study's limitation was the lack of an objective measure of physical activity (pedometers or accelerometers).

Conclusion

Here we advanced in the previous intervention research, which provided evidence that girls' and boys' positive routine outcomes were the results of MC intervention, with broader effects for the girls. These results suggested that mastery climate intervention supports parents in changing children's tasks at home, moving from less active at the beginning of the intervention to more active play by the end of the intervention. Besides, our results support the understanding that intervention offers an effective means to improve motor skills, cognitive and motor perceived competence, social acceptance, and global self-worth in childhood for girls and boys; this could help to equality of outcomes between sex. The Mastery Climate approach could be implemented in regular physical education lessons to improve children's health and psychosocial outcomes; this approach requires few resources, promotes children's autonomy, and allows the teacher to focus less on children's behavior and more on instruction feedback.

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