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Original Article

Developing educational tools that incorporate basic movements of judo into physical education classes for eight-years-old elementary school students

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Abstract
Judo has been a mandatory aspect of physical education classes at junior high schools in Japan since 2012. However, unlike swimming and dance, judo is considered a form of exercise that students learn after starting junior high school. Therefore, there is no systematic curriculum organized according to the developmental stage of students that covers the period, including elementary school, up to the junior high school. Yogi et al. (2022) conducted a study emphasizing the systematic nature of physical education classes at elementary school up to the junior high school, examining the lower grades of elementary school. Therefore, the current study developed educational tools that incorporate basic movements of judo into the learning content of physical education classes for students in the middle grades of elementary school (eight-years-old children) and examined the usefulness of those educational tools by testing the physical fitness and motor skills of the students. An elementary school affiliated with a national university cooperated in implementing the lessons. The participants comprised six boys and six girls in the third grade of elementary school (all aged eight), for a total of 12 participants. The intervention was conducted in March 2022, involving a total of six lesson plans. A survey was conducted to examine the usefulness of the developed educational tools, assessing students' performance using the following exercises to test physical fitness and motor skills: dustcloth walk, grip strength, and paired ball walk. The results of this study demonstrated a significant improvement in the time that students took to move forward and backward in the dustcloth walk exercise. Furthermore, students' performance in terms of the left-hand grip strength and time required to complete the paired ball walk exercise showed significant improvements. The results suggest that the educational tools developed in this study, incorporating basic movements of judo into the learning content of physical education classes, may prove useful for classes in the middle grades of elementary school (eight-years-old students). The generic and practical nature of the educational tools developed in this study means that they may also be useful for instructional programs outside of physical education classes, such as judo clubs for children of the same age.
Keywords: **Judo, judo instruction, physical education classes, development of educational tools**

Introduction

In Japan, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) stipulates Courses of Study (i.e., curriculum guidelines), which set the standards for the curriculum to ensure that a certain level of education is maintained at all schools nationwide. The Courses of Study are revised approximately once every decade. In 1958, when the Courses of Study was first established in law, what is currently referred to as *budo* (i.e., the more traditional martial arts) were then referred to and classified using the word *kakugi* (referred to as "martial arts" hereinafter). The Junior High School Course of Study (1958) listed sumo, judo, and kendo as martial arts, stipulating that schools must select one martial art to be taught to each grade and that they should be taught only to boys. According to Motomura (2011), girls would opt for dance and home economics classes, whereas boys would opt for martial arts. At that time, martial arts were allocated 12–15 class hours a year, accounting for 5%–10% of the total time allocated for physical education. The 1969 revision of the Junior High School Course of Study (1969) established the promotion of health and physical fitness as a basic policy, increasing the number of hours of Health and Physical Education classes by 20 hours for each grade, resulting in an increased allocation of time for martial arts. The class hours for each subject were reviewed in the 1977 revision, and the class hours for Health and Physical Education were returned to the previous 105 hours, with the aim to facilitate a greater degree of comfort in students' school lives. However, the seven categories of exercise were reduced to five (gymnastics, individual sports, team sports, martial arts, and dance), increasing the overall weighting of martial arts.

In the 1989 revision of the Junior High School Course of Study (1989), the name of the category of exercise that had been referred to as "martial arts" (*kakugi*) until then was changed to *budo*. Sugiyama (1989) elucidated that the terminology was changed to include an emphasis on traditional behaviors that were particular

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to *budo*, rather than simply defining it as a sport. Furthermore, Todo (2005) highlighted that the name was changed from martial arts to *budo* to better realize the instruction that could make the best use of the characteristics of Japan's unique culture. A major improvement of this revision was that previously only boys could take martial arts, but now *budo* has become available to girls as well, aiming to achieve gender equality and a gender-equal society. However, the emphasis was switched from encouraging the practice of sports throughout the life course of the students, and consequently, class times were no longer stipulated for physical education, as time was now to be allocated for the different categories of exercise based on the extent to which a given student had attained proficiency in that exercise.

Therefore, as with the other categories of exercise, the number of hours allocated for *budo* classes was to be organized according to the specific situations of individual schools, with further variations in terms of the uptake of *budo* classes emerging with the subsequent introduction of a system of optional categories of exercise for physical education. The 1998 revision of the Junior High School Course of Study (1998) reduced the number of lesson hours in each subject in line with reductions in the total number of lesson hours to promote a more relaxed approach to education. The number of class hours in Health and Physical Education was reduced from 105 hours a year to 90 hours, but *budo* was an optional category of exercise; therefore, there was no significant change in terms of *budo* uptake from the time of the 1989 revision.

The 2008 revision of the Junior High School Course of Study (2008) made the previously optional *budo* compulsory for all students in the first and second grades from the 2012 academic year onward. In 2007, the Physical Education and Health Specialization Subcommittee of the Central Education Council, which was in the process of revising the Course of Study, created a draft thereof that made both *budo* and dance mandatory in the first and second grades, both previously being optional in junior high school Health and Physical Education classes. This draft was subsequently compiled and reported to the MEXT by the Central Council for Education in January 2008; thereafter, the new Course of Study was announced in March of the same year. There were various contextual factors influencing the decision to make *budo* compulsory; among these, Sato (2009) highlighted revisions to both the Fundamental Law of Education (2006) and School Education Act (2007), which were intended to enhance education within individual school subjects, enabling them to serve as a means for accepting, passing on, and developing the culture and traditions of one's own country in response to the increasing globalization of the international community, and that in this context, the subject of Health and Physical Education started to emphasize instruction in *budo*.

The 2008 and 2018 revisions of the Course of Study (2008; 2018a) focused on providing students with the foundation for a fulfilling engagement with sports throughout their lives, with instructional content tailored to the developmental stages of students. The background to introducing systematic instructional content based on students' developmental stages can be found in Article 45 of the School Education Act, which stipulates that "the purpose of junior high schools shall be to provide general education in the form of compulsory education based on the foundation of elementary schools, according to the mental and physical development of students." In addition, Article 30, Paragraph 2 of the School Education Act stipulates that junior high schools shall "provide students with essential knowledge and skills so that they can develop a foundation for lifelong learning." Thus, the objectives became more explicitly linked at the compulsory education stage. In particular, looking at 12 years from the beginning of elementary school to the end of high school, the developmental stages were divided into blocks of four years as follows: a period in which students lay down the foundations of various forms of exercises; a period in which they gain a breath of experience of different types of exercises; and a period in which students connect their experiences with lifelong sports practices. Furthermore, it was clearly stated that junior high schools should emphasize their connections with elementary schools.

Unlike categories of exercise, such as swimming and dance, for *budo*, including judo, there is no systematic curriculum that covers the period through elementary and junior high schools according to the developmental stage of students. Yogi and Kyan (2021a) conducted a survey of junior high school Health and Physical Education teachers regarding the introduction of judo-related activities starting in elementary school. The study found that numerous teachers agreed on the importance of providing instruction according to the developmental stage of students starting in elementary school. Various studies on judo educational tools for junior high school students have been conducted since *budo* was made compulsory in Japan in 2012 (Ozawa et al. 2012; Kozaki & Suganami 2015; Yogi & Kyan 2021b).

However, there are a few studies on the development of educational tools examining physical education classes in elementary schools with a focus on the systematic judo instruction that are tailored to the developmental stage of students. In one such study, Yogi et al. (2020) developed educational tools that incorporated basic movements of judo, such as "gripping" and "rolling." In another study, Yogi et al. (2022) developed educational tools incorporating the "slide stepping" movement in addition to "gripping" and "rolling." However, all these studies focused on students in the lower grades of elementary school (children aged six and seven), and hence, there is a need to develop educational tools that account for the developmental stage of students in the middle grades. Therefore, the current study developed educational tools that incorporated basic movements of judo into learning content for students in the middle grades of elementary school (children aged eight) and examined the usefulness of those educational tools.

Material & methods

(1) Educational tools that incorporate basic movements of judo

The Elementary School Course of Study (2018b) describes six areas of exercise content: stretching and gymnastics, equipment-based exercise, athletics, swimming, ball exercises, and expressive exercise. There is no curriculum for *budo*, including judo, in an elementary school. In this context, to develop educational tools for elementary schools that incorporate basic movements of judo, it is most desirable to encourage students to perform exercises that create the various movements included in the aforementioned "stretching and gymnastics" category. The stretching and gymnastics category was introduced in the 1998 Course of Study with the aim of improving the physical fitness of children in response to a decline in physical fitness that had been ongoing since the latter half of the 1980s. Five exercises are intended for students in the middle grades (children aged eight and nine) that create various physical movements: physical balance exercises, physical movement exercises, equipment-based exercises, exercises that test strength, and exercises that combine basic movements. Therefore, the current study employed a lesson plan with a total of six sessions (45 minutes each), focusing on developing educational tools that incorporated basic movements of judo (slide stepping, grip strength, posture, and gripping techniques [*kumite*]) into physical movement exercises, exercises that test strength, and exercises that combine basic movements. The "slide stepping" (*suri-ashi*) from judo was employed as a physical movement exercise. Slide stepping is a distinctive movement found in *budo* in which the practitioner walks on the floor in a manner akin to shuffling the soles of the feet and is a basic movement that is learned in the initial training stage. An exercise that uses the students' "grip strength" using a white belt was adopted as an exercise to test strength. Developing grip strength is important to prevent injury when throwing one's opponent. For the exercise that combines basic movements, an amalgamation of posture and gripping techniques was adopted for the upper body, along with slide stepping in the lower body. This combination of movements forms the basic movements used when developing one's attack and defense while grappling an opponent.

For the physical movement exercise, a "dustcloth walk" educational tool was developed to enable students to acquire slide stepping movements. In the dustcloth walk exercise, students were instructed to stand on two dustcloths and slide their feet in a manner that enabled them to move forward, backward, and sideways (Photos 1 and 2). For the exercise to test strength, educational tools were developed to improve grip strength, given the importance of keeping one's hands gripped to prevent injury when throwing an opponent with a throwing technique. Students were taught how to leverage their full strength when pulling a white belt (Photo 3). For the exercise that combines basic movements, an educational tool was developed in which pairs of students were asked to hold two balls (one in each hand) between them with their upper body facing each other, thereby enabling them to develop posture and gripping technique, and to use their lower bodies to combine movements using slide stepping that incorporates forward, backward, and sideways movements that they learned in the dustcloth walk exercise. This exercise is referred to as the paired ball walk, during which students were instructed to move quickly and in the correct posture without dropping the balls (Photo 4). The Course of Study (2018b) stipulates that physical education classes should provide students with opportunities to engage in activities that enable them to experience the joy of exercise, resulting in improvements to students' physical fitness. Consequently, the three educational tools developed in the current study have been created to initiate content that enables children to enjoy themselves with their current strength before moving to the content that they can enjoy as they challenge themselves in a step-by-step manner according to their progress.


(Photo 1)


(Photo 2)


(Photo 3)


(Photo 4)

(2) Study Period and Participants

An elementary school affiliated with a national university collaborated in implementing the lessons in the current study. The participants were six boys and six girls in the third grade of elementary school (all aged eight), for a total of 12 participants. The participants were extracted from a group of children with average total scores in the physical fitness tests conducted at the cooperating school. A total of six lessons were planned in the period from the first week to the second week of March 2022. Regarding ethical considerations, the researcher provided an informed consent explanation to the school principal and homeroom teachers that participants would not be disadvantaged by cooperating with the survey, that they could ask the researcher to explain the contents of the survey, and that no individuals would be identified as the collected data would be analyzed as a representative value of the survey population.

(3) Survey content

In this study, tests of physical fitness and motor skills were conducted to examine the usefulness of the developed educational tools. The test comprised the following exercises: the dustcloth walk, grip strength, and paired ball walk.

In the dustcloth walk exercise, participants stood on two dustcloths (length 27 cm; width 18 cm) and the researcher measured the time that participants took to move 10 m forward and 10 m backward (total 20 m) in the gymnasium with their feet on the dustcloths. Furthermore, the researcher measured the time that participants took to move 10 m to the right and 10 m to the left (total 20 m) by sidestepping. Participants' grip strength was measured once for each left and right hand, and the mean value was calculated. A grip strength meter (GRIP-D, manufactured by Takei Scientific Instruments Co., Ltd.) was used. For the paired ball walk, a MIKASA soft volleyball (circumference 78 cm; weight 210 g) was used, and a square with 3.5 m sides was drawn with a line. The researcher measured the time participants took to move along the line in pairs through slide stepping while maintaining the correct posture without dropping the two balls. The tests of physical fitness and motor skills were implemented after the second and sixth lessons out of the six lessons. A SEIKO stopwatch was used to measure time in the dustcloth walk and paired ball walk exercises.

(4) Analysis

A paired t-test was performed using the records of the participants' performance in the three exercises as tests of physical fitness and motor skills conducted after the second and sixth sessions. Statistical analysis in this study was performed using Excel 2016 and SPSS Statistics 25. The level for statistical significance was set to * $P < 0.05$.

Results

(1) Dustcloth walk exercise

Table1 Comparison of participants' performance after the second and sixth sessions of the dustcloth walk exercise

Gender	Item	First half of unit		Second half of unit		t value	P value
		Mean	SD	Mean	SD		
Boys (n=6)	Forward and Backward Dustcloth walk (seconds)	20.44	3.61	16.74	3.16	5.53	0.01*
	Sideways Dustcloth walk (seconds)	21.05	3.42	18.44	2.16	1.88	0.12
Girls (n=6)	Forward and Backward Dustcloth walk (seconds)	21.62	3.62	17.20	1.43	3.23	0.02*
	Sideways Dustcloth walk (seconds)	21.68	3.83	20.20	2.36	1.31	0.25

Table 1 reports the participants' performance records and t-test results after the second and sixth sessions of the dustcloth walk exercise. For both boys and girls, the total time taken to walk 20 m (moving 10 m forward and backward each) was significantly less after the sixth session than after the second session, and a statistically significant difference was observed. However, although there was a similar improvement in participants' performance in the sideways movement exercise, no statistically significant difference was observed.

(2) Grip strength

Table 2 Comparison of grip strength after the second and sixth sessions of the grip strength exercise

Gender	Item	First half of unit		Second half of unit		t value	P value
		Mean	SD	Mean	SD		
Boys (n=6)	Right hand Grip strength (kg)	13.13	1.74	14.07	2.60	-1.29	0.25
	Left hand Grip strength (kg)	13.25	1.89	13.90	2.02	-4.70	0.01*
Girls (n=6)	Right hand Grip strength (kg)	12.62	2.80	13.30	2.70	-1.22	0.28
	Left hand Grip strength (kg)	12.45	2.13	13.45	1.83	-3.44	0.02*

Table 2 presents the participants' performance records and t-test results after the second and sixth sessions of the grip strength exercise. For both boys and girls, an improvement was noted in the grip strength of the right hand after the sixth session compared with that after the second session; however, no statistically significant difference was observed.

Furthermore, an improvement was noted in the grip strength of the left hand in both boys and girls after the sixth session compared with that after the second session, and a statistically significant difference was observed.

(3) Paired ball walk

Table3 Comparison of participants' performance records after the second and sixth sessions of the paired ball walk exercise

Gender	Item	First half of unit		Second half of unit		t value	P value
		Mean	SD	Mean	SD		
Boys (n=3)	Paired ball walk (seconds)	11.07	1.50	6.32	0.92	5.76	0.03*
Girls (n=3)	Paired ball walk (seconds)	12.97	2.73	6.24	0.31	4.63	0.04*

Table3 report participants' performance records and t-test results after the second and sixth sessions of the paired ball walk exercise. There was a statistically significant reduction in the time taken for both boys and girls to complete the exercise after the sixth session compared with that after the second session.

Discussion

The dustcloth walk exercise measured the time that participants took to move a total of 20 m backward and forward (10 m in each direction) by shuffling dustcloths with their feet while retaining control of the dustcloths and a total of 20 m sideways (10 m to the right and left each) through slide stepping. In the sessions in the first half of the lesson plan, the students found the exercise difficult because they were not accustomed to walking with the soles of their feet shuffling on the floor in their daily lives, but with practice, their movements smoothened. In the dustcloth walk exercise, improvements in students' performance appeared to be associated with students' learning movements through practice, such as walking without raising the feet off the floor and moving with speed. Yogi et al. (2022) developed educational tools that incorporated slide stepping for children in the lower grades of elementary school and used the same method of measuring time as in the current study (albeit only measuring the time take to move 10 m forward by slide stepping), reporting that students could learn basic movements of judo. In this study, considering the developmental stage of students in the middle grade (children aged eight), in addition to forward movement, the educational tools incorporated backward and sideways movements. The results revealed a significant reduction in the time taken to move forward and backward and a positive change in sideways movement after the sixth session, albeit not a statistically significant one. Slide stepping is defined as one of the basic movements of judo (MEXT, 2018a) and is the first movement that students learn in junior high school physical education judo. Therefore, acquiring this movement in the middle grade of elementary school, a period identified as being the most suitable for learning movements within an athletics course (Miyashita, 1984), should enable students to smoothly transition to the motor skills required at junior high school.

The students demonstrated a significant improvement in terms of grip strength for both the right and left hands after the sixth session compared with that after the second session; however, a statistically significant difference was observed only for the left hand. The 12 participants, six boys and six girls, had a dominant right hand. Given this fact, it is certain to believe that the performance of the right hand, which is the dominant hand, would be significantly improved. However, the result was the opposite. Studies have suggested that dominant and nondominant hands are determined by the frequency of use (Oldfield, 1971; Touwen, 1972), and other studies have reported that children decide which hand they prefer to use around eight years of age (Nakao et al., 1997). Considering these facts, although the participants in the current study were children with a dominant right hand, the participants' performance after the second session demonstrated no significant difference in the grip strength between the dominant and nondominant hands. It is interesting to note why the participants' performance with the nondominant left hands demonstrated significant improvement. The frequency of use of muscles in daily life has been found to affect muscle strength (Chi et al. 1977; therefore, children with a dominant right hand may use their right hand more frequently than their left hand in their daily lives. However, the educational tool using a white belt developed in the present study required students to hold the white belt with both hands and pull it toward them. Therefore, it is likely that students' performance was significantly improved through use of the left hand, that is, the nondominant hand that they used less in daily life. In addition, although no significant difference was observed, students could improve their performance with the dominant right hand. The grip strength performance of children, including elementary and junior high school students, was found to be on a marked declining trend in Japan since the 1990s (Yogi & Kokudo, 2014; 2015). Since it is extremely rare to exert maximum muscle strength in daily life (Halaney & Carey, 1989), the educational tool developed in this study in which students hold a white belt with both hands and pull it toward themselves may teach not only the basic "gripping" movement in judo but also enable students to exert their maximum strength as they pull the white belt toward themselves opposite their friends. This suggests that the exercise of pulling the white belt with both hands may be useful as an educational tool for improving the declining grip strength of children in Japan.

In the paired ball walk exercise, pairs of students were required to face each other and hold two balls between them without dropping them, which was associated with appropriate posture and gripping technique in the upper body leads while incorporating the forward, backward, and sideways movements that students learned in the dustcloth walk exercise into the lower body. This exercise uses a combination of different movements of

the upper and lower bodies, which, when properly combined, enables a practitioner to move quickly when grappling an opponent in judo to develop offensive and defensive skills. This exercise was scheduled for practice after every session of the dustcloth walk exercise. In the first half of the planned sessions, the students experienced great difficulty in learning different movements for the upper and lower bodies. However, with practice, they could learn to move with the correct posture, combining the sensation of holding the balls between them with the sensation of moving by slide stepping. Consequently, the students could significantly improve their performance after the sixth session. Practitioners must use various movements according to the movement and speed of the opponent when grappling in judo to develop offensive and defensive skills. Therefore, this exercise makes it possible to practice these skills in a manner suited to the student's age by adapting the exercise depending on their developmental stage; for example, by using larger or heavier balls or expanding the area in which the students need to slide step.

Study limitations

The study was conducted under limiting conditions (in terms of sample size, lesson plan, implementation time, etc.) at the cooperating schools. Moreover, there is a definite possibility that the tests of physical fitness and motor skills that were conducted include results in which participants' performance was over- or underestimated because of the effects of social desirability at that time among the participants. Nonetheless, the study examined the usefulness of the developed educational tools from different angles based on the results of the physical fitness and motor skills tests, and it was, therefore, possible to ensure that the results were representative to a certain extent.

Conclusion

The study developed educational tools that incorporate basic movements of judo into a plan with a total of six lessons for students in the middle grade of elementary school (children aged eight). Furthermore, it examined the usefulness of those educational tools using tests of physical fitness and motor skills. When the results after the sixth session were compared with those after the second session, improvements were demonstrated in the students' performance in all three exercises (dustcloth walk, grip strength, and paired ball walk) for both boys and girls. This suggests that the educational tools developed in this study may be useful in the context of physical education for students in the middle grades of elementary school. Consistent with the previous research by Yogi et al. (2022) on the development of educational tools for judo-related activities for the lower grades of elementary school, the current study demonstrated the usefulness of educational tools that incorporate the basic movements of judo into physical education classes in the middle grade of elementary school, which had not previously been studied. In addition, the educational tools developed in this study are generic and practical, and therefore, they are likely suitable for use in instructional programs both within physical education classes in elementary schools and in judo clubs for children of the same age.

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