



## Erasmus+ “Karate: sport@school”

### Final report from the University of Padua

#### Introduction

The Karate:sport@school project was designed according to best-practice recommendations derived from research into teaching experiences that maximize opportunities for learning and success. It enhances cooperation between sport clubs and schools in order to increase the amount and quality of physical activity performed by children. It is suitable to be endorsed by local authorities, healthcare centers, private companies, etc. and therefore to be sustained by a local network of relevant stakeholders. The program aims not only at enhancing motor skills but at the harmonious development of children’s body and personality. Secondary aims of the program include increasing the competency and skills of federal teachers/coaches, promoting the role and contribution of research in sport, and highlighting school teachers’ expertise and training as an important consideration that can be analyzed and developed in future projects or initiatives. Evaluation of the program focused on two aspects:

- change in children behavior and learning abilities (level of attention, socialization with peers, etc.);
- change in children motor abilities (the focus of this report).

#### Procedure

The project involved 4 schools from each participating country. Schools were recruited from different regions with different characteristics in order to ensure a broadly representative sample. The project was implemented in one class per school (pupils aged 7-8 years) with a control class from the same school. Each partner was responsible for conducting the study in their own country. The experimental group (K group) carried out the “karate mind & movement” activities for 2-hours per week during school hours, throughout the academic year. The students in the control group (C group) followed their usual activities throughout the year.

The physical activities performed in the experimental group were conducted by trained technicians (Action 2.1 of the Erasmus+ protocol) in cooperation with school teachers. These activities were age-appropriate and included both theoretical and practical components. Specific equipment (sponge balls, tatami, etc.) to create the “enriched environment” was used. A preliminary test was conducted to assess children abilities and skills. Specific motor activities were used with consideration of the individual pupils’ varying levels of competency and ability to ensure inclusion.

Tests to evaluate motor performance designed by experts have been administered by federal technicians at two-time points (at baseline – October 2017 - and after 6-months of project – May 2018), while results have been analyzed by external university experts.

## Participants

At baseline, a total of 688 pupils (mean age  $8.1 \pm 0.4$  years) from 5 Countries participated in the study and were randomized into an experimental group (Karate group  $n= 353$ ) or a control group ( $n=335$ ). Distribution of participants in the intervention and control groups by city is shown in Table 1.

**Table 1.** City-based distribution of participants that commenced the intervention.

		Karate Group	Control Group	Tot
<b>Germany</b>	Bremen	22	17	39
<b>Portugal</b>	Braga	18	20	38
	Vila Franca	26	26	52
	Trofa	18	26	44
	Faro	23	19	42
<b>Spain</b>	Alcalà	18	19	37
	Campanillas	21	19	40
	Arnedo	26	28	54
	Palencia	13	12	25
<b>Poland</b>	Poznan	18	9	27
	Szczecin	20	20	40
	Elblag	15	13	28
	Lodz	24	17	41
<b>France</b>	Paris	24	24	48
	Locon	21	22	43
	Orleans	22	22	44
	Bousse	24	22	46
<b>Total</b>		<b>353</b>	<b>335</b>	<b>688</b>

## Measures

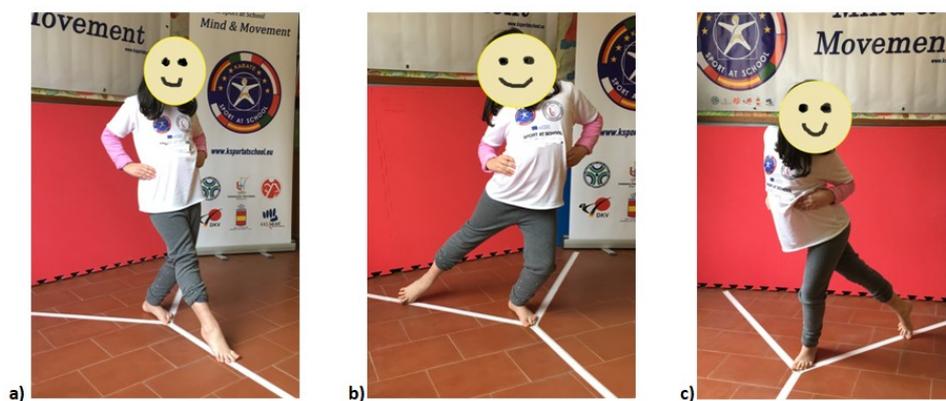
Participants in both the experimental and control groups took part in two evaluation sessions (pre and post intervention) consisting of five fitness tests. The tests were selected in order to evaluate general coordination, karate-specific coordination, balance and flexibility. Below is a detailed description of each test.

### *Y Balance test*

In the Y-balance test (Kinzey & Armstrong, 1998) the child stands on one leg in the center of a grid (Figure 1), with the most distal aspect of the great toe at the starting line. While maintaining a single-leg stance, the subject is asked to reach with the free limb in the anterior, posteromedial, and posterolateral directions in relation to the stance foot (Figure 1). The maximal reach distance is registered, corresponding to the point where the most distal part of the foot reached. The test is considered null when the subject:

- a) fails to maintain unilateral stance,
- b) lifts or moves the stance foot from the grid,
- c) touches down with the reach foot, or
- d) fails to return the reach foot to the starting position.

The process should be repeated while standing on the other leg. The greatest of 3 trials for each reach direction is used for analysis of the reach distance in each direction. In addition, the greatest reach distance from each direction is summed to yield a composite reach distance for analysis of the overall performance on the test, having in this way a total Y-right and a total Y-left leg score.



**Figure 1.** Y-Balance test execution: a) anterior reach; b) posteromedial reach; c) posterolateral reach.

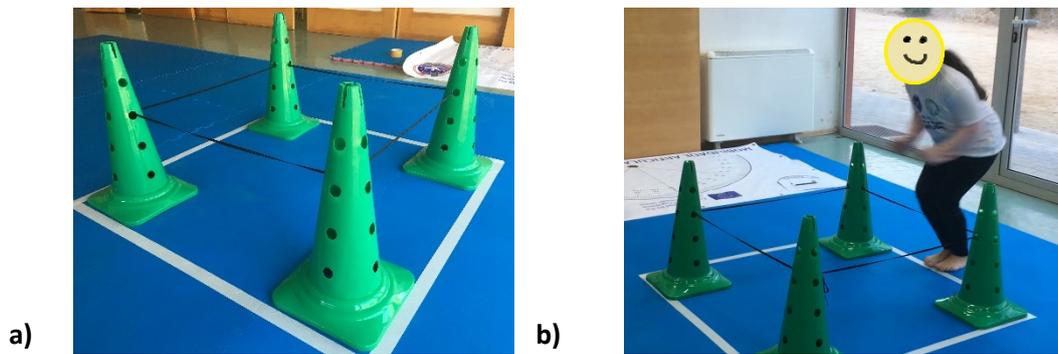
### *Castle test*

The Castle test evaluates the rapidity and reaction of inferior limbs muscles; however, the result of this test is also influenced by the coordinative ability of the subject.

The Castle test consists of six, feet together jumps inside-out of a square (the castle) with sides of 80cm length and a rope positioned at 30cm high from the ground (Figure 2). The subject is asked not to use their arms to help the jumps and to perform three repetitions. The time registered in each repetition corresponds to the score, and the best of the three trials is considered as final score.

The test is considered null, thus reporting a score of 0, when the subject:

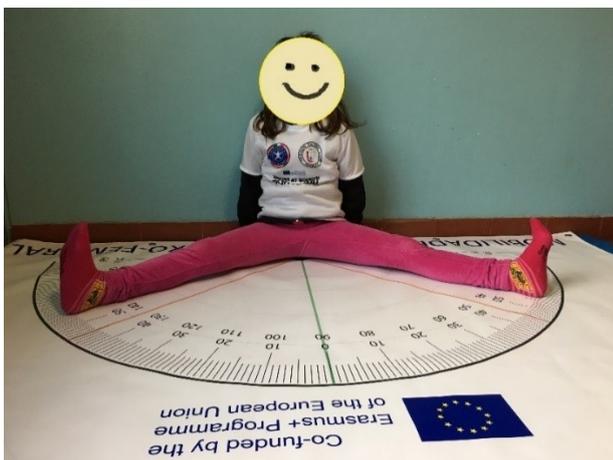
- a) uses arms to help the jumps,
- b) jumps more than 6 times, adjustment jumps are not allowed,
- c) jumps without keeping their feet together.



**Figure 2.** Castle test structure (a) and execution (b).

### *Frontal split test*

The Frontal Split test measures the flexibility of the hip joints. It is executed with the subject seated on the ground, their back vertical and against a wall, with legs stretched apart. This test measures the maximal frontal split in angle degrees (Figure 3), and it should be executed once.



**Figure 3.** Frontal split test execution.

### *Somersault test*

The Somersault test evaluates the overall motor control ability and coordination of the subject that is asked to perform a somersault on a mat.

The Somersault test is evaluated using three parameters:

- a) Stiff legs: 1= not ok and 2= ok.
- b) Contemporary feet arrival: 1= not ok and 2= ok.
- c) Stand up arrival: 1= not ok and 2= ok.

The test is null if participants can't perform a somersault, and the score is recorded as 0. If performed, it can reach a final value of between 3 and 6 by summing up the scores on the three parameters. The test is performed three times and the final total score is the average of the three trials.

#### *Frontal Kick preparation test*

The Frontal Kick preparation test (FKP) is useful in evaluating specific coordination ability. The participant is asked to stand with their feet together with arms alongside the body. It consists of flexing each one of the legs until reaching a 90° angle at the hip joint and maintaining the position for at least 5 seconds (Figure 4). The test is executed three times per leg, and the ground foot should be kept stationary.

The Frontal Kick preparation test is evaluated on three parameters:

- a) Ground foot stationary: 1= not ok and 2= ok.
- b) The thigh is parallel to ground: 1= not ok and 2= ok.
- c) The trunk is vertical: 1= not ok and 2= ok.

For each leg, the FKP test can reach a final value of between 3 and 6 if performed. The test is null when the participant loses balance within the first 5 seconds of testing and touches the floor with the suspended leg in which case the score is recorded as 0.



**Figure 4.** Frontal Kick preparation test execution.

## Results

Country-based participants distribution by gender and group is reported in Table 2, the descriptive statistics of all the motor tests for the Karate and the Control groups at baseline are reported in Table 3. Only participants with complete baseline data are reported.

**Table 2.** Country-based distribution of participants' gender.

	Karate Group			Control Group		
	Boys	Girls	Tot	Boys	Girls	Tot
Germany	10	12	22	6	11	17
Portugal	32	30	62	56	35	91
Spain	33	45	78	37	41	78
Poland	48	29	77	31	27	58
France	43	48	91	43	47	90
<b>Total</b>	<b>166</b>	<b>164</b>	<b>330</b>	<b>173</b>	<b>161</b>	<b>334</b>

**Table 3.** Descriptive statistics and independent samples *t*-test results for each assessment at baseline for the two groups.

	Karate Group M ± SD (n)	Control Group M ± SD (n)	<i>t</i>	<i>p</i>
Y balance anterior reach (right leg)	43.4 ± 10.8 (325)	41.5 ± 16.5 (325)	1.806	n.s.
Y balance posteromedial reach (right leg)	50.5 ± 15.1 (326)	50.1 ± 18.9 (325)	0.255	n.s.
Y balance posterolateral reach (right leg)	45.3 ± 16.1 (325)	43.0 ± 20.2 (325)	1.583	n.s.
Y-Right (composite score)	139.3 ± 36.5 (325)	134.6 ± 47.9 (325)	1.418	n.s.
Y balance anterior reach (left leg)	45.0 ± 10.6 (325)	42.9 ± 16.7 (325)	1.923	n.s.
Y balance posteromedial reach (left leg)	52.9 ± 12.5 (325)	49.9 ± 20.1 (325)	2.273	<b>0.02</b>
Y balance posterolateral reach (right leg)	46.7 ± 14.4 (325)	43.9 ± 20.8 (325)	2.024	<b>0.04</b>
Y-Left (composite score)	144.7 ± 31.7 (325)	136.7 ± 49.1 (325)	2.447	<b>0.02</b>
Castle test	7.8 ± 4.4 (327)	8.0 ± 5.0 (326)	-0.652	n.s.
Frontal split test	119.7 ± 17.4 (327)	126.4 ± 64.6 (328)	-1.837	n.s.
Somersault test	3.3 ± 1.6 (326)	3.3 ± 1.5 (328)	-0.220	n.s.
Frontal kick preparation test right leg	4.5 ± 1.4 (327)	4.7 ± 1.1 (326)	-2.341	<b>0.02</b>
Frontal kick preparation test left leg	4.5 ± 1.4 (327)	4.5 ± 1.2 (327)	-0.401	n.s.

**Note.** M = Mean value; SD = Standard deviation; (n) = number of participants; *t* = *t* value at independent sample *t* test; *p* = *p* value, significance level has been established at *p*<.05; n.s. = not significant.

As per results highlighted in Table 3, the Karate and the Control group reported some significant differences at baseline, namely in the Frontal kick preparation test (right leg) and the Y-Balance test posteromedial, posterolateral reach, and total score for the left leg. For this reason, analyses of the differences between groups in the post-intervention measure have been conducted via ANCOVAs, adjusting for baseline values (Vickers & Altman, 2001). Results are reported in Table 4.

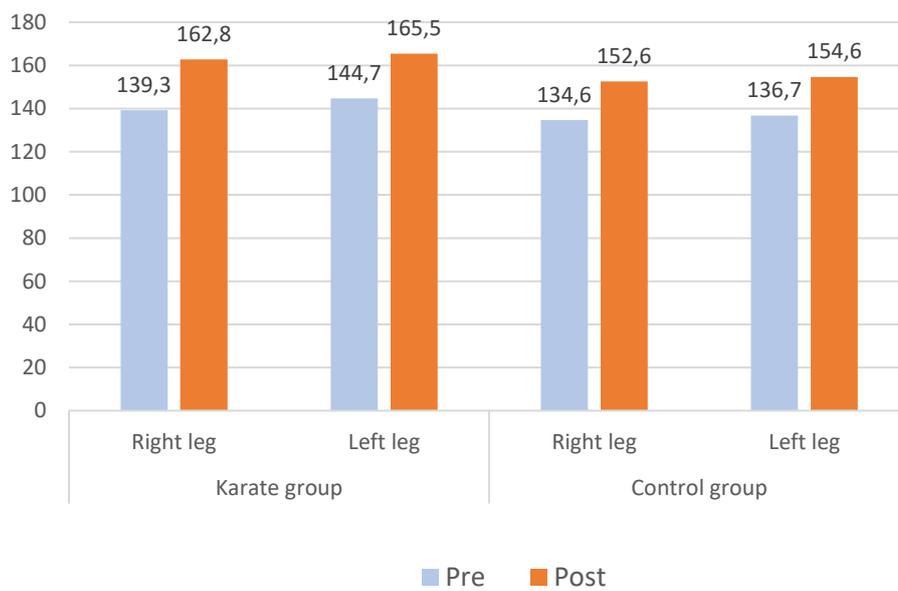
**Table 4.** Descriptive statistics and ANCOVA results for each assessment at post-intervention for the two groups.

	Karate Group M ± SD (n)	Control Group M ± SD (n)	F	p
Y balance anterior reach (right leg)	50.1 ± 7.6 (320)	48.4 ± 12.0 (302)	6.8	.01
Y balance posteromedial reach (right leg)	56.8 ± 12.7 (320)	52.5 ± 15.9 (302)	30.9	<.001
Y balance posterolateral reach (right leg)	55.9 ± 13.2 (320)	51.6 ± 15.1 (302)	13.2	<.001
Y-Right (composite score)	162.8 ± 28.5 (320)	152.6 ± 36.8 (302)	26.8	<.001
Y balance anterior reach (left leg)	50.6 ± 8.1 (320)	49.9 ± 11.0 (302)	.01	n.s.
Y balance posteromedial reach (left leg)	57.8 ± 11.3 (320)	52.8 ± 16.0 (302)	23.7	<.001
Y balance posterolateral reach (right leg)	57.1 ± 11.3 (320)	51.8 ± 15.0 (302)	24.1	<.001
Y-Left (composite score)	165.5 ± 25.5 (320)	154.6 ± 36.0 (302)	21.9	<.001
Castle test	7.7 ± 4.3 (320)	7.5 ± 4.6 (303)	0.8	n.s.
Frontal split test	125.9 ± 15.9 (320)	123.3 ± 17.2 (305)	6.2	.013
Somersault test	5.0 ± 1.3 (320)	4.0 ± 1.4 (302)	99.0	<.001
Frontal kick preparation test right leg	5.4 ± 0.9 (321)	4.8 ± 1.4 (303)	56.8	<.001
Frontal kick preparation test left leg	5.3 ± 0.9 (321)	4.8 ± 1.3 (304)	45.3	<.001

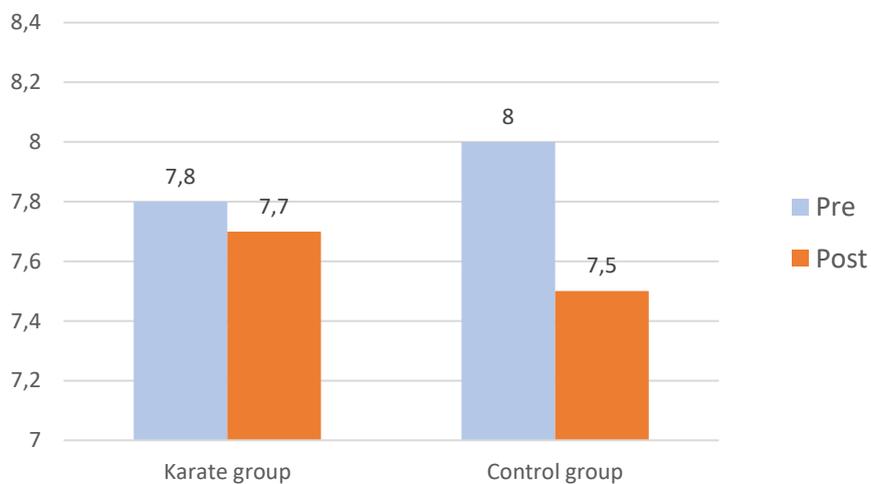
**Note.** M = Mean value; SD = Standard deviation; (n) = number of participants; F = F index of ANCOVA analysis; p = p value, significance level has been established at  $p < .05$ ; n.s. = not significant.

In the following graphs, representations of the pre-post variations in the Karate and the Control group are reported (Graph 1 to 5).

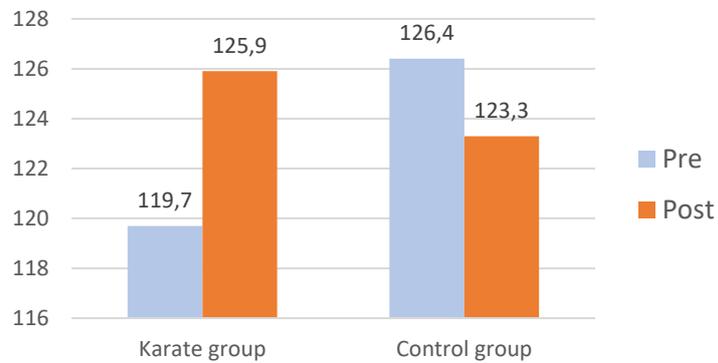
**Graph 1.** Pre-post-intervention variations of Y balance test composite score for right and left leg, for both the groups.



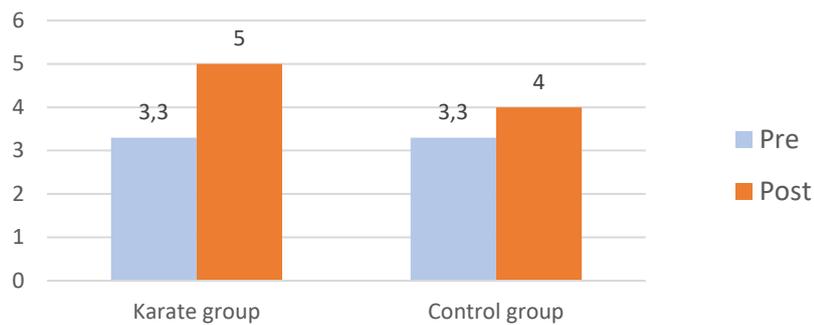
**Graph 2.** Pre-post-intervention variations of Castle test for both the groups.



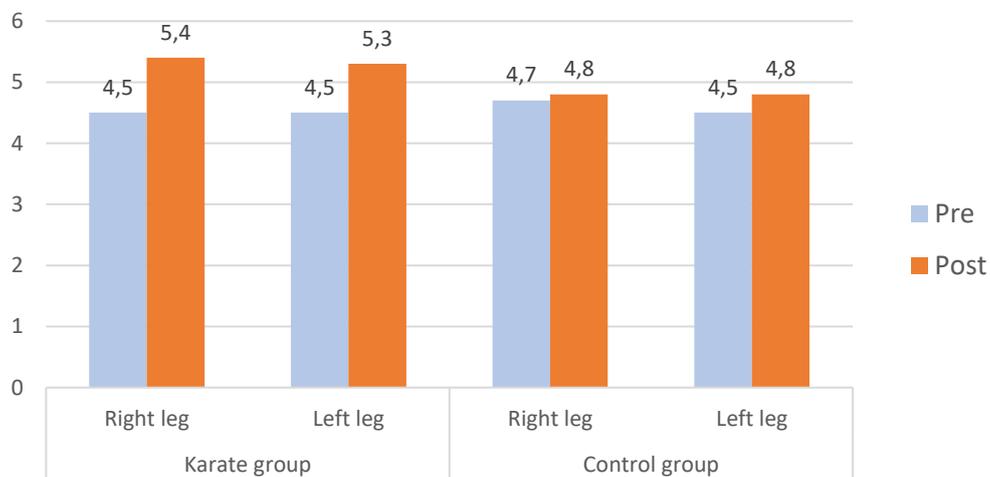
**Graph 3.** Pre-post-intervention variations of Frontal Split test for both the groups.



**Graph 4.** Pre-post-intervention variations of Somersault test for both the groups.



**Graph 5.** Pre-post-intervention variations of Frontal Kick preparation test for right and left leg for both the groups.



In Table 5, mean percentage change and the associated effect size are reported for each assessment with significant differences between groups at post intervention only.

**Table 5.** Mean percentage changes of the significant tests at post-intervention and associated effect sizes of the differences between groups.

	Karate Group Mean % change	Control Goup Mean % change	$\eta^2$
Y balance anterior reach (right leg)	15.4%	12.2%	.011
Y balance posteromedial reach (right leg)	10.0%	3.2%	.048
Y balance posterolateral reach (right leg)	25.2%	19.0%	.021
Y-Right (composite score)	20.5%	15.2%	.041
Y balance posteromedial reach (left leg)	9.3%	1.3%	.037
Y balance posterolateral reach (right leg)	24.3%	13.2%	.037
Y-Left (composite score)	19.0%	15.4%	.034
Frontal split test	8.3%	0.8%	.01
Somersault test	60.3%	28.4%	.138
Frontal kick preparation test right leg	26.9%	4.9%	.084
Frontal kick preparation test left leg	26.2%	10.6%	.068

*Note.* M = Mean value; SD = Standard deviation.

The Karate group reported moderate effects (highlighted in yellow) in improvements on Y balance test posteromedial reach and composite score for the right leg; and on frontal kick preparation test of both the legs. Strong effect size (highlighted in green) was reported on Somersault test ( $\eta^2 = .138$ ) with a mean percentage increment of 60.3% in comparison to that of the control group of 28.4%. Weak effects were reported for all the other outcomes' improvements in the Karate group.

## Discussion

After the intervention period, participants in the Karate group reported significantly higher values in the post test evaluations in comparison to the Control group in all the motor tests, with exception of the Castle test and the Y balance anterior reach for the left leg where no differences were detected. The findings

support the fact that Karate@school project is effective in improving motor abilities of children aged 7-9 years.

In particular, a strong effect was reported for Somersault test with an average improvement of 60.3% among the experimental group. Therefore the intervention seems particularly effective in improving specific coordination: in fact the Somersault test evaluates specific coordination and the skills and abilities involved in the complete somersault can be considered peculiar of Karate.

## References

Kinzey, S. J., & Armstrong, C. W. (1998). The reliability of the star-excursion test in assessing dynamic balance. *Journal of orthopaedic & sports physical therapy*, 27(5), 356-360.

Vickers, A. J., & Altman, D. G. (2001). Analysing controlled trials with baseline and follow up measurements. *Bmj*, 323(7321), 1123-1124.