The Effect of Intelligence, Leg Muscle Strength, and Balance Towards The Learning Outcomes of Pencak Silat Empty-Handed Single Artistic

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Abstract. This study aims to Determine the effect of intelligence, leg muscle strength, as well as the balance towards the learning outcomes of pencak silat empty-handed single artistic on the Physical Education students of Islamic University 45 Bekasi. The research method is a survey, and the analysis technique is path analysis. This research held in Islamic University 45 Bekasi with 122 people of population. The sampling technique used is random sampling, then a sample of this research is 60 people. The instruments used are a rubric 4 scale (very good, good, enough and less) of the learning outcomes of pencak silat empty-handed single artistic, intelligence test with IST (Intelligent Structure Test), leg muscle strength with instrument squat test, and test of balance by using the modified bass test of dynamic balance. Based the result of the data processing and analysis, the Conclusions are: (1) Intelligence directly effect on the learning outcomes of pencak silat empty-handed single artistic with ργ₁ = 0.359, (2) Leg muscles strength directly effect on the learning outcomes of pencak silat empty-handed single artistic with ργ₂ = 0.228, (3) Balance directly effect on the learning outcomes of pencak silat empty-handed single artistic with ργ₃ = 0.356, (4) Intelligence indirectly effect on the balance with ργ₃ = 0.662, and (5) Leg muscle strength directly effects on the balance with ργ₂ = 0.298.

Keywords: Intelligence; Leg Muscle Strength; balance; Learning Outcomes of Empty-Handed Single Artistic; Pencak Silat

I. INTRODUCTION

Pencak silat is the original culture of Indonesia and at present continues to grow, both in the regulation and organization. A Martial arts organization in Indonesia called Indonesian Pencak Silat Association, abbreviated IPSI initiated by Mr. Wongsonegoro and inaugurated on May 18, 1948 in
Surakarta with the aim to unite and foster the whole school of pencak silats in Indonesia.

Efforts to promote and development of pencak silat are offered through various pathways, one of which is through formal education from primary school to college. In the Faculty of Education, Islamic University 45 Bekasi, coaching sport pencak silat do inside and outside the lecture hours. In the curriculum, pencak silat in charge as one of the compulsory subjects in the Bohemian community (MBB), while sports coaching activities conducted outside lecture hours more familiar with student activity units (Unit Kegiatan Mahasiswa).

The substance of the course theory practice pencak silats are designed with orientation and skill mastery learning approach. Learning is developed in this course consists of history, basic techniques, pencak silat (single artistic) and pencak silat sports (fighting). Pencak silat courses in the Faculty of Education University of Islam 45 Bekasi intended to equip students as candidates for the faculty to have the competence to teach pencak silats in school or community.

One of the skills that must be mastered by students is the pencak silat empty-handed single artistic is a series of complex motion and consists of 7 moves to the 48 series of motion and motion put forward several elements, including attitude, offensive, protection, defense, and fallout.

In a single moment studying pencak silat empty-handed single artistic, students are required to have good physical fitness components. Allegedly the physical fitness component is the leg muscle strength and balance as they both strongly support the movement, in order to attain the truth of motion and stability of motion in a single moment assessment of the pencak silat empty-handed single artistic.

In addition to the components of physical fitness, intelligence factors are also thought to influence student pencak silat empty-handed single artistic. This has to do with one's ability as measured in tests of intelligence, the ability to recall (memory) for a series of moves that quite a lot and requires a good memory.

The problems that arise in the course of pencak silat is bad result to the learning outcomes pencak silat empty-handed single artistic. This is presumably due to several aspects that affect, among others: leg muscle strength, balance, and intelligence. Lower leg muscle strength possessed students expected to result in unstable balance and reduce the stability of motion. While lower intelligence is suspected will lead to error motion sequences and pencak silat empty-handed single artistic.

The learning result is the ability of learners after receiving experience during the learning process. According to Bloom's theory, learning outcomes are divided into three domains, namely cognitive, affective and psychomotor. In this study, the learning outcomes to be assessed is the result of a single moment to learn pencak silats. According to Johansyah (2014), a pencak silat single artistic is a series of complex motion and consists of a wide range of motion and stance, both empty hand and weapons. In the resulting National Conference (National Conference) IPSI XII explained that in a single category match, raw single moment consists of 7 empty-handed tactics, weapons stance cleaver (golok) 3, and 4 moves stick (toya) weapon, with a time of 3-minute appearance.

Learning outcomes pencak silat empty-handed single artistic in this research is the students ability to perform tricks single raw empty hand pencak silat consisting of 7 moves with 48 core motion and 6 intervals, and an element of movement attitude, attack, protection, defense, and fallout.

In addition to the necessary factor in good physical condition, it is also necessary intelligence related to cognition in the perspective of information processing, concept formation, memory, and perception. This is due to the ability to recall information or memorize the movement of a single moment has been previously learned.

Intelligence is an abstract concept that is difficult to define satisfactorily. Wechsler in Sunaryo (2014) argues that intelligence is the ability to adapt, while according to Stenberg in Zubaidi (2009), intelligence is a mental capacity of individuals to process the information automatically and to emit the proper behavior in response to something that is new, involves meta component, component performance-component, and components. Knowledge-acquisition

While the physical condition factors are also needed to support the movement in a single artistic empty- handed practice pencak silats, the physical condition of the main elements is the leg muscle strength. According to Bompa (2009), the strength is maximal (maximal force) or torque (rotational force) produced by muscle or group of muscles. Meanwhile, according to Widiastuti (2015), physiologically muscle strength is the ability of a muscle or group of muscles to perform one maximal contraction against resistance or load. According to Tangkudung (2009), the strength of the type of power / biggest power generated by a muscle to contract did not specify how fast a movement is done or how long the movement can be forwarded.
According to Badriah (2015), physiological factors affecting muscle strength are: (a) Age, until the age of 12 years an increase in muscle strength caused by an increase in muscle size, in men and women alike, (b) Gender, pelvic floor muscle strength woman 80% of muscle strength of men, and the strength of the arm muscles of women is only 55% of the strength of the muscles of the arms of a man, (c) The temperature of the muscles, muscle contraction will be stronger and faster when the temperature of the muscles slightly higher than the temperature normal. Meanwhile, according to Bompa [4], the factors that affect the strength is: (1) the number of motor units involved / recruitment, (2) the number of motor units are stimulated (rate coding), (3) the number of motor unit synchronization, (4) on the stretch-shortening cycle, (5) the degree of inhibition neuromuscular, (6) the type of muscle fibers, and (7) the degree of muscle hypertrophy.

In this study, the authors make restrictions that affect the strength of a learning outcomes of pencak silat empty-handed single artistic in leg muscle strength, the ability of a group to do the leg muscle contraction or tension to the maximum.

In addition to strength, physical condition other factors which contributed to demonstrate the truth of motion in a pencak silat empty-handed single artistic is a balance. According to Widiastuti (2015), the balance of a person's ability to maintain the attitude and position of the body quickly upon standing (static balance) or at the time of the motion (dynamic balance).

Furthermore, Magill (2011) says that the static equilibrium is the maintenance of balance, although not moving as standing, sitting or kneeling. While the dynamic balance is maintaining balance while moving such as when walking or running. The ability to maintain a balance influenced by visual and vestibular.

The balance is a complex interaction of integration/interaction sensory system (vestibular, visual and somatosensory including proprioceptor) and musculoskeletal (muscles, joints, and finger other software) are modified/regulated in the brain (motor control, sensory, Basai ganglia, cerebellum, association area) in response to changing conditions. Internal and external, if one system is impaired, there will be disturbances in the body balance(imbalance).

Based on the above, it is necessary to do in-depth research on the influence of intelligence, leg muscle strength and balance to the learning outcomes of pencak silat empty-handed single artistic. The exogenous variables (independent variables) in this study is the intelligence and leg muscle strength by intervening variables balance and the learning outcomes of pencak silat empty-handed single artistic serve as an endogenous variable (the dependent variable).

II. RESEARCH METHOD

The research method used in this research is survey method with measurement and test. Analysis technique used is path analysis. According to Kadir (2015) used path analysis techniques to study the causal relationship between independent variables and the dependent variable.

The research was conducted at the Islamic University 45 Bekasi, Jl. Cut Meutia No. 83 Bekasi. The population in this study were students of Physical Education Islamic University 45 Bekasi, amounting to 122 people. The sampling technique in this research using random sampling, the sample in this study amounted to 60 people.

The instrument used in this study is an assessment rubric 4 scale (excellent, good, fair and less) on the assessment of the learning outcomes of pencak silat empty-handed single artistic, intelligence tests were measured using instruments test IST (Intelligent Structural Test), leg muscle strength was measured using squat test while the balance test instrument using a modified bass test of dynamic balance.

III. RESULT AND DISCUSSION

Samples students of Physical Education in Islamic University 45 Bekasi. For descriptive statistical calculation results can be seen in the table below:

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Count Results in Descriptive statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>60</td>
</tr>
<tr>
<td>The Learning Outcomes of Pencak Silat Empty-Handed Single Artistic</td>
<td>60</td>
</tr>
<tr>
<td>Intelligence</td>
<td>60</td>
</tr>
<tr>
<td>Leg Muscle Strength</td>
<td>60</td>
</tr>
<tr>
<td>Balance</td>
<td>60</td>
</tr>
</tbody>
</table>

Before calculating the coefficient of the line, it must be done the test requirements analysis, namely: normality test, linearity and significance of
the regression equation and correlation test. The summary results of the prerequisite test analysis:

**Normality Test**

Results of the calculations can be seen in Table II below:

**Table II**

Results of Normality Test the Kolmogorov-Smirnov

<table>
<thead>
<tr>
<th>Tests of Normality</th>
<th>Kolmogorov-Smirnova</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence</td>
<td>.110</td>
<td>.666</td>
</tr>
<tr>
<td>Leg Muscle Strength</td>
<td>.065</td>
<td>.200</td>
</tr>
<tr>
<td>Balance</td>
<td>.112</td>
<td>.660</td>
</tr>
<tr>
<td>The Learning Outcomes of Pencak Silat Empty-Handed Single Artistic</td>
<td>.108</td>
<td>.080</td>
</tr>
</tbody>
</table>

a. Lillifors Significance Correction

The table test above results can be seen in the column Kolmogorov-Smirnov. It is known that significant value to the intelligence of 0.066, leg muscle strength of 0.200, 0.060 and the balance amounting to learning outcomes of pencak silat empty-handed single artistic to be 0.800. Because of the significance for all variables more than (0.05), it can be concluded that the overall study variables with normal distribution.

**Linearity test and regression equation Significance**

The test results linearity and the significance of the regression equation to 4 variables of the study, the results can be seen in the summary table below:

**Table III**

Summary Significance Tests and Test Results Linearity Regression

<table>
<thead>
<tr>
<th>Regression</th>
<th>Equation</th>
<th>F Linearity Test</th>
<th>p-value</th>
<th>F Significance Test</th>
<th>p-value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y at X1</td>
<td>Y^2 = -467,827 + 11,392X</td>
<td>1.535</td>
<td>0.124</td>
<td>93.511</td>
<td>0.000</td>
<td>Linear/Significant</td>
</tr>
<tr>
<td>Y at X2</td>
<td>Y^2 = 270,843 + 3,046X</td>
<td>0.549</td>
<td>0.944</td>
<td>48.372</td>
<td>0.000</td>
<td>Linear/Significant</td>
</tr>
<tr>
<td>Y at X3</td>
<td>Y^2 = 200,878 + 10,132X</td>
<td>2.072</td>
<td>0.073</td>
<td>109.828</td>
<td>0.000</td>
<td>Linear/Significant</td>
</tr>
<tr>
<td>X at X1</td>
<td>X^2 = -51,304 + 0.965X</td>
<td>1.707</td>
<td>0.075</td>
<td>131.725</td>
<td>0.000</td>
<td>Linear/Significant</td>
</tr>
<tr>
<td>X at X2</td>
<td>X^2 = 12,622 + 0.245X</td>
<td>0.858</td>
<td>0.668</td>
<td>49.304</td>
<td>0.000</td>
<td>Linear/Significant</td>
</tr>
</tbody>
</table>

Based on a summary of the significance test and regression linearity test, it can be seen that the overall variable have p-value = 0.000 < 0.05. It means all variable in this research linear and significant.

**Correlation**

From the test results of correlation to 4 variables of the study, the results can be seen in the summary table below:

According to the table correlations above, the sig line or p-value = 0.000 < 0.05 or H0 is rejected, in other words, there is all variables research has a strong relationship. This is indicated by the Pearson correlation values above 0.50.

After the calculation of the test requirements analysis, data research is eligible and can proceed to test hypotheses using path analysis.

**Hypothesis Testing**

Based causal models in the form of theoretically obtained path analysis diagram and then calculated the coefficient of each track. Very important requirements that must be met is a significant correlation between variables related and connected to one another. The relationship has been demonstrated above has not concluded that the occurrence of a causal relationship between these variables. From the field data has been processed and through various tests required, then the next stage in testing models of causality is to conduct path analysis.

For data processing path analysis by Kadir (2015), the Output and interpretation of the results SPSS version 23 is as follows:

**Structural I**

From the table above, the coefficient of determination (R^2) equals to 0.754. This means that 75.4% of balance (X1) and leg muscle strength (X2). So the error (ε) = 1 - 1 - R^2 = 0.754 = 0.246.
Based on the analysis in the above table was obtained \( F_0 = 87.348; \) \( DF_1 = 2; \) \( DF_2 = 57; \) \( p\)-value = 0.000 < 0.05 or \( H_0 \) is rejected. Thus, variable intelligence and leg muscle strength affects the balance, here in after:

**Table VII**

*Coefficients Structural 1*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>-44.031</td>
<td>7.292</td>
<td>-6.038</td>
<td>.000</td>
</tr>
<tr>
<td>Intelligence</td>
<td>.767</td>
<td>.093</td>
<td>.662</td>
<td>8.261</td>
</tr>
<tr>
<td>Leg Muscle</td>
<td>.108</td>
<td>.029</td>
<td>.298</td>
<td>3.719</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Dependent Variable: Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table coefficient in model 1, was obtained in a row as are follows:

1) \( \rho_{31} = 0.662; t_0 = 8.261, \) \( p\)-value = 0.000 < 0.05, or \( H_0 \) is rejected, which means intelligence (X₁) has a positive direct effect on the balance of (X₃).

2) \( \rho_{32} = 0.298; t_0 = 3.719, \) \( p\)-value = 0.000 < 0.05, or \( H_0 \) is rejected, which means the leg muscle strength (X₂) has a positive direct effect on the balance of (X₃).

Based on the calculation results in a structural path coefficients 1 indicates that the leg muscle strength and intelligence positive direct effect on the balance.

**Structural 2**

**Table VIII**

*Structural Path Analysis 2*

<table>
<thead>
<tr>
<th>Model</th>
<th>R square</th>
<th>Adjusted R square</th>
<th>Std. Error of the Estimate</th>
<th>R square Change</th>
<th>F Change</th>
<th>df I</th>
<th>df II</th>
<th>Sig. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.850</td>
<td>.723</td>
<td>.706</td>
<td>59.571</td>
<td>723</td>
<td>48.742</td>
<td>3</td>
<td>56</td>
</tr>
<tr>
<td>a. Predictors: (Constant), Balance, Leg Muscle Strength, Intelligence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the above table, the coefficient of determination (R²) of 0.723 means that 72.3% of the variability of the learning outcomes of pencak silat empty-handed single artistic (Y) is influenced by the intelligence (X₁), leg muscle strength (X₂) and balance (X₃). So the error \( (\varepsilon) = 1 - 1 - R^2 = 0.723 = 0.277.\)

Based on the analysis in the above table was obtained \( F_0 = 48.742; \) \( DF_1 = 3; \) \( DF_2 = 56; \) \( p\)-value = 0.000 < 0.05 or \( H_0 \) is rejected. Thus the intelligence variable, leg muscle strength and balance simultaneously positive direct effect on the learning outcomes of pencak silat empty-handed single artistic, for more details can be learned from the table below:

**Table IX**

*Coefficient Structural 2*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>-169.637</td>
<td>125.178</td>
<td>-1.355</td>
<td>.181</td>
</tr>
<tr>
<td>Intelligence</td>
<td>5.201</td>
<td>1.845</td>
<td>.359</td>
<td>2.819</td>
</tr>
<tr>
<td>Leg Muscle</td>
<td>1.028</td>
<td>.432</td>
<td>.228</td>
<td>2.578</td>
</tr>
<tr>
<td>Balance</td>
<td>4.457</td>
<td>1.776</td>
<td>.356</td>
<td>2.510</td>
</tr>
<tr>
<td>a. Dependent Variable: The Learning Outcomes of pencak silat Empty-Handed Single Artistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table, coefficient data consecutive succession:

1) \( \rho_{31} = 0.359; t_0 = 2.819, \) \( p\)-value = 0.007 < 0.05, or \( H_0 \) is rejected, which means intelligence (X₁) a positive direct effect on the learning outcomes of pencak silat empty-handed single artistic (Y).

2) \( \rho_{32} = 0.228; t_0 = 2.378, \) \( p\)-value = 0.021 < 0.05, or \( H_0 \) is rejected, which means the leg muscle strength (X₂) a positive direct effect on the learning outcomes of pencak silat empty-handed single artistic (Y).

3) \( \rho_{33} = 0.356; t_0 = 2.510, \) \( p\)-value = 0.015 < 0.05, or \( H_0 \) is rejected, which means balance (X₃) a positive direct effect on the learning outcomes of pencak silat empty-handed single artistic (Y).

Based on the calculation results in a structural path coefficient 2 shows that intelligence, leg muscle strength and balance a positive direct effect on on the learning outcomes of pencak silat empty-handed single artistic. The SPSS summary hypothesis testing can be seen in the table below:
single artistic has been previously learned. In this research, intelligence gives the effect of 0.359 (35.9%) on the learning outcomes of pencak silat empty-handed single artistic.

In addition to the intelligence elements of the physical condition also affects on the learning outcomes of pencak silat empty-handed single artistic, namely the leg muscle strength and balance. In studying the movement of a single moment, the function of the legs is as the support body, so that the legs of a fighter should have the power in the legs to keep the body at the time of kick and maintain balance. The level of leg muscle strength affects on the learning outcomes of pencak silat empty-handed single artistic.

In the pencak silats exercise, muscle strength used in the kicking motion is static and dynamic muscle strength, muscle sector which acts to move the body from one place to another and maintain the position of standing on one leg. Muscle contraction is used to generate an external force to move the body. Leg strength directly on the learning outcomes of pencak silat empty-handed single artistic, especially in supporting the body when one foot raised and leg strength that performs the basic techniques of horses, attacks, and the pattern of steps in a single artistic empty-handed practice pencak silats. In this study, the effect of leg muscle strength of 0.228 (22.8%) on the learning outcomes of pencak silat empty-handed single artistic.

Results of research Lee and Aronson (1974) in Edward (2011), the balance is strongly influenced by a variety of visual information presented. Taken together, the information structure of the vestibular apparatus is also important to maintain a sense of balance. Meanwhile, according to Dewi Laelaatul Badriah (2009), disorders of the eye and the ear will result in a person difficult to halt or motion and difficulty in movement circuit. So it can be concluded that the balance is a stable state or to maintain weight loss center, especially when in an upright position regardless of internal or external power.

In studying and practicing tricks of pencak silat empty-handed single artistic, the element of balance is needed because a lot of movement step that requires a balance of the body, namely at the time intervals and maintain a standing position when an attack (especially kicking), a standing easel on one leg, or at the time of changing the direction of movement and do a 180°. From these results, the balancing effect for 0.356 (35.6%) on the learning outcomes of pencak silat empty-handed single artistic.
Exogenous variables also impact the other exogenous variables. In accordance with a model drawn constellations, there are two hypotheses influence between exogenous variables, namely the influence of intelligence on the balance and the effect of leg muscle strength to the balance.

The balance is a complex interaction of integration/interaction system sensory (vestibular, visual and somatosensory including proprioceptor) and musculoskeletal (muscles, joints, and finger other software) are modified/regulated in the brain (motor control, sensory, Basal ganglia, cerebellum, association area) in response to changing internal and external conditions.

According to Ibrahim (2005), someone who has a low intelligence level, it can even be categorized mild mental retardation (IQ of 69-55) tend to have a perception that is not normal and have no problems in perceptual-motor. This can occur in the form of visual perception and auditory perception, so it will affect the balance of the motion. Based on that statement, the alleged intelligence level affect balance. From these results, intelligence gives the effect of 0.662 (66.2%) against the results of the balance.

While the contribution of leg muscle strength gives the effect of 0.298 (29.8%) of the balance. The better the leg muscle strength one has, the better the balance. Based on that idea, then the leg muscle strength contributes in maintaining balance.

Leg muscle strength should be adequate to maintain the body balance when the force from the outside. Muscle strength is directly related to the ability of muscles to resist gravity and other external loads that continuously affect the position of the body.

**IV. CONCLUSIONS**

Based on the results of data processing and analysis, the conclusion is as follows: (1) Intelligence directly effect on the learning outcomes of pencak silat empty-handed single artistic with $\rho_{y1} = 0.359$, (2) Leg muscles strength directly effect on the learning outcomes of pencak silat empty-handed single artistic with $\rho_{y2} = 0.228$, (3) Balance directly effect on the learning outcomes of pencak silat empty-handed single artistic with $\rho_{y3} = 0.356$, (4) Intelligence directly effects on the balance with $\rho_{x1} = 0.662$, and (5) Leg muscle strength directly effects on the balance with $\rho_{x2} = 0.298$.

Suggestions can author to convey the outcomes of this research is for lecturers, coaches, trainers, and physical education teachers, the results of this study can be used as a reference and information on the effect of intelligence, leg muscle strength and balance to learning outcomes of pencak silat empty-handed single artistic, so it can be used as a reference for athletes looking for talent single categories based on the level of intelligence and good physical fitness.

**REFERENCES**


