

The Effect of Karate Practice on Self-Esteem in Young Adults with Visual Impairment: A Case Study

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ABSTRACT

Previous research has not examined the potential relationship between physical activity interventions and psychological domains of young adults with visual impairment (VI). This study aimed to investigate whether karate practice improves the self-esteem of young adults with VI. A secondary aim of this study was to explore the exercise and self-esteem model (EXSEM) on young adults with VI. Following a non-concurrent multiple baseline approach, four males and one female (age range 19-40 years) with VI participated in this study. Four undergraduate students completed the Self-Perception Profile for College Students and one postgraduate student completed the Adult Self-Perception Profile. All participants completed the Physical Self- Perception Profile and the Exercise Self-Efficacy Scale. When the score stability was attained the intervention was introduced. Each participant attended a 60-minute karate session twice a week for 10 weeks at the University of Edinburgh. The students completed all questionnaires every two weeks during the karate program and a visual inspection approach was used for data analysis. Visual inspection showed that four participants improved their global self-esteem. Self-efficacy was improved in three participants whereas the other two had high self-efficacy before participation in the karate program. Most of the physical self-perception domains were improved for all five participants while one participant did not improve one domain of the physical self-perception. Findings suggest that karate practice may improve self-esteem, physical self-perception, and exercise self-efficacy in young adults with VI.

Keywords: Karate, Self-esteem, and EXSEM

INTRODUCTION

Physical inactivity during childhood, adolescence and early adulthood may be associated with future health problems such as cardiovascular diseases, obesity, and cancer (van Oostrom et al., 2012). Although physical inactivity is a major health concern for all, Lieberman et al. (2010) believe that people with impairments are at a higher risk of developing sedentary lifestyle. Other studies (Kozub & Oh, 2004; Lieberman, et al., 2010; Lieberman & McHugh, 2001; Longmuir & Bar-Or, 2000; Skaggs & Hopper, 1996), have also found that children and adolescents with visual impairment (VI) are less physically active and in poorer physical condition than sighted peers. Unfortunately, sports participation in adolescence is one of determinants for leading an active life during adulthood (de Montes, Arruza, Arribas, Irazusta, & Telletxea, 2011; Stuart, Lieberman, & Hand, 2006) and growing evidence shows that being active when young can influence the level of physical activity later in life (Buckworth, Dishman, O'Connor, & Tomporowski, 2013).

For instance, Tammelin (2003) evaluated the association between participation in different adolescent sports and physical activity in adulthood. A follow-up survey included 7794 males and females who completed the questions about their physical activity at the age of 14 and at the age of

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31. Participation in sports after school was associated with a high level of physical activity later in life, and this outcome has been supported recently by (Houotari, Nupponen, Mikkelsen, Laakso, & Kujala, 2011). They conducted a 25-year follow-up study to explore how sport participation in leisure time during adolescence predicts leisure-time physical activity in adulthood. In their study 1525 males and females completed muscular fitness, agility, aerobic capacity, and self-report weekly frequencies of activity when they were adolescents and 25 years later (1976-2001). Results showed that activity in adolescence predicted activity in adulthood in both males and females and the risk for adult inactivity was significantly lower for those who were physically inactive in adolescence.

Since children and adolescents with disabilities seldom participate in exercise and physical activity (Longmuir & Bar-Or, 2000) they are more likely to be inactive with increasing age. From this perspective, children and adolescents with VI are worthy of further study as they are less engaged in physical activity than sighted children and adolescents (Sport England, 2001) and less involved in physical education classes than the curriculum standard (Atkinson & Black, 2006). Although previous literature did not explore whether people with VI who were inactive in childhood are inactive later in life, Kozub and Oh (2004) reported an inverse relationship ($r = -.75$) between age and physical activity level among children and adolescents with VI. Another study (Ayvazoglu, Oh, & Kozub, 2006) examined the relationship between the physical activity level of children with VI and the physical activity of their parents/siblings. Five families and six children with VI participated in the study, physical activity was monitored whilst they wore accelerometers for seven days, and open-ended interviews were conducted with the parents. Quantitative findings revealed that younger children were more active than older participants.

The results above indicate that both normally sighted and people with VI become more inactive with increasing age from childhood toward adulthood. Further, children with VI are less physically active than sighted people. However, to date evidence suggests that young adults with VI need to be more physically active (Kakiyama, Koda, & Matsuda, 1999; Willis, Jefferys, Vitale, & Ramulu, 2012). Sherrill et al. (1984) found that adults with VI reported little involvement in physical education classes during childhood/adolescence and reported lack of encouragement to develop physical/recreational activities. More recently, Holbrook et al. (2009) studied men and women with mild VI ($n=8$), moderate VI ($n=9$), and severe VI ($n=8$). Physical activity levels were quantified with a Step Activity Monitor for a 7-day period. In their study participants' averaged 8,028 steps a day, which was below the physical activity recommendation of approximately 10,000 steps per day (Tudor-Locke & Bassett, 2004). Furthermore, the authors highlighted that this volume of physical activity (8,028 steps a day) was similar to the values reported among older adults ($M=79$ years) with functional limitations (Cavanaugh, Coleman, Gaines, Laing, & Morey, 2007). Willis et al. (2012) explored how accelerometer-measured physical activity is affected by VI and uncorrected refractive error. All participants ($n=2852$) were older than 20 years and divided into three groups: VI, uncorrected refractive error, and normal sight. Results showed that adults from the first group (those with VI) scored significantly less steps per day and were significantly less engaged in moderate or vigorous physical activity ($p \leq .01$).

Benefits of physical activity, the consequences of physical inactivity, and its relationship to psychological and social aspects have been established in the literature. Many different psychological and social health benefits of physical activity participation were reported for children and adolescents (Eime, Young, Harvey, Charity, & Payne, 2013b) and adults (Eime, Young, Harvey, Charity, & Payne, 2013a). Self-esteem was the most commonly being improved domain for children and adolescents (Eime, et al., 2013b). A positive impact of physical activity participation on self-esteem in children and adults has been previously reported by others (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2009; Spence, McGannon, & Poon, 2005). Self-esteem is particularly important since it is positive self-regard, self-worth, or overall good feelings about self which is as the best indicator of the well-being of the self-system and an overall measure of success of the self-system (Sherrill, 2004).

However, studies of psychological aspects (including self-esteem) and physical participation of young adults with VI are scant and further study is warranted. Apart from one recent study (Papadopoulos, Montgomery, & Chronopoulou, 2013) previous research has failed to investigate the self-esteem level of young adults with VI as their studies have focused on children and adolescents

(Shapiro, Moffett, Lieberman, & Dummer, 2008). In the Papadopoulos et al. (2013) study among 108 adults ($M=34.81$ years, $SD=11.35$ years), people with VI achieved significantly lower self-esteem score on the Rosenberg self-esteem scale than those with normal sight.

To our knowledge there is only one study (Papadopoulos, et al., 2013) that included young adults to investigate self-esteem level of people with VI. However, they did not explore the relationship between exercise and self-esteem. The exercise and self-esteem model (EXSEM) (Sonstroem, Harlow, & Josephs, 1994) has been considered as a potential help for researchers to understand the relationships between exercise engagement and self-esteem (McAuley et al., 2005). For example, Moore et al. (2011) aimed to determine whether changes in response to resistance training of college students followed the hierarchical structure of the EXSEM. Since their results appeared to support the EXSEM, the authors strongly recommended examining the EXSEM with different population groups. Within the EXSEM it is assumed that exercise improves exercise self-efficacy which improves physical self-worth (sport competition, sport conditioning, body attractiveness, and physical strength) to better global self-esteem (GSE).

Martial arts are considered to be a unique form of exercise that focuses the correct mental and physical participation and not simply on winning or receiving extrinsic reward such as a black belt (Funakoshi, 1973). Traditional martial arts practice is not limited on teaching self-defence, but involves philosophical and ethical teachings to be applied to life. They have a high degree of ceremony and ritual, emphasize the integration of mind and body, and have a meditative component (Binder, 1997). Further, martial arts improve practice improves socialization (Lantz, 2002) intellectual ability (Ryan, 2008) and morality (Lantz, 2002). Previous studies have shown a positive impact of martial arts on exercise self-efficacy (Caldwell, Harrison, Adams, & Triplett, 2009), physical self-worth (Li, Harmet, Chaumeton, Duncan, & Dincan, 2002; Linxuan, 2011), and GSE (Brown et al., 1995; Lee, Lee, & Woo, 2010; Mustian et al., 2004; Yin, 2006).

Therefore the purposes of the present study were to:

- a- investigate the effect of martial arts program on self-esteem in young adults with VI through the EXSEM.
- b- provide descriptive analyses of self-efficacy, physical self-perception, and self-esteem levels in young adults with VI.

METHODS

In order to recruit participants, a description of the present study was outlined and sent to the disability offices at both the University of Edinburgh and Edinburgh Napier University. Six students subsequently contacted the researchers for further information. More detailed information about the study was emailed to the six respondents. However, one student did not respond and therefore only five young adults (four males and one female) were recruited for this study. Profiles of these students are presented in table one below.

Measures

Following the EXSEM, three questionnaires were used:

Exercise Self-Efficacy: The Exercise Self-Efficacy Scale (EXSE) (McAuley, 1993) was used for all five participants. The scale was developed for sedentary middle aged adults and consists of 8 questions in which participants have to rate their confidence to participate in moderate physical activity 3 times for more than 40 minutes during the next week, the next two weeks; and so forth until the eighth week. The following is an example of the first item of the EXSE: "I am able to continue to exercise three times per week at moderate intensity, for 40+ minutes without quitting for the NEXT WEEK". Since no one particular activity exists within the phrase "exercise", using this scale with such items can include karate.

Table 1: Profiles of the five student participants

Participant	Age (years)	Gender	University level	Visual impairment
P1	19	F	Undergraduate	6/60
P2	19	M	Undergraduate	Visual field of 5° & 10°
P3	24	M	Undergraduate	6/18
P4	38	M	Undergraduate	2/60
P5	40	M	Postgraduate	Monocular blindness

Notes: P1= participant one, P2= participant two & so forth.

Also, this scale captures variation in mode of activity rather than focusing solely on aerobic activity (Elavsky et al., 2005), and meets Bandura's (2006) recommendations for a scoring system. The items on the EXSE scale were ranked on the basis of a 100-point percentage scale composed of 10-point increments, ranging from 0% (not at all confident) to 100% (highly confident). The scale has been used with disabled people in a previous study that included young participants aged 22 years (Motl, McAuley, & Snook, 2007). They reported internal consistency based on coefficient alpha for the EXSE .99. This high internal consistency of .99 was also found in older participants (Hu, McAuley, & Elavsky, 2005).

Physical Self-Perception: Physical self-description questionnaire (PSDQ) developed by (Marsh, Richards, Johnson, Roche, & Tremayne, 1994) and Richards Physical Self-Concept Scale (Richards, 1988) are similar to the Physical Self-Perception Profile (PSPP) (K. Fox & Corbin, 1989) and were designed for the same purposes. However, whereas Sabiston et al. (2012) reported that the PSPP and PSDQ are the best measures for physical self-perception, Sonstroem et al. (1994) expanded the EXSEM to include the PSPP but not the PSDQ. Therefore, it was decided to use the PSPP in our study. It consists of five 6-item scales of sport competence, physical condition, body attractiveness, physical strength, and physical self-worth. The PSPP was designed to reflect the advances developed by Harter (1985) and Shvaelson et al. (1976) in identifying the physical self as an important construct to measure in its own right, and to reflect the multidimensional hierarchical nature of the physical self (Marsh & Cheng, 2012). Each PSPP item consists of two opposite descriptions e.g "Some people are very competitive" but "Others are not quite so competitive". Participants have to choose the description that best fits and then indicate whether this description is sort of true or really true for them, using a 4-point Likert scale.

Self-esteem: The Self-Perception Profile for College Students (SPPCS) (Neemann & Harter, 1986) was used for the four undergraduate students and the Adult Self-Perception Profile (ASPP) (Messer & Harter, 1986) for the postgraduate student. These two scales follow a multidimensional approach of self-esteem which has been preferred in the literature, particularly when exercise interventions are present (Buckworth, et al., 2013). Reliability of the SPPCS and ASPP ranged between 0.76-0.92 and 0.63-0.92, respectively. Although Fox (1990) recommended using Rosenberg's Self-Esteem Scale (Rosenberg, 1965) accompanied with the PSPP, it was not considered appropriate for the present study as this study explores not only GSE but also self-esteem domains (such as intellectual, social, and morality). The SPPC and ASSP items consists of two opposite descriptions e.g "Some adults like the way they are leading their lives" but "Other adults don't like the way they are leading their lives". Participants have to choose the description that best fits and then indicate whether description is somewhat true or very true for them, using a 4-point Likert scale.

Although the SPPC and ASSP consist of 12 and 11 domains respectively, we will include only those that have been related in previous studies somehow to martial arts, namely; social acceptance (Jones, Mackay, & Peters, 2006; Lantz, 2002), intellectual ability (Ryan, 2008) and morality (Lantz, 2002). To our knowledge previous research has not reported any link between martial arts practice and scholar achievement, parental relationship, humor, job competence... etc.

Social validation: When the 10-week karate program was completed the participants answered social validation questionnaire. Study participants responded on a 1 (not at all) to 7 (very much so) Likert scale to the following four questions:

- (a) How important to you is improvement in exercise self-efficacy, physical-self-worth, and GSE?
- (b) Do you consider any of these improvements that have occurred to be significant?
- (c) How satisfied were you with the program?
- (d) Has the procedure proved useful to you?

To get in-depth answers such as recommended by Page and Thelwell (2013) and following Mellalieu et al. (2009), additional open-ended questions were utilized in an attempt to better understand the participants' perceived underlying reasons for the relative success or failure of the karate program. This audio-recorded interviews were semi-structured and focused on the three themes about the program (Martin, Thompson, & Regher, 2004), namely: participants' opinion about the goals of the program; participants' opinion about the program procedure; and participants' opinion about the results produced by the program procedure.

Procedures

Ethical approval for the study was granted by the ethics committee in the Moray House School of Education at The University of Edinburgh. The lead researcher met the participants individually and administered the informed consent process. After receiving the informed consent sheets the participants answered the three questionnaires several times (using large print or verbally) until the stability of dependent variables was found. Each participant completed the questionnaires during this stage within 12 weeks. Time between two subsequent measures varied between 2 and 6 weeks. When the stability (more details are available in data analysis) was found for each participant, he/she completed a Physical Activity Readiness Questionnaire (PAR-Q) which preceded the karate program. After four, six, eight, and ten weeks of the program the participants completed the questionnaires. This process is called a multiple baseline approach AB and according to Barker et al. (2011) represents one of the key methods for determining intervention effectiveness in applied research.

For the purposes of this study we used a non-concurrent multidimensional staggered baseline approach developed by Watson and Workman (1981) who claimed that this approach provides flexibility and has been considered as practical. According to Harvey et al. (2004) the non-concurrent designs could be arranged for different semesters and when the participants become available (Fox & Boliek, 2012; Watson & Workman, 1981; Wong, 2010). The flexibility was important for this study because the participants were university students at different levels and from different universities. Furthermore, some of participants were not from the UK and had to go to their own country at different times. Not all participants therefore were available at the same time. In this study, two participants started the intervention for 10 weeks, while the other three started their 10-week karate program during the intervention at different times. Therefore, the participants did not complete the sessions together (N=5) and were training as a group for only one and a half week.

Karate program

The participants attended our 'traditional' karate program twice a week (60 minutes per session) for 10 weeks. Although no concrete evidence has shown the necessary time for self-esteem improvement, previous literature has focused mainly on interventions that lasted between eight to twelve weeks (Linxuan, 2011; Taylor-Piliae, Haskell, Waters, & Sivarajan Froelicher, 2006; Yang, 1997; Yeh et al., 2013). For example, Yeh et al. (2011) found that a 12-week of martial arts practice were enough to improve exercise self-efficacy in people with heart failure (M=67 years, SD= 11 years). Similarly, a 11-week of taekwondo practice were enough to improve GSE in children (Yang, 1997) whereas 8-week of taekwondo program improved physical self-worth and GSE in college women students (M=22.61 years) (Finkenber, 1990). Therefore, we considered ten weeks as an appropriate period to show changes in self-esteem that could be associated with our karate program.

Following the example of others (Graham, 2007; Reeves, Nicholls, & McKenna, 2011; Shearer, Mellelieu, Shearer, & Roderique-davies, 2009), all sessions were led by the first author due to his karate qualifications as a coach (3rd Dan holder and 3rd level coach) and previous experience in teaching people with VI karate (about three years of experience). The sessions were held privately in one of the sports halls at the University of Edinburgh. During the training period all participants completed basic blocks, stances, punches, kicks and the first Kata (Heian Shodan). Kata is a form of predetermined series of movements that are performed against imaginary opponents (Doria et al., 2009). Although all participants had to complete Heian Shodan, teaching pedagogy and methodology were differentiated to accommodate the different visual abilities among participants. All sessions included physical training in addition to karate principles developed by (Funakoshi & Nakasone, 2003).

Data analysis

The two standard deviation (2-SD) (Shewhart, 1931) band method was used to compare the scores from each of the EXSE, PSPP, SPPCS, and the ASPP during the baseline. The 2-SD band method is known as statistical process control charts (SPC) (Orme & Cox, 2001). A process is said to be in control if the distribution of the data appears to be statistically stable over time (Wild & Seber, 2000). The SPC charts consist of three elements; a central line which usually represents the mean (CL), upper and lower control limit (UCL and LCL respectively) corresponding to \pm two standard deviations from the CL and are drawn as dashed lines parallel to the CL. The most appropriate chart for this study was X-mR-Chart (moving range chart) since it has been determined as useful in human single case experiments when the number of data points is relatively small (usually between 2-10), and when individual variability is high (Ottenbacher, 1986). If the process under study is producing normally distributed data points then 95% of the data points will fall within 2 SDs.

Visual analysis is a traditional basic method to analyse single-case research data and comprises visually inspecting data and judging whether an intervention had produced a significant change in the dependent variables (Kinugasa, Cerin, & Hooper, 2004). Visual analysis has been used in research as a method for identifying the effect of an intervention (Parker & Brossart, 2003), including sport-related studies (Barker & Jones, 2008; Jordet, 2005; Mellalieu, et al., 2009). Despite of the limitation that visual inspection has (subjectivity) (Barker, et al., 2011), Barker et al. (2013) reviewed 66 single case studies in the period from 1997 to 2012 and found that all of them employed both visual analysis and graphical procedure compared to 16 studies that used statistical analysis. Therefore, in the line with previous studies in the field, visual inspection was utilized to determine the impact of our karate program on the study variables.

RESULTS

Each participant's rating of the variables was graphed to provide a visual inspection of the effectiveness of the program. Following the EXSEM the figures below (figures 1a to 1e) show the three main variables of the EXSEM (exercise self-efficacy, physical self-worth, and GSE) for each participant during both the baseline and the karate program.

Table two (below) shows the EXSE mean score in the baseline and during the karate program period. The three participants (P1, P2, P5) with low baseline EXSE improved their EXSE scores during the karate program whereas, the other two (P3 and P4) had relatively stable scores.

In Table three, mean scores of the PSPP domains for the baseline and during the karate program are presented. Almost all of the physical domains were improved during the karate program for all five participants, the exception being physical strength for P2.

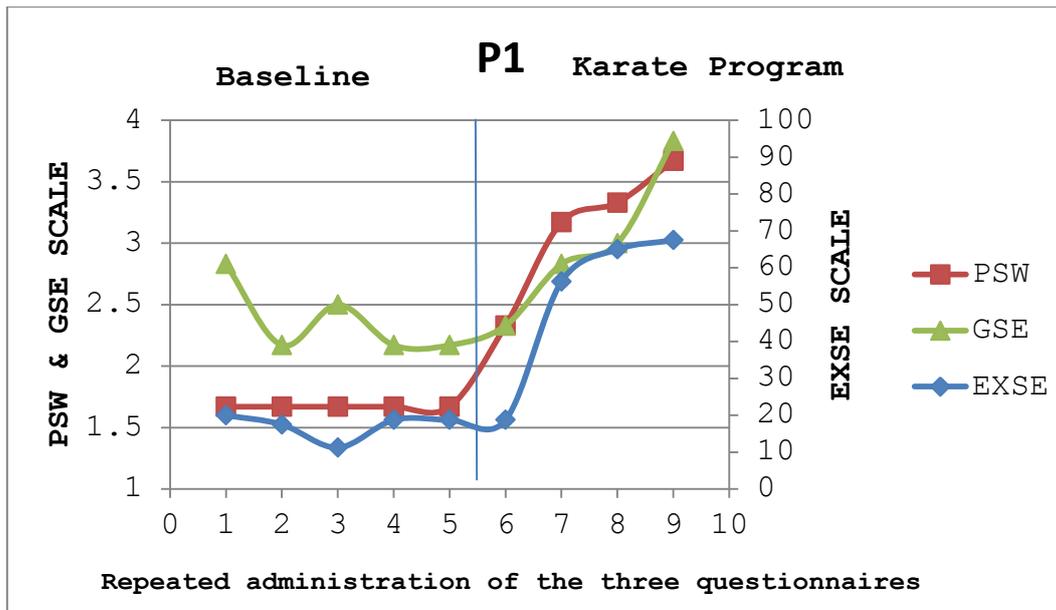


Figure 1a: The five repeat baseline questionnaire repeat measurements across a 3-month period, as well the four repeat questionnaire measurements during the 10-week karate program for each individual participant. Figure 1a is data from participant 1 (P1).

PSW= Physical self-worth, GSE= global self-esteem, EXSE= exercise self-efficacy

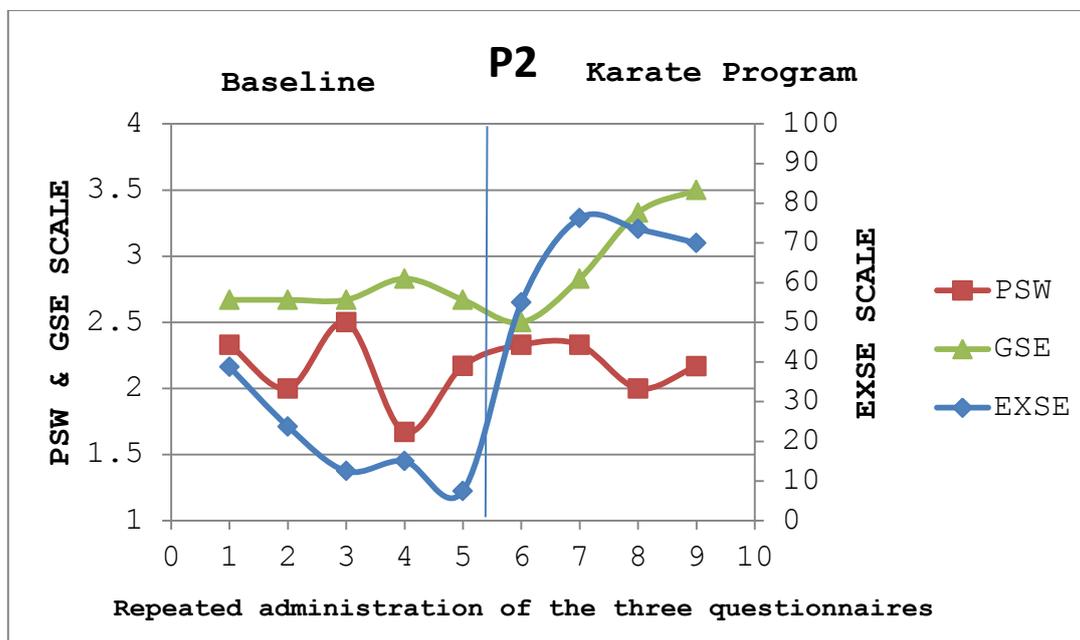


Figure 1b: Participant 2 (P2).

PSW= Physical self-worth, GSE= global self-esteem, EXSE= exercise self-efficacy

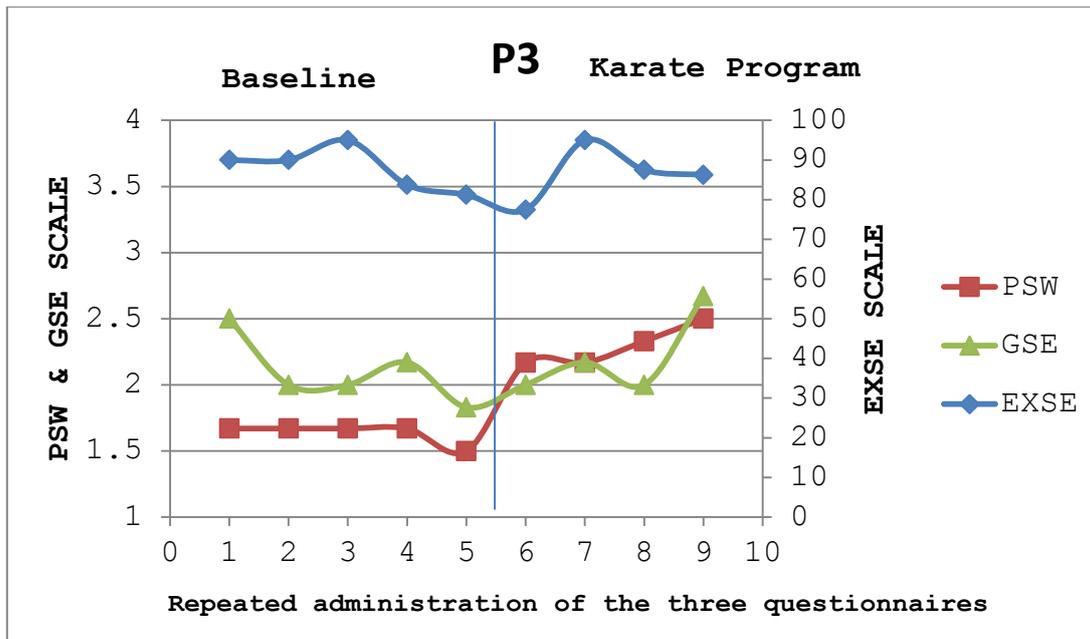


Figure 1: Participant 3 (P3).

PSW= Physical self-worth, GSE= global self-esteem, EXSE= exercise self-efficacy

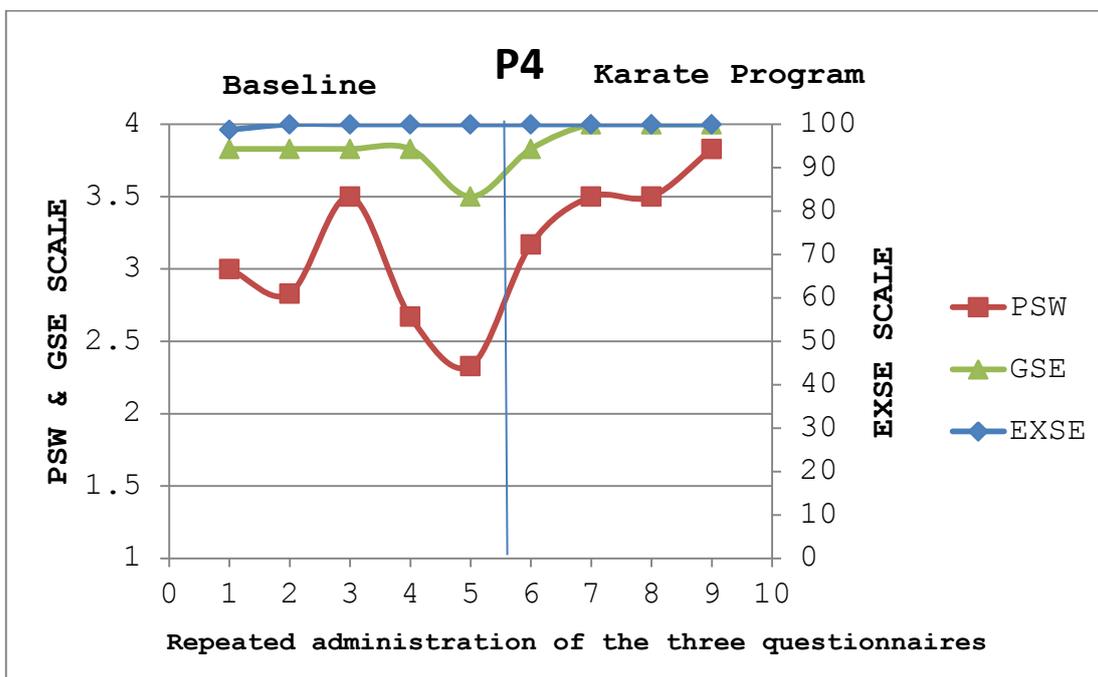


Figure 1d: Participant 4 (P4).

PSW= Physical self-worth, GSE= global self-esteem, EXSE= exercise self-efficacy

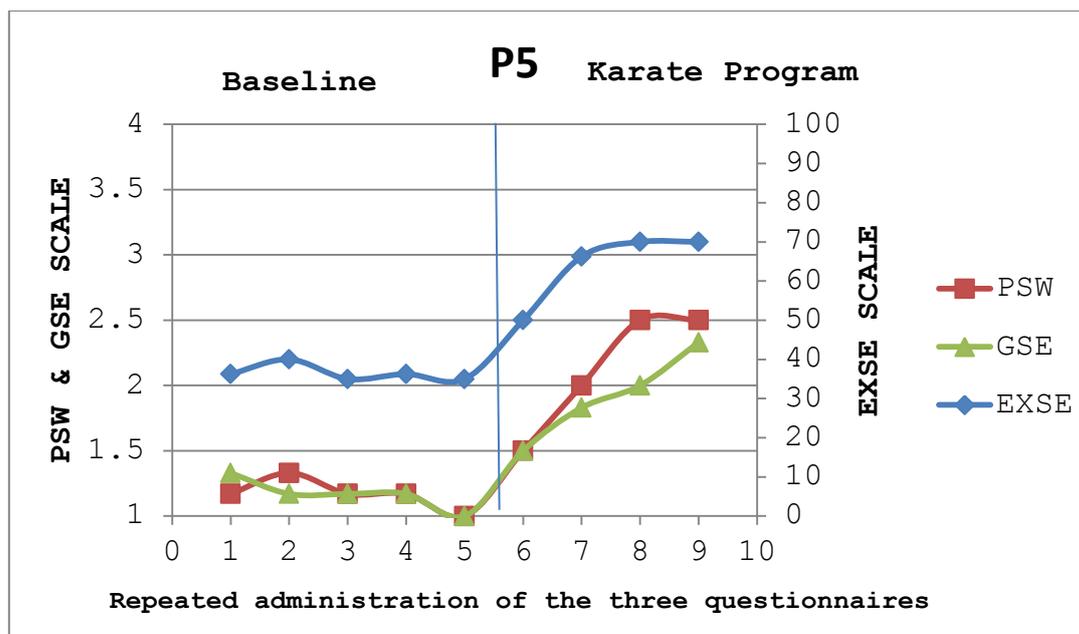


Figure 1e: Participant 5 (P5).

PSW= Physical self-worth, GSE= global self-esteem, EXSE= exercise self-efficacy

Table 2: Exercise self-efficacy mean scores during both baseline and the karate program for each participant (N=5).

Participant	P1		P2		P3		P4		P5	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
Score	17.25	51.87	19.5	68.68	88	86.56	99.75	100	36.5	64.06

Notes: P1= Participant 1, P2= Participant 2 and so forth.

M1= Mean score at the baseline, M2= Mean score during the karate program

Table 3: Physical self-perception profile domains mean scores during both baseline and the karate program for each participant (N=5).

Variable/Participant	P1		P2		P3		P4		P5	
	M1	M2								
Sport competition	1.79	2.20	1.37	1.83	2.1	2.37	3.57	3.75	1	2.04
Sport condition	1.6	3.41	2.47	2.54	2.34	2.75	2.77	2.84	1.47	2.38
Body attractiveness	2.26	2.79	1.5	1.92	2	2.42	2.5	2.96	1	1.08
Physical self-worth	1.67	3.13	2.13	2.21	1.64	2.29	2.87	3.5	1.17	2.13
Physical strength	1.8	2.92	3.17	2.83	1.83	2.13	2.13	2.96	2.1	2.67

Notes: P1= Participant 1, P2= Participant 2 and so forth.

M1= Mean score at the baseline, M2= Mean score during the karate program

Table 4: Self-esteem domains mean scores at baseline and during the karate program for each participant (N=5).

Variable/ Participant	P1		P2		P3		P4		P5	
	M1	M2								
Social	2.1	2.81	2.65	3.13	2	2.5	3.6	3.75	1	1.56
Intellectual	2.4	2.69	3	3.5	2.31	2.5	2.9	3.38	1.1	1.38
Morality	3.3	3.25	3.5	3.75	2.95	3	3.55	3.94	3.65	4
Athletic	1.9	2.81	1.2	1.88	2.7	2.75	3.55	3.63	1.1	2.31
GSE	2.39	2.99	2.7	3.04	2.1	2.21	3.76	3.96	1.17	1.92

Notes: mean scores of social acceptance, intellectual ability, morality, athletic competence, and GSE.

Baseline and during the program mean scores for social acceptance, intellectual ability, morality, athletic competence, and GSE are shown in table four (below). All participants showed an improvement during the karate program, except morality for P1, which decreased (0.05).

Social validation

The participants classified their answers into three categories based on the questionnaire (exercise self-efficacy, physical self-esteem, and GSE). Mean (M) and standard deviations (SD) were calculated across all five participants for the social validation measures, shown for each question below.

- 1- “How important to you is improvement in exercise self-efficacy, physical-self-worth, and global self-esteem?”
 - Exercise self-efficacy: M=4.9, SD= 0.74
 - Physical self-worth: M=5.4, SD= 0.54
 - GSE: M= 6.4, SD= 0.54
- 2- “Do you consider any of these improvements that have occurred to be significant?”
 - Exercise self-efficacy: M=5.3, SD= 0.83
 - Physical self-worth: M=5.8, SD= 1.09
 - GSE: M= 5.25, SD= 1.25
- 3- “How satisfied were you with the program?”
 - M= 6.3, SD= 0.44
- 4- “Has the procedure proved useful to you?”
 - M= 6, SD= 0.7

None of the participants scored under 4 in any of the questions. This means that the scores ranged from 4 to 7. However, through semi-structured interviews the participants had an opportunity to expand and explain their answers. The interviews aimed to identify positive and negative aspects of the program. This feedback may potentially give a critical feedback to us and to those who would like to introduce similar programs with similar aims to young adults with VI. From conducted interviews following two themes existed:

a. Positive and negative aspects of the program:

Two participants were not satisfied with the period of intervention and considered it too short a time period. P1 said that she was not very satisfied with the program stating: “I was satisfied with it (program) a lot but the reason for 0.5 is like I feel we could train more, like had more sessions. But everything else is really good” (P1).

P3 also shared P1’s opinion, stating: “I think it was nice. I just enjoyed it. I felt it was a bit short and there wasn’t too many people. I think I would improve more if you made it longer evidently and make it with more people but I do think it was quite nice” (P3).

Similarly, P2 enjoyed being involved with other people giving the program a score of 6, stating: “I liked being with other people doing sports together. I don’t do it very often so that was fun. So the kind of social aspects that was good” (P2).

P4 and P5, who assessed the program as 6 and 7 respectively, also enjoyed doing the program and this was associated with the pedagogical approach that was followed as well as the focus on philosophical and theoretical aspects of karate: “the conversations between the trainings were very, very important and very stimulating and very enjoyable for me. The theories, the aspects of karate, what do I think about this or that and that. It was interesting to experience that, to talk about that. I enjoyed that” (P4).

P1 and P2 also felt happy that they tried new skills which reflected in their perspective of their improvement, reflected in the following quote by P1: “the very clear outcome is that I found I can be good in sports which I haven’t have these taught before. It’s a new skill, it’s the first time I feel confident about sports” (P1).

Whilst P3 stated that he became more confident about his body and physical strength, P4 employed some of the skills in his personal life, stating: “I use the technique of relaxation, when I am stressed I am using the technique you told us about, the breathing, controlling it, trying to observe what’s happening, don’t react right the way and if you decide to go, you don’t go back just keep going forward. I kind of translated not only to the physical but for my personal life I start something” (P4).

b. Karate program for people with VI

All participants agreed that such programs are needed for people with VI for different reasons. For example, “I think they would benefit from it physically and psychologically” (P5).

More precise were the other four participants who focused on social interaction. For instance, “it improves your fitness, provides a new skill to you, also I loved to meet new people, new friends, like who train with you. I think it is a good thing” (P1).

P3 highlighted more philosophical point, as follows: “martial arts in general, self-defence is really important just to feel confident with yourself. If you are suffering it makes you more comfortable, I mean like suffering in a real life. Not just with physical pain but like you know perceptions in life. I do believe that martial arts has influence in that, teaching about frustration, about how to overcome all situations and to be more calm” (P3).

P4 agreed with P3 that karate programs may improve not only confidence but also self-esteem for the following reason: “on a physical level I believed back being able to do hand-stands. I never expected to do the number of push-ups I did. Honestly I beat my high school record. If I can do that I could come to the class and...just every time leaving the class going back home I felt my self-esteem the global self-esteem was already so high. I felt very, very good going back home. Sometimes I felt really tired coming in but going back the sense of achievement and global self-esteem was just amazing. I felt like the world is not above me but below me. I felt like I am controlling the world” (P4).

Importantly, P2 considered that such programs increase social relationships, stating: “you feel more comfortable because you are with people where you can be interrelating more instead of doing alone when you are visually impaired” (P2).

DISCUSSION

Results of this study suggest that karate practice may improve EXSE in young adults with VI (table 2). Three of the participants (P1, P2, and P5) improved their EXSE during and immediately post the 10-week karate program, whereas the other two participants (P3 and P4) had high EXSE during the baseline and this may account for their apparent lack of improvement. This outcome is in agreement with previous findings that martial arts practice improves exercise self-efficacy (Caldwell, et al., 2009). They found that a 15-week tai chi program had a significant effect on exercise self-efficacy among college students (mean age =21years). Caldwell et al. (2009) reported that the mean

increased from 57.6 to 63.2 (out of 84) ($p = .0005$), which indicates that participants perceived themselves as being more able to control their movements mindfully at the end of the intervention than at the beginning.

Interestingly, tai chi programs (physically very different but from a psychological perspective very similar to our karate program) for 11 and 12 weeks have also had a positive impact on the exercise self-efficacy among older adults (Dechamps, Onifade, Decamps, & Bourdel-Marchasson, 2009; Taylor-Piliae, et al., 2006; Taylor-Piliae, Silva, & Peachey Shermeta, 2012) and those with heart failure (Yeh, et al., 2011; Yeh, et al., 2013).

The present study findings also support previous studies that found martial arts programs improved physical self-worth (Li, et al., 2002; Linxuan, 2011). For instance, Li et al. (2002) found that tai chi exercise for six months improved physical self-worth and GSE. They used the PSPP for the physical self-worth measurement and found an improvement in all sub-domains, namely: attractive body, physical strength, and physical conditioning. We found an improvement in all PSPP sub-domains for all participants (except physical strength for P2) which resulted in a higher score of the physical self-worth across all five participants (table 3). Li et al's (2002) and our findings propose a hierarchical structure of the PSPP sub-domains which seems to result in enhanced physical self-worth.

However, another recent study on people with brain injury, with 10 participants in an experimental group (mean age=44.5 years) and 10 participants in a control group (mean age=46.2 years), did not find significant improvement in physical self-worth (Blake & Batson, 2009). Although they did find an improvement in the experimental group it was not significant. Blake and Batson (2009) identified two limitations of the study that probably affected their results: a small sample size and the short duration of the program (once a week for 8 weeks). In contrast to their study, in our study we followed a multiple baseline approach rather than their randomized controlled trial study design. A multiple baseline approach has been described as a viable alternative to the randomized controlled trials which uses smaller sample sizes which are still statistically rigorous (Hawkins, Sanson-Fisher, Shakeshaft, D'Este, & Green, 2007).

Almost all study participants improved their social acceptance, intellectual ability, and morality (except for P1 in morality). During the baseline data collection only P4 had a high social acceptance scores. However, after the karate program all participants (including P4) appear to have developed their social self-esteem (table 4). Conversely, intellectual ability and morality were different at baseline across the participants but all participants (except P1 in morality) showed an improvement in these two domains.

Social relationships were previously identified as one of the main reasons for people practising martial arts (Jones, et al., 2006; Lantz, 2002) and it has been claimed that martial arts practice improves social acceptance (Winkle & Ozmun, 2001). In an earlier study social self-esteem was found to be improved due to taekwondo training among college women students (Finkenberg, 1990). Although a single case study was employed in our study, in which participants trained as a group ($n=5$) for one and a half week and not the whole 10 weeks, it seems that the short period was enough to improve their social self-esteem. Our social validation findings support this explanation, evidenced by the participants expressed desire for longer karate program. Further, participants in the current study reported that they felt accepted by the instructor and were happy that they were invited to participate in the karate program.

In our study intellectual development across all five participants was observed (table 4). The program was based on traditional karate which has physical movements as well as theoretical and philosophical principles (Funakoshi & Nakasone, 2003). Additionally, this traditional training approach that we adopted had intellectual components that may lead to the development of GSE (Ryan, 2008).

Moral development was also found to be improved across four participants (P1 scored lower morality for 0.05). This outcome from our study is in agreement with Lantz's (2002) study in which he conducted interviews with parents of children who were practicing martial arts. The parents stated

that their children improved moral standards due to the martial arts practice. In the present study, we had a similar outcome, possibly due to our pedagogy based on Funakoshi's (2003) traditional karate. The participants in our study were taught karate principles, mainly those developed by Funakoshi (2003), and links were explained on how to employ and integrate some of them into real life situations beyond our karate program. Karate sessions begin and end with rei (respect), there is no first strike in karate, karate stands on the side of justice, and karate goes beyond the dojo are just some of examples of principles.

During the sessions in our study the instructor discussed these principles with the participants and encouraged brief yet critical discussion about their meanings. Interview data indicates that they found this a positive experience. For example, one participant stressed on the impact of these constructive discussions, stating: "The conversations between the trainings were very very important and very stimulating and very enjoyable for me. The theories, the aspects of karate, what do I think about this or that and that. It was interesting to experience that, to talk about that. I enjoyed that" (P4).

Compared to our study, others have reported different outcomes from martial arts intervention studies on GSE across different population groups. The studies that did not find a significant improvement in GSE either included small sample size (Anthony, 2005; Conant, Morgan, Muzykewicz, Clark, & Thiele, 2008), focused on the other primary aims (e.g. cognitive, affective, and physical self-regulation) rather than GSE (Lakes & Hoyt, 2004), or did not clarify the methodology sufficiently (Foster, 1997). In contrast to Schmidt's (1988) findings, the present study is in agreement with others who found a significant improvement in GSE due to martial arts training (Brown, et al., 1995; Finkenberg, 1990; Lee, Lee, & Frkam, 2007; Lee, et al., 2010; Li, et al., 2002; Mustian, et al., 2004; Yin, 2006).

These studies showed that martial arts training for periods from eight and up to twenty four weeks can improve GSE. According to Winkle and Ozmun (2001) GSE improvement may occur because students experience success which they see as their own achievement (a form of self-regulation (Moote, Williams, & Sproule, 2013)) without comparing themselves to others reflecting a mastery approach (Gray, Sproule, & Morgan, 2009). Further, GSE improvement seems to be a result of not only the hierarchical development of self domains (Marsh & Cheng, 2012) in the EXSEM, but also in the SPPCS and SPPA.

Limitations & Implications for Future Research

In this study we used visual inspection and not statistical analysis because of the small sample size. To obtain more objective results we strongly recommend introducing statistical analysis in addition to graphical data, but this requires significantly more participants. Further, future research should focus on the factors that lead to improved exercise self-efficacy and self-esteem and this would probably involve in-depth interviews. Based on the findings of the present study we still do not know whether GSE was improved due to the EXSEM or SPPCS and SPPA domains. Therefore, research on the mechanisms that improve self-efficacy and also the relationships between the EXSEM and non-physical self-esteem domains is warranted.

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