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Development of sensory media-based reaction speed training forms

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Abstract

Pencak silat is a sport that requires speed in carrying out attack techniques against opponents, which is done to take value or defeat opponents. This study aimed to develop a form of Pencak silat reaction speed exercise through sensor media. Seeing the importance of speed in pencak silat sports, this study aims to develop a form of reaction speed training in pencak silat using sensor media. This research is a research development or Research and Development (R&D). So this study uses several research steps: Potential and Problems, Data Collection, Product Design, Design Validation, Design Revision, Product Trial, Product Revision, and User Trial. Material experts and media experts first validated this development research. The product trial was carried out on Extracurricular Students of the Darul Arapah Islamic Boarding School, while the number of samples was as follows: There were 14 students. Small group test of 7 students and large group test of 14 students. Types of data collection with the instrument in the form of a questionnaire. From the results of the study, the total feasibility test calculation of the research "Development of sensory-based reaction speed training forms" according to respondents amounted to 91.57% categorized as "Very Worth It", which can be interpreted that the product is "Very Worth It" to be used as an exercise aid. Based on the assessment results of material judges, practitioner judges, and respondents to product trials and usage trials in the study "Development of sensory-based reaction speed training forms" stated that the quality of sensory-based reaction speed training auxiliary media in Pencak silat was categorized as "Very Worth It" for use.

Keywords: Sensor media, training, pencak silat reactions.

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Authors contribution: a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version

INTRODUCTION

Pencak silat is a martial art inherited from the ancestral culture of the Indonesian people. To defend his life, humans always defend themselves from threats from nature, animals, and others who are

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considered to threaten their integrity (Rahayu, 2018). Pencak silat is one of the original pencak silat sports of the Indonesian cultural heritage, which can play a role in shaping the mentality and personality of the Indonesian people (Saputra, 2018). People who are strong, skilled, disciplined, agile, calm, patient, chivalrous and self-confident. The basic movement of Pencak silat is planned, directed, coordinated and controlled (Mustain & Akbar, 2021). The basic movement of pencak silat is a planned, directed, coordinated and controlled movement with 4 aspects as a whole. This aligns with the statement Susanto et al., (2020) that Pencak silat is a sport that is quite complete to study because it has four aspects that are a unified whole and cannot be separated.

Attack techniques that are often used in Pencak silat are kicks, punches, drops and sweeps (Irfandi, 2021). Of the several techniques that are dominant in the match, kicks are used because kicks are attacks that have a higher value than punch attacks. The score obtained from the punching technique gets a value of 1 (one), while kicks get a value of 2 (two). If an opponent's attack can be avoided while kicking and hitting a valid target, you get a score of 1+2. Kick techniques consist of front/straight, circular/sickle, back, and side kicks (Nurdin et al., 2020). So that the kick can be said to be in, then the kick must be done at a high speed. One important factor in Pencak silat is speed.

Speed is a factor that has an important role in pencak silat matches, therefore every technical movement in pencak silat must be carried out quickly so that the opponent does not have the opportunity to dodge, dodge, catch and counter or what is commonly referred to as movement speed. Speed is a physical component that is very necessary in every sport, including pencak silat (Shapie et al., 2013). Reaction speed is the ability to carry out similar movements successively in the shortest possible time or to cover a distance in a short time (Mustain & Akbar, 2021). In addition, according to Murniati (2018), Speed Reaction is a person's ability to respond to a stimulus in the shortest possible time.

In Pencak silat, the speed of reaction in carrying out attacks is carried out so that the opponent does not easily anticipate it is one of the important things. Training the reaction speed of Pencak silat athletes' attacks is an important consequence of improving the quality of an athlete's attack reaction speed, especially in the sparring category. A good training program and good training facilities are the main components in improving the quality of the reaction speed of Pencak Silat athletes' attacks.

The development of facilities for pencak silat training is increasingly rapid. However, the development of facilities to train the reaction speed of kicks and punches, especially in Indonesia, still needs to be created. For example, there are no means to train the reaction speed of punches and kicks, so coaches only use cues or whistles as stimuli through the sense of hearing in training the reaction of kicks and punches of their athletes. There needs to be a breakthrough from Pencak silat coaches or experts to develop media or training facilities that can support the increase in the reaction speed of Pencak silat athletes.

One of the means to train in Pencak silat is still manual, including speed training for kicks, punches, and a combination of both, still using a stopwatch. Speed training for kicks, punches, and a combination of both, which uses a stopwatch as an assistive tool, is lacking and requires development to support the techniques of pencak silat athletes.

From previous observations, speed training for kicks, punches, and a combination of both, which uses a stopwatch, has been largely abandoned by other pencak silat sports, and researchers have yet to see further development. This inspired researchers to develop innovative training tools to increase reaction speed so that it is more effective and efficient by using technology to develop reaction speed with sensors.

Based on the background of the problems that have been described, researchers have the idea to develop a means product to train the reaction speed of pencak silat athletes' attacks to be more effective and efficient using sensor technology. The tool using this sensor is

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implemented to facilitate the monitoring of the speed of techniques in pencak silat so that it is further developed and contributes to providing the reaction speed carried out by pencak silat.

METHOD

Research methods

The research design used is research development (Research and Development). Design research and development is a process or steps to develop a new product or perfect an existing product, which can be accounted for (Sudjana, 2011). While according to Sugiyono (2016), Research and development methods are research methods used to research to develop existing products (innovation) and to create new products (creations) that are tested. The development method will produce effective and efficient products so that they can be appropriately applied and benefit its users. In addition, developed products can provide solutions and overcome problems.

This research aims to produce reaction agreement training aid products using martial arts sensors. The stages of development in this study use research and development (R &; D) methods from Sugiyono (2016) as follows: 1) Research and information collecting, 2) Planning, 3) Developing preliminary form of product, 4) Preliminary field testing, 5) Revise test results, 6) Main product field, 6) Main filed testing, 7) Operational product revision, 8) Operational field testing, 9) Final product revision, 10) Dissemination and implementation.

Data Collection Techniques

Data collection techniques using questionnaires to respondents. The instrument used in this development research uses the Likert Scale. The questionnaires used in this study were closed and open questionnaires accompanied by a suggestion column. Questionnaires were given to material judges, practitioner judges and small-scale product trials on subjects designated in this study on pencak silat and usage trials on martial arts athletes. The collected data is then analyzed to determine the

quality of the resulting development products. Data collection resulted from product validation, product trials and usage trials. The product validation will use a feasibility formula to analyze the results of data from experts (Sugiyono, 2013). Phase I trials regarding products and usage trials use feasibility criteria so that researchers can conclude the feasibility results of the tool in accordance with the criteria.

The data obtained in the development of this electric reaction punching bag are in the form of quantitative data. Quantitative data is obtained from the results of field tests in the form of general assessments of sensor devices for reaction speed training.

Data Analysis Techniques

Data analysis used in this research is descriptive analysis in the form of good, good enough, bad, bad statements, which will be converted into quantitative data with a Likert scale or a score of 1 to 4.

4: Strongly Agree, 3: Agree, 2: Disagree, 1: Strongly Disagree

With Formulas

$$\mathbf{P = \frac{x}{xi}100\%}$$

P = Percentage of test subject evaluation results

X = Total score answers by test subjects

Xi = Maximum number of answers in the aspect of assessment by test subjects

100% = Constant.

The results of the data calculation are then made in the form of a percentage multiplied by 100%. According to Arikunto (2019), there are five eligibility categories. The range of percentage numbers always respects a scale. The expected value is 100% and a minimum of 0%.

Table 1. Eligibility percentage

Score in Percentage	Eligibility Category
81%-100%	Very Worth it
61%-80%	Worthy
41%-60%	Pretty decent
21%-40%	Not feasible
<21%	Very Unworthy

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RESULT

Research result

1) (Materials Expert)

The implementation of the Material Expert is carried out in two stages

Table 2. Step I Product material test

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	18	20	90%	Worthy
2	Design and Display	18	20	90%	Worthy
3	Use	17	20	85%	Worthy
	Sub-Total	53	60	88.33%	Worthy

Material experts in this study use qualified judges in the field of engineering. Material tests by expert conformity experts are carried out twice, the assessment aspects seen in this product material include: physical, design and appearance, and use. The validation results of the judge material can be seen in Table 2. The assessment by the material judge regarding the product "Development of sensory-based reaction speed training forms" showed that for the assessment of the physical aspect of 90%, which was categorized as "Worthly", for the design and appearance aspect of 90% which was categorized as " Worthly", and for the use aspect of 85% which was categorized as " Worthly". According to material experts, the total feasibility test assessment of research materials "Development of sensory-based reaction speed training forms" amounted to 88.33% categorized as " Worthly" to be tested to the next stage. Judge practitioners are carried out by experts according to ability, who have experience in training athletes from several colleges.

Table 3. Step II Product material test

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	19	20	95%	Very Worth it
2	Design and Display	19	20	95%	Very Worth it
3	Use	20	20	100%	Very Worth it
	Sub-Total	59	60	98.33%	Very Worth it

In Table 3, the results of the assessment by expert practitioners on the product "Development of sensory-based reaction speed training forms"

in the second stage show that for the assessment of the physical aspect of 95%, which is categorized as "Very Worth It", for the design and appearance aspect of 95% which is categorized as " Very Worth It", for the use aspect of 100% which is categorized as " Very Worth It".

2) Media Expert

The implementation of media experts was carried out in two stages

Table 4. Step I Product media test

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	15	20	75%	Worthy
2	Design and Display	16	20	80%	Worthy
3	Use	15	20	75%	Worthy
	Sub-Total	53	60	73.33%	Worthy

The assessment by the media judge on the product "Development of sensory-based reaction speed training forms" in Table 4 shows that for the assessment of physical aspects, 75% is categorized as "Worthy", for design and appearance aspects, 80% is categorized as "Worthy", and for the use aspect of 75% is categorized as "Worthy". According to material experts, the total feasibility test assessment of research materials "Development of sensory-based reaction speed training forms" amounted to 73.33%, categorized as "Worthy" for testing to the next stage. Judging media practitioners is carried out by experts according to ability, who have experience in training athletes from several universities.

Table 5. Step II Product media test

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	19	20	95%	Very Worth it
2	Design and Display	19	20	95%	Very Worth it
3	Use	19	20	95%	Very Worth it
	Sub-Total	57	60	95%	Worthy

In Table 5, the results of the assessment by expert practitioners on the media "Development of sensory-based reaction speed training forms" in the second stage show that for the assessment of physical aspects of 95%, which is categorized as "Very Worth It", for design and appearance aspects of 95% which are categorized as "Very Worth It", for aspects of use by 95% which is categorized as "Very Worth It". The feasibility test

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assessment of the research media "Development of sensory-based reaction speed training forms" according to material experts by 95% is categorized as "Very Worth It".

Table 6. Small group product trials

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	115	140	82.15%	Very Worth it
2	Design and Display	121	140	86.43%	Very Worth it
3	Use	120	140	85.71%	Very Worth it
	Sub-Total	356	420	84.76%	Very Worth it

Results of Product Trial Respondent Assessment in Small Trials based on the results of the product assessment "Development of sensory-based reaction speed training forms" by 356 respondents, analyzed using score interpretation criteria. The calculation results of the product trial "Development of sensory-based reaction speed training forms" showed that for the physical aspect, 82.15% was categorized as "Very Worth It", for the design and appearance aspects, 86.43% was categorized as "Very Worth It", and for the use aspect of 85.71% it was categorized as "Very Worth It". The total feasibility test calculation of the study in the small group "Development of sensory-based reaction speed training forms" according to respondents amounted to 84.76%, categorized as "Very Worth It" to be tested to the next stage.

Table 7. Large group product trials

No	Rated aspect	Score obtained	Maximum score	Percentage (%)	Category
1	Physique	254	280	90.71%	Very Worth it
2	Design and Display	256	280	91.43%	Very Worth it
3	Use	255	280	91.57%	Very Worth it
	Sub-Total	765	840	91.57%	Very Worth it

Table 7 shows the results of assessing respondents' Usage Trials in large groups. Based on the results of the product assessment "Development of sensory-based reaction speed training forms" by 765 respondents, the analysis used score interpretation criteria. The calculation results of large group trials in the use of "Development of sensory-based reaction speed training forms" showed that for physical aspects, 90.71% were categorized "Very Worth It", for design and

appearance aspects, 91.43% were categorized "Very Worth It", and for usage aspects, 91.57% were categorized "Very Worth It". The total feasibility test calculation of the study "Development of sensory-based reaction speed training forms" according to respondents amounted to 91.57%, categorized as "Very Worth It", which can be interpreted as the product being "Very Worth It" to be used as an exercise aid. Based on the assessment results of material judges, practitioner judges, and respondents to product trials and usage trials in the study "Development of sensory-based reaction speed training forms" stated that the quality of sensory-based reaction speed training auxiliary media in Pencak silat was categorized as "Very Worth It" for use. Some of the basic movements that have been described then, athletes can perform basic movements in pencak silat using the media "Development of sensory-based reaction speed training forms" so that it becomes a tool in training.

DISCUSSION

From the results obtained, sensory media-based reaction speed training development is likely feasible when viewed from several aspects, such as the material used. From the results of the study, the total feasibility test calculation of the research "Development of sensory-based reaction speed training forms" according to respondents amounted to 91.57% categorized as "Very Worth It", which can be interpreted that the product is "Very Worth It" to be used as an exercise aid. The materials used in this study follow the design of Ikhsan et al., (2018), By using digital technology measuring instruments by combining them through electronic components. The results were obtained that the material used in terms of physical design and use was considered feasible. This is because this tool has been tested before through circuit tests in making kicking instruments in pencak silat (Ikhsan et al., 2018). This success is also supported by Magdalena et al., (2020) with the presence of props Able to attract attention and make the atmosphere so pleasant. In addition, the electronic manufacture of materials can also produce good purposes if done appropriately (Sriwahyuni et al., 2019). Media can be used in the teaching

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and learning process because the media conveys messages more easily from the messenger to the recipient of the message (Afandi et al., 2013). Systematic use of media from sources for learning is a process of learning design specification (Sebayang et al., 2020).

In addition, judging from the media used, it has also increased in all aspects. This is because the media used is considered to have a complexity of the needs of the physical aspects used in the pencak silat branch. For this reason, it is necessary to select auxiliary media in sports training that suits the needs according to sports which also refers to training methods. As the opinion expressed (Ratten, 2019), selecting and determining the type of auxiliary media in sports is an important aspect of making the attractiveness of exercise because increasing the attractiveness affects the effectiveness and efficiency of the exercise process in sports. Exercise auxiliary media is a useful tool for achieving the efficiency and effectiveness of an exercise process in sports, such as understanding, clarity, and exercise objectives (Pino-Ortega & Rico-González, 2021).

While viewed from small and large group tests, the results obtained from each test item measured positively impact the success of the tools used. So, in this case, the tool is worth using. This certainly provides efficiency and effectiveness to the trainer when giving reaction speed tests (Mustain & Akbar, 2021). Reaction speed is needed in an athlete because through effective and efficient movements are able to provide optimal results in competition, therefore, movement can be done effectively and efficiently if supported by good skills (Harun et al., 2020).

Good kicking skills will also have good speed (Venkatraman et al., 2019). A good speed is formed with movements repeated as much as possible. Skilful movement is an efficient movement. The interrelation between the movements of various factors will give rise to efficient movements (Romanova et al., 2022). In the opinion Mujahid & Subekti (2021), three components that support efficient movement are physical freshness and ability to move, sensory or sensory abilities and perceptual

processes. The efficient movement emphasizes travel time when kicking when the foot leaves the ground or base until it reaches the target or opponent (Kholis, 2016). Research The development of a sensory-based form of reaction speed training Pencak Silat has several limitations in research. The sample of trial use of the product still needs to be improved due to the limited time of respondents from various backgrounds. Making tools that take a long time hampers the research process because tool makers require materials and experts who require a long process in making tools (Rony Syaifullah, 2023).

CONCLUSION

Based on the assessment results of material judges, practitioner judges, and respondents to product trials and usage trials in the study "Development of sensory-based reaction speed training forms" stated that the quality of sensory-based reaction speed training auxiliary media in Pencak silat was categorized as "Very Worth It" for use. The implications of research based on theoretical studies and empirical studies will impact the way athletes train because training can positively impact athletes, as athletes' motivation in participating in training and the coach's motivation in creating, developing and using learning media.

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REFERENCES

Arikunto, S. (2019). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.

Harun, H., Hidayat, S., & Hadjarati, H. (2020). Analisis kecepatan tendangan samping pesilat remaja. *Jambura Journal of Sports Coaching*, *2*(1), 1–7.

Ikhsan, N., Yulkifli, & Yohandri. (2018). Instrumen Kecepatan Tendangan Pencak Silat Berbasis Teknologi. *Jurnal Sosioteknologi*, *17*(1), 124–131.

https://doi.org/10.29407/js_unpgri.v9i2.18763
9 (2) 2023 | 247-259

Irfandi. (2021). Analisis Survei Kemampuan Kondisi Fisik Atlet Pencak Silat Usia 14-17 Perguruan Tunas Nusantara Se-Aceh. *Journal Coaching Education Sports*, *2*(1), 77–86. https://doi.org/10.31599/jces.v2i1.528

Kholis, N. (2016). Aplikasi nilai-nilai luhur pencak silat sarana membentuk moralitas bangsa. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, *2*(2). https://doi.org/10.29407/js_unpgri.v2i2.508

Magdalena, I., Prabandani, R. O., Rini, E. S., Fitriani, M. A., & Putri, A. A. (2020). Analisis Pengembangan Bahan Ajar. *Jurnal Pendidikan Dan Ilmu Sosial*, *2*(2), 170–187.

Mujahid, H., & Subekti, N. (2021). Analisis Taktik Pertandingan Pencak Silat Kategori Tanding Tactical Analysis of Pencak Silat Competitions in the Competing Category. *Journal Coaching Education Sports*, *2*(2), 123–136. https://doi.org/10.31599/jces.v2i2.693

Murniati, S. (2018). Korelasional Antara Kecepatan Reaksi, Daya Ledak Otot Lengan Dan Koordinasi Mata-Tangan Dengan Keterampilan Smash Mahasiswa Fkip Jpok Unlam Banjarbaru. *Multilateral: Jurnal Pendidikan Jasmani Dan Olahraga*, *17*(1), 35–40. https://doi.org/10.20527/multilateral.v17i1.5012

Mustain, A. Z., & Akbar, R. (2021). Pengembangan Alat Ukur Kecepatan Reaksi Tendangan Dan Pukulan Berbasis Whole Body Reaction (WBR) Pada Atlet Pencak Silat. *Sosioedukasi: Jurnal Ilmiah*, *10*(1), 139–149.

Nurdin, A., Perabunita, & Pasaribu, A. M. N. (2020). Pengaruh Media Audio Visual,Video Terhadap Penguasaan Gerak Dasar “Tendangan” Pencak Silat Pada Anggota Perguruan Cimande Desa Sukadamai Kecamatan Tanjung Lago Kabupaten Banyuasin. *Jurnal Speed (Sport, Physical*, *3*(1). https://doi.org/10.35706/jurnal%20speed.v3i1.3562

Oktarina Puspita WardaniMuhamad Afandi.Evi Chamalah. (2013). Model dan metode pembelajaran. In *UNISSULA PRESS*. UNISSULA PRESS.

Pino-Ortega, J., & Rico-González, M. (2021). The Use of Applied Technology in Team Sport. In *The Use of Applied Technology in Team Sport*. https://doi.org/10.4324/9781003157007

Rahayu, N. (2018). Tingkat Kondisi Fisik Atlet Pencak Silat di Padepokan PSHT Kabupaten Tulungagung Tahun 2017. *Jurnal Simki Techsain*, *02*(05), 1–12.

Ratten, V. (2019). Sports Technology and Innovation. In *Sports Technology and Innovation*. https://doi.org/10.1007/978-3-319-75046-0

Romanova, E., Kolokoltsev, M., Vorozheikin, A., Purtova, G., Zotin, V., Vrachinskaya, T., Garov, S., Sarandev, A., & Aganov, S. (2022).

Speed abilities in Kyokushin karate at the stage of initial training in 9-10-year-old boys. *Journal of Physical Education and Sport*, *22*(10). https://doi.org/10.7752/jpes.2022.10307

Rony Syaifullah, I. L. M. (2023). Speed analysis of the front kicks technique in 2022 pencak silat world champion athletes: Kinematic analysis. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *9*(1), 146–159. https://doi.org/https://doi.org/10.29407/js_unpgri.v9i1.19983

Saputra, V. D. (2018). The Influence of Teaching Style and Motor Ability Level Toward Pencak Silat Learning Results on The Fifth Grade Students of SD Hj Isriati Baiturrahman 2 Semarang City. *Journal of Physical Education and Sports*, *7*(2), 100–104. https://doi.org/https://doi.org/10.15294 /jpes.v7i2.23609

Sebayang, F. A. A., Saragih, O., & Hestina, H. (2020). Pemanfaatan Media Pembelajaran Online untuk Meningkatkan Pembelajaran Mandiri Di Masa New Normal. *Pelita Masyarakat*, *2*(1). https://doi.org/10.31289/pelitamasyarakat.v2i1.4222

Shapie, M. N., Oliver, J., O'Donoghue, P., & Tong, R. (2013). Development of new field-based kick and movement speed tests in youth martial arts. *Journal of Combat Sports and Martial Arts*, *4*(2). https://doi.org/10.5604/20815735.1090657

Sriwahyuni, I., Risdianto, E., & Johan, H. (2019). Pengembangan Bahan Ajar Elektronik Menggunakan Flip Pdf Professional Pada Materi Alat-Alat Optik Di Sma. *Jurnal Kumparan Fisika*, *2*(3), 145–152. https://doi.org/10.33369/jkf.2.3.145-152

Sudjana, N. (2011). Penilaian Hasil Proses Belajar Mengajar. In *PT Remaja Rosdakarya Offset*.

Sugiyono. (2013). Metode Penelitian Pendidikan Pendekatan Kuantitaif, Kualitatif, dan R&D. In *Metode Penelitian Pendidikan Pendekatan Kuantitaif, Kualitatif, dan R&D* (pp. 283–393)

Sugiyono. (2016). Metode penelitian kuantitatif, kualitatif,dan R&D. In *Alfabeta, cv.*

Susanto, D. M., Maidarman, Suwirman, & Lesmana, H. S. (2020). Kondisi Fisik Atlet Pencak Silat. *Jurnal Patriot*, *2*(3), 692–704. https://doi.org/10.4135/9780857020116.n162

Venkatraman, J., Manwar, R., & Avanaki, K. M. (2019). Development of a punch-o-meter for sport karate training. *Electronics (Switzerland)*, *8*(7). https://doi.org/10.3390/electronics8070782