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Impact of video modeling training with verbal encouragement on the technical performance and mental toughness of novice karate athletes: an experimental study at Jakarta state university

Impacto del entrenamiento con modelado en video y estímulo verbal en el rendimiento técnico y la fortaleza mental de atletas novatos de kárate: Un estudio experimental en la universidad estatal de Yakarta

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Abstract

This study aims to analyze the effect of video modeling training (VMT)+verbal encouragement (VE) towards the enhancement of technical performance (TP), and mental toughness (MT) among novice karate athletes. A true experimental design with a randomized control trial (RCT) was adopted in this study. 54 entry-level karate athletes were randomly devided in to control group (CG, n = 27, 11.7±0.72 year, 149±2.76 cm, 44.0±2.51 kg, 21.7±0.92 kg/m2), and experimental group (VMT+VE, n = 27, 12.3±0.76 year, 150±3.39 cm, 44.3±2.30 kg, 21.9±0.84 kg/m2). TPT, and KPT were used to measure technical performance, while MTQ-18 was used to measure mental toughness. Based on the pre- and post-measures of CG and VMT+VE, the study's findings indicated significant differences in TP ($p < 0.05$). In addition, there were significant main effects of time ($p < 0.05$), intervention program ($p < 0.05$), and interactions time × intervention program ($p < 0.05$) on TP variables. The second finding showed significant changes in MT variables between pre- and post-measures in VMT+VE ($p < 0.05$), but there was no change in CG ($p > 0.05$). However, repeated measures ANOVA confirmed that there were significant main effects of time ($p < 0.05$), intervention program ($p < 0.05$), and interactions time × intervention program ($p < 0.05$) on MT variables. Thus, we confirm that involving the use of an intervention program in the form of VMT+VE is an effective way to increase the levels of TP and MT among karate athletes than CG.

Keywords: sports training, technology, feedback, coaches, sports performance, martial arts.

Resumen

Este estudio tiene como objetivo analizar el efecto del entrenamiento con modelado de video (VMT) + estímulo verbal (VE) en la mejora del rendimiento técnico (TP) y la fortaleza mental (MT) entre atletas novatos de karate. En este estudio se adoptó un diseño experimental verdadero con un ensayo controlado aleatorio (ECA). 54 atletas de karate de nivel de entrada se dividieron aleatoriamente en un grupo de control (CG, n = 27, 11,7 ± 0,72 años, 149 ± 2,76 cm, 44,0 ± 2,51 kg, 21,7 ± 0,92 kg/m2) y un grupo experimental (VMT+VE, n = 27, 12,3 ± 0,76 años, 150 ± 3,39 cm, 44,3 ± 2,30 kg, 21,9 ± 0,84 kg/m2). Se utilizaron TPT y KPT para medir el rendimiento técnico, mientras que se utilizó MTQ-18 para medir la fortaleza mental. Con base en las mediciones previas y posteriores de CG y VMT+VE, los hallazgos del estudio indicaron diferencias significativas en TP ($p < 0,05$). Además, hubo efectos principales significativos del tiempo ($p < 0,05$), el programa de intervención ($p < 0,05$) y las interacciones tiempo × programa de intervención ($p < 0,05$) en las variables de TP. El segundo hallazgo mostró cambios significativos en las variables MT entre las mediciones previas y posteriores en VMT+VE ($p < 0,05$), pero no hubo cambios en CG ($p > 0,05$). Sin embargo, el ANOVA de medidas repetidas confirmó que hubo efectos principales significativos del tiempo ($p < 0,05$), el programa de intervención ($p < 0,05$) y las interacciones tiempo × programa de intervención ($p < 0,05$) en las variables MT. Por lo tanto, confirmamos que implicar el uso de un programa de intervención en forma de VMT+VE es una forma eficaz de aumentar los niveles de TP y MT entre los atletas de karate que CG.

Palabras clave: entrenamiento deportivo, tecnología, retroalimentación, entrenadores, rendimiento deportivo, artes marciales.

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Introduction

Karate is a widely recognized fighting sport that involves technical performance (TP) characteristics such as punches, kicks (Rodrigues et al., 2023), and parry in attacking or defensive conditions (Jeknić et al., 2022). In karate, as a beginner athlete, it is needed to focus and develop TP. Data from previous studies reported that a high TP is the main factor in determining success in karate (Ribas et al., 2020; Seyedi et al., 2021). In general, when a novice athlete demonstrates proficiency in punching, kicking, parrying, dodging, and knocking out an opponent, it may be predicted that he will be able to win the competition (Błaszczyszyn et al., 2019). However, if there are many mistakes in their actions, it will potentially cause novice athletes to experience defeat (Herrera-Valenzuela et al., 2021). According to Koopmann et al. (2020), TP is an important element and high demands are required in various sports. Considering the importance of the TP aspect for a novice athlete (Tropin et al., 2023), many coach applied various types of training to develop TP among novice athletes (Deng et al., 2023; Luo et al., 2022).

Mental toughness (MT) is another supporting factor for athletes to achieve success in competitive sports (Gu et al., 2022; Jang et al., 2020; Mojtahedi et al., 2023). Basically, MT can be interpreted as the ability of novice athletes to have self-confidence, focus and motivation to encounter difficulties as best as possible (Tangkudung et al., 2022; Piggott et al., 2019; Silva et al., 2018). In karate, MT can be used as a powerful weapon to trigger mental strength (Setiawan et al., 2020), thereby minimizing the level of anxiety (Guszkowska & Wójcik, 2021), and stress felt by novice athletes during training or competition (Drinkwater et al., 2019; Rintaugu et al., 2022). Several previous studies mentioned that MT has a positive impact on athletes, especially for beginner level, a consistent high MT could maintain an optimism (Gameiro et al., 2023), concentration (Farnsworth et al., 2022), perseverance (Stamatis et al., 2020), until control emotions in tense situations (Toros et al., 2023). Apart from that, another benefit of developing MT is that novice athletes can bounce back after a setback (Fengjun et al., 2022), and it is claimed as an effective method to overcome problems (Hsieh et al., 2023), moreover, it provides great opportunities to achieve goals (Lee & Kim, 2023). Meanwhile, a low MT can be used to predict that novice athletes are likely to face failure and perform poorly (Ismail et al., 2022). A

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recent study reported that MT was proven to be one of the psychological factors that greatly influences the level of performance in several types of sports (Bird et al., 2021; Brace et al., 2020; Liew et al., 2019), including combat sports (Mojtahedi et al., 2023). Therefore, coaches need an appropriate training to improve the quality of TP and MT among novice karate athletes.

Nowadays, competitive sports training process involves advanced technology (Bedir & Erhan, 2021; Gani et al., 2023; Rusmanto et al., 2023; Usra et al., 2024). Research reported that the implementation of technology in karate sports activities has been proven to provide many positive benefits (Coppola et al., 2019). Video modeling training (VMT) is a technology currently used as a tool in the sports training process (Rekik et al., 2021; Tannoubi et al., 2023), including karate (Carlsson et al., 2020). Basically, VMT can be interpreted as a form of training that uses recordings (videos) from an expert in carrying out technical performance in a sport (Petro et al., 2018; Mödinger et al., 2022), and then this video will be presented to novice athletes (Zhi-chao & Zhang, 2019). Through VMT, novice athletes could focus and analyze each movement accurately (Case & Yun, 2019; Zhao et al., 2022), so that they can learn the movements in the training session optimally. Previous study observed that VMT has proven effective in improving tactical qualities in basketball athletes (Rekik et al., 2021). Another positive effect provided by VMT is to improve athletes' motor skills (Amri-Dardari et al., 2022; D'elia et al., 2023; Jarraya et al., 2019). On the other hand, according to Tannoubi et al. (2023), VMT provides convenience and contentment for novice athletes to capture information regarding the training tasks from coach. It promotes better understanding and allows novice athletes to master each type of movement more quickly. Apart from that, the study tried to present a new experience by applying VMT with verbal encouragement (VE) during the training session. VE is an activity carried out by coaches to provide positive verbal encouragement to athletes during training sessions. VMT with VE is a training innovation that presents expert video recordings (visuals) to novice athletes then the coach provides verbal encouragement during training session. Encouragement from coach has proven to be an effective method to improve several aspects of novice athletes such as decision making, execution skills (Rusmana et al., 2023), physical fitness (Pacholek & Zemková, 2022), mood state, enjoyment (Selmi et al., 2023) to TP (Hammami et al.,

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2023). Research by Sahli et al. (2022), reported that encouragement words, such as "you can do it", "good", are able to motivate novice athletes and ultimately improve their performance optimally.

According to the best of our current knowledge, there was no previous studies that have implemented VMT in relation to TP and MT in novice level karate athletes. Based on this gap, we present a novelty in terms of testing the effect of VMT with VE through true experimental research with a randomized control trial design for 10 weeks. Thus, this study aims to analyze the effect of VMT with VE on TP, and MT in novice karate athletes.

Methods

Participants

In this study, a true experimental method was adopted with a randomized control trial design for 10 weeks. The participants involved male beginner level karate athletes from Jakarta State University (Indonesia). A priori power analysis used G*Power (Version 3.1.9.4, University of Kiel, Germany) and showed that a minimum sample size of 27 participants was sufficient to detect differences (effect size = 0.80, $\alpha = 0.05$) with an actual power of 80%. The inclusion criteria in this study were: (i) athletes must be at beginner level, (ii) aged 11 to 12 years, (iii) training experience less than 1 year, (iv) in a healthy condition without injuries. The exclusion criteria in this study were: (i) training experience more than 1 year, (ii) athletes who are taking part in competitions at national and international levels, and (iii) minimum attendance to training sessions is 2 times. There were 54 beginner level karate athletes were selected to participate in this research (see Fig. 1). Participants were randomly allocated into the control group (CG, n = 27) and the experimental group (VMT with VE, n = 27) using random analysis assistance from https://www.randomizer.org/. All participants and parents are required to sign a letter of consent to be involved in this research. The detail information about CG, and VMT with VE is described in Table 1.

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Table 1. Participant information on CG and VMT with VE

Group	n	Age (year) Mean±SD	Height (cm) Mean±SD	Weight (kg) Mean±SD	BMI (kg/m^2) Mean±SD
CG	27	11.7±0.72	149±2.76	44.0±2.51	21.7±0.92
VMT with VE	27	12.3±0.76	150±3.39	44.3±2.30	21.9±0.84

Note: CG: Control group, VMT with VE: Video modeling training with verbal encouragement, BMI: Body mass index, SD: Standard deviation.

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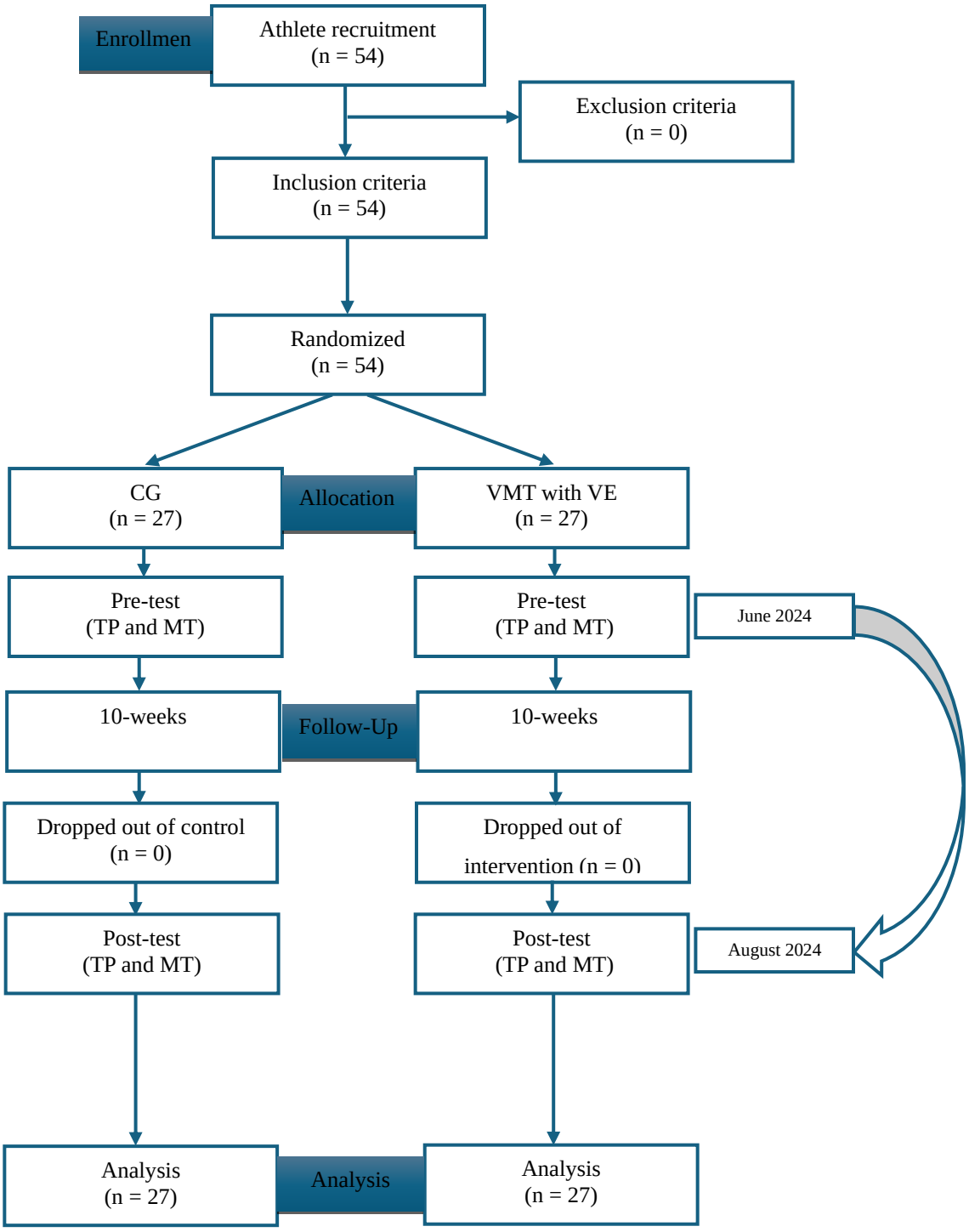

Figure 1. CONSORT flow chart

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Instruments

Technical Performance (TP)

Target punching test (TPT). In this study we adopted TPT to measure punching ability (guiako zuki) of a karate athlete. This test was carried out by punching the target (pacing pad) as many times as possible in 1 minute. The assessment was carried out by counting the number of punches that hit the target. Cronbach's alpha = 0.845 and validity = 0.879 have been tested in this study.

Kick Performance Test (KPT). In this research, KPT was adopted from previous studies (Kabadayı et al., 2022). In this test, participants perform five sets of kicks (mawashi-geri). After the instructor claim "Go", participants should kick the target (pacing pad) as many times as possible for 15 seconds in one set. While assessing, the number of kicks in each set was counted and the sum was calculated. The Cronbach's alpha value for this instrument was 0.867 and validity = 0.924.

Mental Toughness (MT)

The Mental Toughness Questionnaire-18 (MTQ-18) was used as the measurement tool for assessing mental toughness in karate athletes (Dagnall et al., 2019; Mojtahedi et al., 2023). This instrument consists of 18 items from sub indicators: (i) confidence (7 items), (ii) control (5 items), (iii) commitment (3 items), and (iv) challenge (3 question items). Examples of questions (e.g., “I can perform my best”, “I can be in control”). A five-point Likert scale (from 1 = strongly disagree to 5 = strongly agree) is used to assess each item. The scores were added up to calculate the MT for each karate athlete. The Cronbach's alpha value for this instrument was 0.910 and validity = 0.938.

Ethical Considerations

Participants were asked to sign an informed consent form to join the study. This research was carried out in accordance with the last Declaration of Helsinki (2013) and the protocol was approved by the Ethics Committee of State University of Jakarta (no: 689/LPPM-UNJ/2023).

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Procedures

The study was carried out from June-August 2024 at Jakarta State University (Indonesia). The first week on June 2, 2024, pre-measures for TP and MT were conducted from 08.00-09.00 am. In this activity, all participants warmed up (5 min) first. Then individual participants carried out the TPT and KPT which were supervised by the research team and after completion the participants were instructed to cool-down. The activity continued with filling out the MT questionnaire. The second week on June 9, 2024, participants in CG carried out the daily training, namely drill or non-VMT with VE technical training, while the experimental group carried out the VMT with VE program. VMT with VE, and CG activities were carried out on the same days, namely Monday, Wednesday and Friday of the week and this activity was carried out until the 10th week, precisely on August 15, 2024. At the last meeting on August 18, 2024, participants in VMT with VE, and CG carried out post-measures namely TP, and MT from 09.00-10.00 am.

Program VMT with VE

VMT with VE program activities were carried out in the morning from 07.00-08.00 at the Gynasium. First, the coach informed instructions for athletes to do waming-up for 5 minutes. Then the coach prepared an Asus (Vivobook X415JA-A416JA) laptop which was placed at 1 meter from the athlete. Then the trainer played a video of an expert in karate (e.g., a professional karate athlete or karate coach) demonstrating punches and kicks for 10 minutes. Throughout this session, the athlete can ask the coach to stop or replay the sequence or ask for an explanation (Tannoubi et al., 2023). After watching the video, the athletes gather to start a training session, namely trying to demonstrate the punches and kicks they have learned from the previous video. During the training session the trainer also carried out VE (e.g., “come on, you can do it!”, “very good!”, “awesome!” or “cheer up!”). The training session lasted 40 minutes. At the end of the activity the coach evaluated the training activities and instructd all athletes to cool down for 5 minutes.

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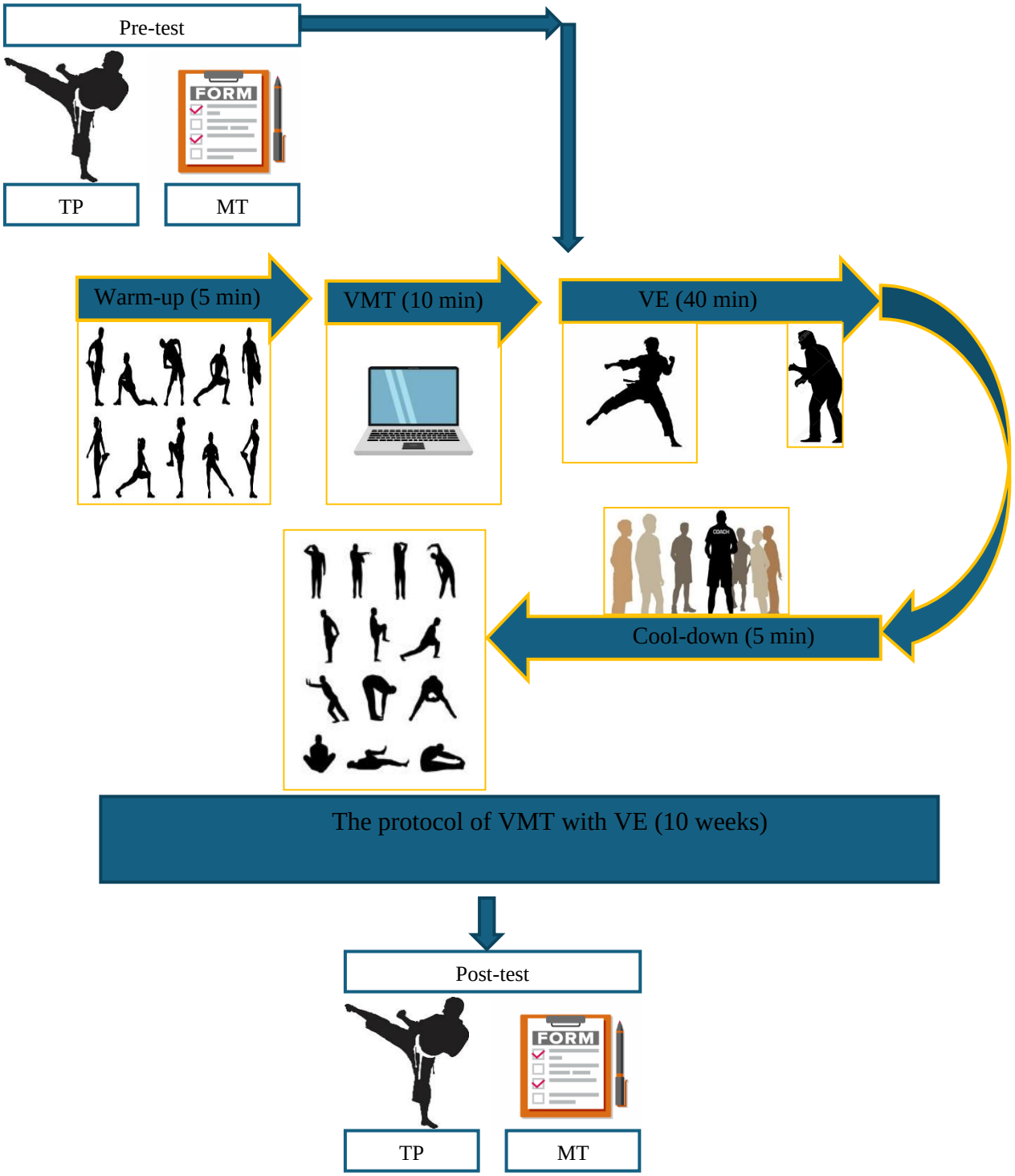

Figure 2. The protocol of VMT with VE

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Statistical Analysis

Data analysis was carried out using Jamovi statistics version 2.3.28 (The jamovi project, Sidney, Australia). The Shapiro-Wilk test was used to assess the normality of data. A two-way Analysis of Variance (ANOVA) with 2 × 2 repeated measures was used to investigate the main effects of intervention program (CG vs VMT with VE) and time (pre vs post) simultaneously. Bonferroni post-hoc analysis would perform to test the group effects (CG and VMT with VE). Additionally, Student's paired t-test was used to detect mean differences between pre-test vs post-test for each group separately. The effect size (ES) (Cohen's *d*) was used with criteria: $0.00 \leq d \leq 0.19$ (trivial), $0.20 \leq d \leq 0.49$ (small), $0.50 \leq d \leq 0.79$ (moderate) and $d \geq 0.80$ (large) (Hammami et al., 2023). The level of statistical significance was set at $p < 0.05$.

Results

Table 3 shows that the data in this study is normally distributed ($p > 0.05$). The results presented in Table 4 show significant changes in TP-TPT and TP-KPT from pre- and post-measures in both CG and VMT with VE ($p < 0.05$). In addition, repeated measures Two-Way ANOVA confirmed that there were significant main effects of time ($p < .001$), intervention program ($p < .001$), and interactions time × intervention program ($p < .001$) on TP-TPT and TP-KPT variables.

Table 3. Results of normality of data on variables

Variables	SW- CG (pre - post)	SW-VMT with VE (pre - post)
TP		
Target punching test (score)	0.125	0.168
Kick performance test (score)	0.085	0.118
MT		
Confidence (score)	0.097	0.132
Control (score)	0.169	0.175
Commitment (score)	0.084	0.272
Challenge (score)	0.140	0.189

Note. SW: Shapiro-wilk, CG: Control group, VMT with VE: Video modeling training with verbal encouragement, TP: Technical performance, MT: Mental toughness.

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Table 4. Changes in technical performance (TP) variables in each group

Variables	CG (n = 27)	ES (Cohen's *d*)	VMT with VE (n = 27)	ES (Cohen's *d*)	Repeated Measures Two-Way ANOVA			
				TP-TPT (score)				
Pre-measures	9.56±1.48		10.8±1.42			F	*p*	η^2
Post-measures	10.63±1.42		13.6±1.63		Time	70.1	< .001[£]	0.215
Pre-Post 95% CI	-1.71 to -0.43	-0.66	-3.47 to -2.08	-1.58	Treatment	38.7	< .001[£]	0.249
t	-3.45		-8.19		Time × treatment	13.7	< .001[£]	0.042
p	0.002[*]		< .001[*]					
				TP-KPT (score)				
Pre-measures	9.33±1.30		11.2±1.15		Time	54.1	< .001[£]	0.154
Post-measures	10.19±1.49		13.8±1.73		Treatment	77.5	< .001[£]	0.395
Pre-Post 95% CI	-1.63 to -0.078	0.43	-3.17 to -2.02	-1.79				
t	-2.26		-9.30		Time × treatment	13.8	< .001[£]	0.039
p	0.032[*]		< .001[*]					

Note. TP: Technical performance, TPT: Target punching test, KPT: Kick performance test, CG: Control group, VMT with VE: Video modeling training with verbal encouragement, CI: Confidence interval, ES: Effect size. [*]Significantly different from pre-post at $p < 0.05$, [£]significant values obtained by the Two-Way ANOVA ($p < 0.05$).

Table 5 based on Paired T-test analysis, we observe that there is a difference in MT from pre- to post-measures in VMT with VE ($p < .001$), but no difference is observed in CG ($p > 0.05$). In addition, repeated measures Two-Way ANOVA confirmed that there were significant main effects of time ($p < .001$), intervention program ($p = 0.033$), and interactions time × intervention program ($p < .001$) on MT-confidence variables, for MT-control it shows that the effect of time ($p < .001$), intervention program ($p = 0.025$), and interactions time × intervention program ($p < .001$), for MT-commitment it shows the effect of time ($p < .001$), intervention program ($p < .001$), and interactions time × intervention program ($p < .001$), while for the MT-challenge the effects of time ($p < .001$), intervention program ($p < .001$), and interactions time × intervention program ($p = 0.030$).

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Original article. Impact of video modeling training with verbal encouragement on the technical performance and mental toughness of novice karate athletes:an experimental study at Jakarta State University (Indonesia)
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Table 5. Changes in mental toughness (MT) variables in each group

Variables	CG (n = 27)	ES (Cohen's *d*)	VMT+VE (n = 27)	ES (Cohen's *d*)	Repeated Measures Two-Way ANOVA			
MT-Confidence (score)								
Pre-measures	21.7±1.72		17.3±2.29			F	*p*	η^2
Post-measures	21.4±2.78		23.4±3.33		Time	41.6	< .001[£]	0.179
Pre-Post 95% CI	-0.812 to 1.48	0.11	-7.50 to -4.65	-1.69	Treatment	4.79	0.033[£]	0.032
t	0.598		-8.76		Time × Treatment	51.8	< .001[£]	0.223
p	0.555 [NS]		< .001[*]					
MT-Control (score)								
Pre-measures	16.4±1.58		12.7±2.84		Time	95.2	< .001[£]	0.207
Post-measures	16.9±1.64		17.9±3.30		Treatment	5.33	0.025[£]	0.050
Pre-Post 95% CI	-1.03 to 0.071	-0.34	-6.24 to -4.13	-1.94	Time × Treatment	65.6	< .001[£]	0.143
t	-1.79		-10.1					
p	0.085 [NS]		< .001[*]					
MT-Commitment (score)								
Pre-measures	8.22±0.97		9.19±1.21		Time	101.1	< .001[£]	0.209
Post-measures	8.63±1.07		12.59±1.45		Treatment	87.8	< .001[£]	0.348
Pre-Post 95% CI	-0.889 to 0.074	-0.33	-4.02 to -2.79	-2.20	Time × Treatment	62.5	< .001[£]	0.129
t	-1.74		-11.4					
p	0.094[NS]		< .001[*]					
MT-Challenge (score)								
Pre-measures	9.11±1.58		9.96±1.37		Time	19.82	< .001[£]	0.076
Post-measures	9.59±1.50		11.41±1.72		Treatment	13.6	< .001[£]	0.146
Pre-Post 95% CI	-1.01 to 0.048	-0.35	-2.16 to -0.73	-0.80	Time × Treatment	4.95	0.030[£]	0.019
t	-1.87		-4.16					
p	0.073[NS]		< .001[*]					

Note. MT: Mental toughness, CG: Control group, VMT with VE: Video modeling training with verbal encouragement, CI: Confidence interval, ES: Effect size, NS: Non-significant different from pre-post. *Significantly different from pre-post at $p < 0.05$, [£]Significant values obtained by the Two-Way ANOVA ($p < 0.05$).

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Discussion

The study aims to analyze the effect of VMT with VE on increasing TP, and MT in novice karate athletes through true experimental research with a randomized control trial design for 10-weeks.

Results from this study showed that VMT with VE provided greater improvement in TP than CG. Furthermore, MT showed greater improvement after VMT with VE than CG. This is due to the benefits of VMT+VE. For example, throughout the training process, recordings of different karate specialists, including professional athletes and karate instructors, are projected, enabling new athletes to examine and increasingly understand each action. Apart from that, if novice athletes did not understand a movement in the video, the coach can replay it again (Jarraya et al., 2019). The findings of Tannoubi et al. (2023), study, supported this, showing that video modeling is an effective training method for enhancing technical skill in team sports like basketball. Furthermore, according to Petro et al. (2018), VMT with VE is appropriate for motor skills as it transmits information that enables precise execution of karate techniques as well as modifications in the quality of techniques, such as punches and kicks that may strike the target. VMT with VE allowed athletes to record modeling videos on their laptops, which is another intriguing outcome from our research. This allowed athletes extra time to practice every striking and kicking stroke. This research also takes into account Bandura's social learning theory (Rekik et al., 2021), which has been shown to be another advantage of VMT with VE and enables athletes to observe and mimic the conduct of others in real life or on film (Case & Yun, 2019). Several previous studies reported that training process involving video modeling was more beneficial than traditional training (Jarraya et al., 2019; Rekik et al., 2021). However, similar results have been reported in study by Zhao et al. (2022), which shows that video modeling-based training is a great technique to improuve athletes' anticipation and decision-making. Additionally, the integration of VE, and VMT is an effective approach that actively engages athletes in developing their technical skill while simultaneously strengthening their mental toughness. The fact that VMT with VE was

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able to raise the MT level of beginning karate athletes is another significant result from this study. This is shown by an increase in commitment, challenge, self-confidence, and control from pre-test to post-test. This is because VMT with VE presented a training process, which required athletes to watch a video and carried out movement exercises that had been learned from the video and accompanied with a coach who provided positive verbal encouragement (Sahli et al., 2022; Selmi et al., 2023). These findings are supported by several previous studies that showed training was more effective when athletes received assistance from a coach (Hammami et al., 2023; Sahli et al., 2020). The research results of Pacholek & Zemková (Pacholek & Zemková, 2022), reported that VE gave positive feedback for athletes, which highly motivated them to train and ultimately increase the athlete's performance. Other research in line with the results of this research showed thatpositive encouragement generated significant changes in an athlete's behavior and attitudes (e.g., self-confidence, motivation, anxiety) (Keller & Szakál, 2021). Furthermore, results from Selmi et al. (Selmi et al., 2023), showed that VE is an effective tool to improve mood states and physical enjoyment.

The study has several notable strenghts. It takes an extensive approach that simulates real-world training conditions where athletes often get both verbal encouragement and visual examples from coaches in addition to video modeling. It is strategically important to concentrate on novice karate athletes as it addresses a critical phase of skill development and provides information on specialized training plans for athletes just starting out. Accuracy, speed, and shape are examples of real technical performance measurements that are included in the research to enhance objectivity and enable accurate assessment of the intervention's efficacy. A psychological component is also included by measuring mental toughness, which gives a deeper understanding of how the intervention affects athletes. The study's practical implications are evident, since instructors and coaches may use the results to enhance their training methods.

This research still has limitations, namely only involved participants from one department at Jakarta State University (Indonesia). This study also only involved one gender, namely men. Participants were from entry level which may limit the

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generalizability of the results. Future research needs to involve a wider range of participants, for example from several universities in Indonesia or other countries and involving both genders, namely men and women. This is important and necessary in order to support research recommendations regarding VMT with VE.

Conclusion

Overall, our current study proved that VMT with VE resulted in better TP and MT quality compared to CG. Therefore, this study contributes important information for karate coaches, and athletes regarding the positive impact of implementing VMT with VE. In addition, we hope that this intervention program can be adopted sustainably by karate coaches so that the quality of TP, and MT is maintained in the future.

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