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Differences in Physical Fitness, Learning Motivation, and Learning Outcomes of Physical Education Sports and Health Based on Student BMI

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ABSTRACTS

Purpose: This study compares differences in physical fitness (PF), learning motivation, and learning outcomes based on senior high school students' Body Mass Index (BMI). It examines students' PF across different BMI categories, the relationship between BMI and learning motivation, and Physical Education learning outcomes based on BMI.

Materials and Methods: This study uses a quantitative approach of ex-post-facto type and comparative studies. The research population is 859 senior high school students. The sample was 95 students, who were selected using random cluster sampling and purposive random sampling techniques. The instruments used are TKJI, learning motivation scales, and grades. The data was analyzed using a multivariate statistical analysis of variance (MANOVA).

Result: 1) There were differences in PF, learning motivation, and learning outcomes of students based on BMI (sig 0.000); 2) There is a difference in students' PF based on BMI (sig 0.000); 3) There was no difference in student learning motivation based on BMI (sig 0.867); 4) There is a difference in the learning outcomes of Physical Education students based on BMI (sig 0.000).

Conclusion: This study found differences in PF and Physical Education learning outcomes based on BMI but not in learning motivation. The results highlight the need for tailored learning models, improved strategies, and a more decisive role for Physical Education in student well-being and learning quality.

Keywords: Physical fitness; Learning motivation; Learning outcomes.

INTRODUCTION

Education is a process that students can use to develop their potential. The essence of education is learning—no education without learning activities (Khatimah et al., 2022). Education is an indicator used for the progress of a country that supports development and is a construction of a country's competence (Mahendra et al., 2021). Through education, humans can face and solve their problems and challenges. Talking about education cannot be separated from the efforts that must be made to create competent and quality human resources (Miasari et al., 2022). The low quality of education in Indonesia is very concerning, and improving this can be done by improving the way of learning (Andayani & Madani, 2023). Learning is indispensable for developing their potential and gaining knowledge about what they learn (Sinta et al., 2022). Learning is a process activity and a

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fundamental element in implementing every type and level of education (Faizah & Kamal, 2024). In addition, through learning, students can acquire skills and shape their attitudes to be more mature in thinking and behaving (Fernando et al., 2024). Learning is a process carried out by individuals to obtain a new change as a result of the individual's own experience in interacting with the environment (Twins, 2021).

One of the school subject groups is Physical Education, Sports, and Health, which focuses on overall individual development through physical activities (Sari et al., 2024). Proper preparation is essential to effectively achieving the goals of Physical Education, Sports, and Health (PJOK). These preparations are realized so that a person can get PF (Mustafa, 2022). According to Pranta (2022), PF is a person's degree of dynamic health, a physical ability that is the basis for successfully implementing the tasks that must be carried out. One core of national sports is improving PF (Sirait & Noer, 2021). School-age children require PF from Kindergarten to Senior High School (Alfarabi & Kuntjoro, 2024). By having high PF, students can carry out daily activities longer than those with low PF (Rohmah & Muhammad, 2021).

PF can support physical education (PE) learning, a learning event carried out by all students in school (Destriana et al., 2022). In implementing PJOK learning, encouragement must arise within and outside the student or student (Pratama & Winarno, 2022). These impulses are called motivation (Habibi & Astra, 2023). Through learning, individuals can develop their potential. Therefore, students need to study seriously, based on motivation to prepare and participate in learning activities, do assignments, and follow up on the subject matter that has been learned (Peby et al., 2022). According to Sardiman (2011), motivation in learning activities can be said to be the overall driving force in students that gives rise to learning activities, which ensures the continuity of learning activities and provides direction to learning activities so that the goals desired by the learning subject can be achieved (Cahyaningtias & Ridwan, 2021). In PE, a student must have the motivation to learn; with high learning motivation, students will get satisfactory learning results. From this opinion, it can be understood that motivation can generate, sustain, direct, and integrate behavior. If a person is motivated, they can find the source of motivation itself (Rozi et al., 2023). Based on the above explanation, it can be concluded that motivation is realized because of the need to encourage a person both inside and outside a person so that in learning, which will later occur a behavior change, this change will affect the individual's mindset in doing and acting.

Senior high school is a level of education in children aged 15 years or early adolescence. At this age, the majority are passive in sports activities, so they have the potential to have low levels of PF (Nurhasan et al., 2020). PJOK and extracurricular activities provide a solution to increase adolescents' motivation to be active in sports. Adolescent age has an increased physiology of muscle ability compared to childhood, with aspects of physical conditions that can be trained in areas such as strength, speed, and explosive power. With improved body physiology, the PJOK learning process and extracurricular activities can be adjusted to enhance students' PF (Wibowo et al., 2022).

Additionally, Migueles et al. (2021) found that children with high BMI levels experienced volume changes in brain regions such as the fusiform gyrus, postcentral gyrus, and hippocampus, which significantly affected cognitive function and could reduce academic achievement. Students do not have enough time to focus on PF due to academic demands such as competition for college admission. However, good PF is essential to ensure high academic performance, and obesity can hinder learners' academic development (Shi et al., 2022).

Achieving and maintaining students' PF level can be one of the successful roles of PJOK because one of the goals of PJOK is to improve students' PF (Nugraha, 2015). Research conducted by (Irianto et al., 2021) states that there is a significant relationship between the learning outcomes

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of PJOK and physical activity carried out by students at SMAN 1 Banjarbaru, namely, students have a score above the average of 82.11, where the standard passing score determined by the school is 80. In addition, Marques et al. (2016) found that 8 out of 12 studies stated that PJOK positively impacted students' academic success, and it was not found that PJOK hurt students' academic performance. Therefore, this study aims to analyze the differences in learning outcomes of PE, PF, and learning motivation based on students' BMI.

PF also affects the quality of a child's learning outcomes (Maidarisa et al., 2023). Good PF can support the implementation of good education for students; on the contrary, poor PF will affect the quality of the child's education (Yahya et al., 2024). That is one of the reasons why PE subjects are applied to students (Sari et al., 2024). Many students are undernourished or overnourished, preventing them from achieving an ideal body (Pratama, 2019). This issue arises due to a lack of motivation among children to engage thoughtfully and consistently in exercise. One way to determine whether we are overweight can be done by measuring the BMI. BMI is a simple tool to monitor a person's nutritional status, primarily related to underweight and overweight (Pratama & Winery, 2022). Based on the analysis of PE learning outcomes in grades X, XI, and XII of the even year academic of the 2014/2015 school year at SMA Negeri 1 Rengat. The value of the minimum provision criteria (KKM) is 80. Many students who got learning results under the KKM had a fat posture of 61, compared to 29 thin and 21 regular students. So, based on the learning outcomes of PE under the KKM, obese, thin, and normal students have different PE learning outcomes; it can be understood that the BMI affects the learning outcomes of PE. This research lies in its ability to improve students' well-being, learning quality, and physical health. By understanding the relationship between PF (BMI), learning motivation, and learning outcomes, this research can help design more effective learning strategies, address weight-related health issues, and support more appropriate educational policies to support optimal student development. Based on this, a deep understanding of students' BMI is needed as it affects PF, learning motivation, and learning outcomes of PJOK. For this reason, it is necessary to conduct further research on PF, learning motivation, and learning outcomes of PE, sports, and health PE based on the BMI at SMA Negeri 1 Rengat.

METHODS

***Study Participants*:** The research population comprises 859 senior high school students aged 16-19 with a BMI (thin, normal, and obese). The sample consists of 95 male and female students selected using random cluster sampling and purposive random sampling techniques.

***Study Organization*:** The sampling in this study used the Proportional Stratified Random Sampling technique. This technique is employed to randomly select samples from the population members in a proportionally stratified manner because the population members are heterogeneous (not uniform). The sampling process began by identifying the population based on class groups, and then 98 students were randomly selected from this population for the study. Data collection was carried out using a Google Form. Before proceeding with the questionnaire, respondents were required to read the instructions provided at the beginning of the Google Form and then continue to complete the questionnaire.

***Statistical Analysis*:** This study involves three dependent variables, namely (Y1) PF, (Y2) Learning Motivation, and (Y3) Learning outcomes of PJOK, and as an independent variable, (X1) is the student's BMI which will be tested in this study. The data collected in this study include learning outcomes of PE, PF, and learning motivation based on students' BMI. The instruments of this study

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are instruments for measuring learning outcomes of PE in the form of tests and instruments for student's BMI in the form of questionnaires. The analysis technique used is manova. Manova was used to test the research hypothesis. The analysis was used to describe the variables' mean value and standard deviation and the learning outcomes of PJOK Education in the form of tests and instruments for students' BMI. Assumption testing is carried out to determine whether the available data can be analyzed with parametric statistics. For the statistics used for data analysis in this study, the assumption tests include the normality, homogeneity, and variance matrix tests. Normality testing is carried out to ensure that the sample comes from a normally distributed population so that hypothesis testing can be carried out. Test the normality of data distribution for Windows using the help of SPSS-10 through the Shapiro-Wilk and Kolmogor-Smirnov tests. Given that the manova calculation is quite complicated and requires a long time, the analysis used the help of the SPSS-PC 10.0 for the Windows program. All hypothesis testing was conducted at the 5% significance level.

RESULT

PF data based on BMI (thin, normal, and obese) was obtained from a sample (respondent) from SMA Negeri 1 Rengat, which totaled 95 students. The sample was 28 skinny, 42 normal, and 25 obese. The PF variable has five tests; the score range is from 1 to 5. A description of PF data based on BMI (thin, normal, and fat) can be seen in Table 1.

Table 1. Frequency distribution and PF categories based on BMI

BMI Category	Interval Score	Category	Frequency (F)	Percentage (%)
Skinny (28 Respondents)	22-25	Very Good (VG)	0	0
	18-21	Good (G)	0	0
	14-17	Medium (M)	8	28,57
	10-13	Less (L)	19	07,86
	5-9	Very Poor (VP)	3	3,57
		Total	28	100
Normal (42 Respondents)	22-25	Very Good (VG)	0	0
	18-21	Good (G)	3	7,14
	14-17	Medium (M)	10	23,81
	10-13	Less (L)	23	54,76
	5-9	Very Poor (VP)	6	14,29
		Total	42	100
Fat (25 Respondents)	22-25	Very Good (VG)	0	0
	18-21	Good (G)	0	0
	14-17	Medium (M)	3	12
	10-13	Less (L)	11	44
	5-9	Very Poor (VP)	11	44
		Total	25	100

Based on Table 1 above, it can be seen that most of the students with a thin BMI, namely 28.57%, have moderate PF, 67.86% have poor PF, and 3.57% have very poor PF. Of students with a normal BMI, 7.14% had good PF, 23.81% had moderate PF, 54.76% had poor PF, and 14.29% had very poor fitness. Of students with a fat BMI, 12% have moderate PF, 44% have poor PF, and 44% have very poor fitness.

Table 2. Description of average and percentage of PF based on BMI

BMI	Score						
	Ideal	Max	Min	Total	Mean	Sd	Category
Skinny (28 Respondents)	25	17	8	356	48,68	1,941	L
Normal (42 Respondents)	25	18	8	524	49,96	2,698	L
Fat (25 Respondents)	25	15	6	224	39,04	2,554	VL
Overall (95 Respondents)	25	18	6	1124	47,32	7,482	L

Note: Max = Maximum Score; Sd = Standard Deviation; VL = Very Less; Min = Minimum Score; L = Less

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Based on Table 2, it can be seen that overall PF based on BMI (thin, normal, and obese) is in the poor category with an ideal score of 25; students with the highest PF score is 18, students with the lowest PF score is 6. Overall, the total score obtained was 1124, with the average score obtained by students being 11.83 or 47.32% of the ideal score, with a standard deviation of 7.482. Thus, on average, PF based on BMI is less (K). In more detail, PF is based on the BMI, where students who have a thin BMI are in the poor category with an average score of 12.17 or 48.68%, and students who have a normal BMI are in the poor category with an average score of 12.48 or 49.96%. Students with a thin BMI are in the poor category, with an average score of 9.76 or 39.04%.

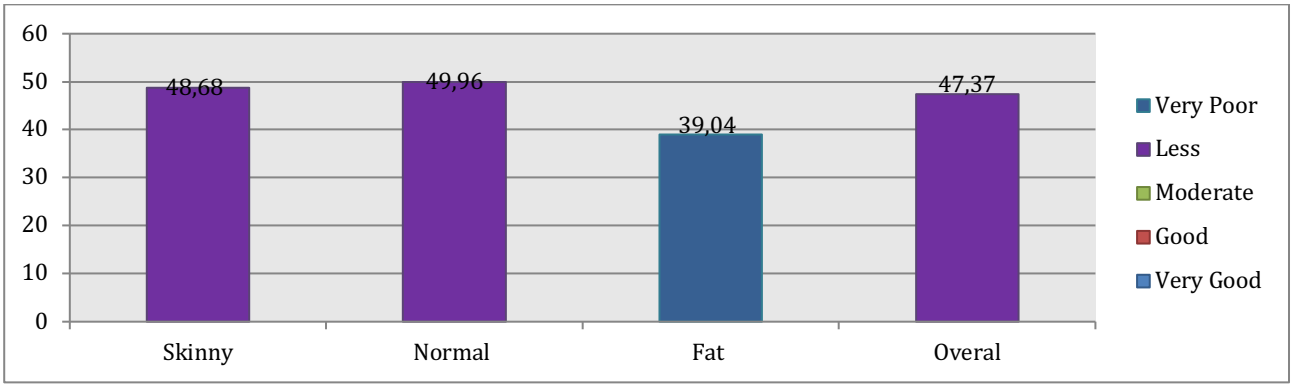

Figure 1. PF of students based on BMI

Based on the figure 1 above, normal students have better PF than thin and fat students, and thin students are better than obese students. Overall, students' PF based on their BMI is in the Lacking category. Data on learning motivation based on BMI was obtained from a sample (respondent) from SMA Negeri 1 Rengat, which totaled 95 students. The sample was 28 skinny, 42 normal, and 25 obese. The learning motivation variable has five items, with a score ranging from 1 to 5. Table 3 describes learning motivation data based on BMI.

Table 3. Frequency distribution and category of learning motivation score based on BMI

BMI Category	Interval Score	Category	Frequency (F)	Percentage (%)
Skinny (28 Respondents)	>126	Very High (VH)	6	21,42
	102-125	High (H)	17	60,71
	78-101	Medium (M)	4	14,28
	54-77	Low (L)	1	3,57
	<53	Very Low (VL)	0	0
		Total	28	100
Normal (42 Respondents)	>126	Very High (VH)	7	16,66
	101-125	High (H)	26	61,90
	78-101	Medium (M)	9	21,42
	54-77	Low (L)	0	0
	<53	Very Low (VL)	0	0
		Total	42	100
Fat (25 Respondents)	>126	Very High (VH)	3	12
	102-125	High (H)	17	68
	78-101	Medium (M)	5	20
	54-77	Low (L)	0	0
	<53	Very Low (VL)	0	0
		Total	25	100

Table 3 shows that most of the students with a thin BMI, namely 21.42%, have very high learning motivation, 60.71% have high learning motivation, 14.28% have moderate learning motivation, and 3.57% have low learning motivation. Students with a normal BMI, namely 16.66%, had very high learning motivation, 61.90% had high learning motivation, and 21.42% had moderate

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learning motivation. Students with a fat BMI, namely 12%, have very high motivation to learn, and 68% have high motivation to learn.

Table 4. Description of average and percentage of learning motivation based on BMI

BMI	Score						
	Ideal	Max	Min	Total	Mean	Sd	Category
Skinny (28 Respondents)	150	137	88	4653	73,86	12,009	High
Normal (42 Respondents)	150	140	74	3149	74,18	14,871	High
Fat (25 Respondents)	150	86	44	2782	74,18	12,236	High
Overall (95 Respondents)	150	140	74	10584	74,27	12,852	High

Based on Table 4, it can be seen that overall learning motivation based on BMI is in the high category with an ideal score of 150; students with the highest learning motivation score is 140, students with the lowest learning motivation score is 44. Overall, the total score obtained was 10584, and the average score obtained by students was 111.41, or 74.27% of the ideal score, with a standard deviation of 12.851. Thus, on average, learning motivation based on BMI is high (T). In more detail, learning motivation is based on the BMI. Students who have a thin BMI are in the high category with an average score of 110.76 or 73.86%, students who have a normal BMI are in the high category with an average score of 112.46 or 74.97%, and students who have a thin BMI are in the high category with an average score of 111.28 or 74.18%.

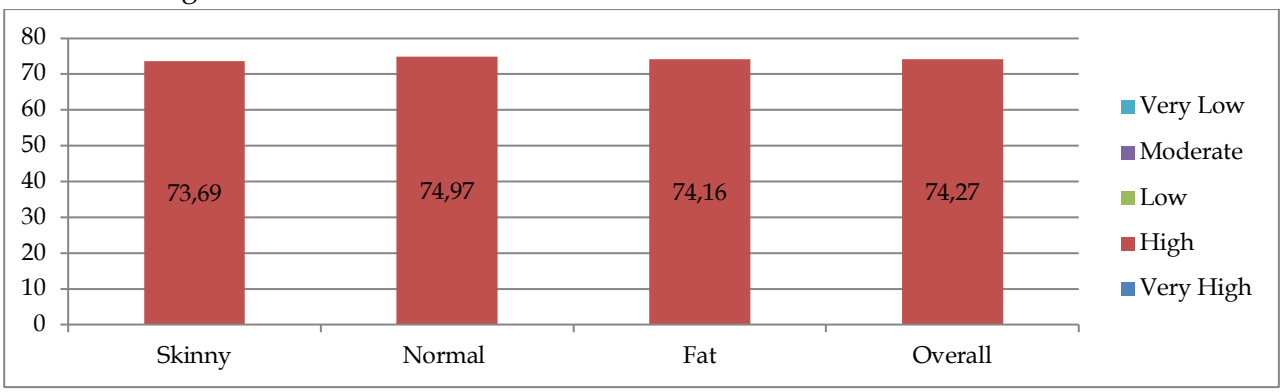

Figure 2. Student learning motivation based on BMI

Based on the figure 2 above, it can be seen that normal has higher learning motivation compared to thin and obese students, and obese students have higher learning motivation compared to thin students. Overall, the student's learning motivation based on the BMI is high. The data on PE learning outcomes based on BMI was obtained from a sample (respondent) from SMA Negeri 1 Rengat, which totaled 95 students. The sample was 28 skinny, 42 normal, and 25 obese. There are five statement items on the PE learning outcome variables, with a score range from 1-5.

Table 5. Frequency distribution and category score of PE learning outcomes based on BMI

BMI Category	Interval Score	Category	Frequency (F)	Percentage (%)
Skinny (28 Respondents)	>86	Very High (VH)	18	64
	71-85	Good (G)	10	36
	56-70	Fair (F)	0	0
	41-55	Less (L)	0	0
	<40	Very Low (WL)	0	0
		Total	28	100
Normal (42 Respondents)	>86	Very High (VH)	42	100
	101-125	Good (G)	0	0
	78-101	Fair (F)	0	0
	54-77	Less (L)	0	0
	<53	Very Low (WL)	0	0
		Total	42	100
Obese (25 Respondents)	>126	Very High (VH)	6	24
	102-125	Good (G)	19	76

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BMI Category	Interval Score	Category	Frequency (F)	Percentage (%)
	78-101	Fair (F)	0	0
	54-77	Less (L)	0	0
	<53	Very Low (WL)	0	0
		Total	25	100

Based on Table 5 above, it can be seen that most % of the students with a thin BMI, namely 64%, have excellent PE learning results, and 36% have good PE learning results. Students who have a normal BMI, which is 100%, have excellent PE learning outcomes. Students with a fat BMI, namely 24%, have excellent PE learning results, and 76% have good PE learning results.

Table 6. Description of average and percentage of learning motivation based on BMI

BMI	Score						
	Ideal	Max	Min	Total	Mean	Sd	Category
Skinny (28 Respondents)	100	89	84	2417	86,32	1,611	VG
Normal (42 Respondents)	100	95	90	3891	92,69	1,554	VG
Fat (25 Respondents)	100	87	82	2109	84,34	1,604	G
Overall (95 Respondents)	100	95	82	8419	88,63	4,032	VG

Note: VG = Very Good; Min = Minimum Score; G = Good

Based on Table 6, it can be seen that overall PE learning outcomes based on BMI are at less with an ideal score of 100; students who get the highest PE learning outcome score is 95, students who get the lowest PJOK learning outcome score is 82. Overall, the total score obtained was 8419, with the average score obtained by students being 88419 or % of the ideal score with a standard deviation of 4,032. Thus, on average, the learning outcomes of PE based on BMI are very good (VG). In more detail, the learning outcomes of PE are based on the BMI. Students with a thin BMI are in the very good category with an average score of 86.32%, and students with a normal BMI are in the very good category with an average score of 92.69%. Students with a thin BMI are in a good category, with an average score of 84.36%.

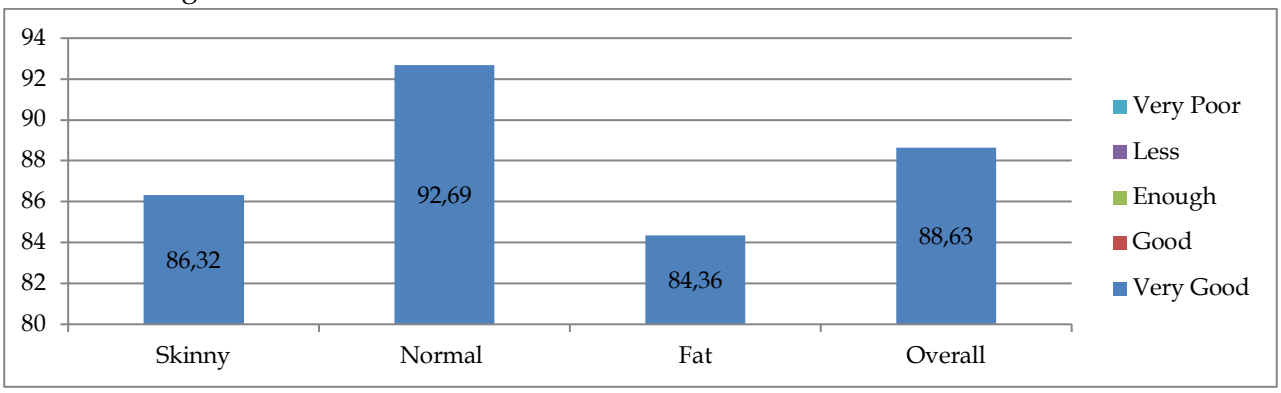

Figure 3. PE learning outcome based on BMI

The Figure 3 above shows that normal students have better PE learning outcomes than thin and fat students, and thin students have better PE learning outcomes than obese students. Overall, the learning outcomes of PE students based on BMI are very good.

Table 7. multivariate test data on PF, learning motivation, and learning outcomes of PJOK students

Effect		Value	F	Hypothesis df	Error df	Sig
Intercept	Pillai's Trace	1,000	92358,662[b]	3,000	90,000	0,000
	Wilks' Lambda	,000	92358,662[b]	3,000	90,000	0,000
	Hotelling's Trace	3078,622	92358,662[b]	3,000	90,000	0,000
	Roy's Largest Root	3078,622	92358,662[b]	3,000	90,000	0,000
PF Learning Motivation and Learning Outcomes of PE Students Based on BMI	Pillai's Trace	,990	29,740	6,000	182,000	0,000
	Wilks' Lambda	,130	53,339b	6,000	180,000	0,000
	Hotelling's Trace	5,793	85,934	6,000	178,000	0,000
	Roy's Largest Root	5,629	170,753[b]	3,000	91,000	0,000

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Based on Table 7, the significance values for PF, learning motivation, and PE learning outcomes among students with different BMI categories were tested using Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root, all of which showed a significance level of ≤ 0.05., it means that there is a significant difference in PF, learning motivation and student PE learning outcomes based on BMI.

Table 8. Tests of between subjects effects of PF data of learning motivation and learning outcomes of PE students

Dependent Variable	BMI	N	Mean	DK	MS	F_{Count}	Sig	Description
PF	Skinny	28	12,17	1	73,277	12,109	0,00	There is a Difference
	Normal	42	12,48	1				
	Fat	25	9,76	1				

Table 8 shows significant differences in PF among students with different BMI categories. These differences were determined using MANOVA, where significance is assessed with an alpha (α) level of 0.05. A p-value of ≤ 0.05 indicates a significant difference, while a p-value of ≥ 0.05 suggests no significant difference. For further details, refer to Appendix 8.

Table 9. Tests multiple comparisons of PF data of learning motivation and learning outcomes of PE students

Dependent Variable	BMI	(J) BMI	Mean Difference (I-J)	Std. Error	Sig
PF	Skinny	Normal	0,24	0,555	0,904
		Fat	2,95*	0,629	0,000
	Normal	Normal	-0,24	0,555	0,904
		Fat	2,72*	0,659	0,000
	Fat	Normal	-2,95*	0,629	0,000
		Fat	-2,72*	0,659	0,000

Based on Table 9, it can be concluded that there is no significant difference in PF between normal and thin students; however, there is a significant difference between normal and obese students and between thin and obese students. Table 9 shows the results of testing the learning motivation hypothesis based on BMI through MANOVA.

Table 10. Test of between subjects effects of PF data of learning motivation and learning outcomes of PE students

Dependent Variable	BMI	N	Mean	DK	MS	F_{Count}	Sig	Description
Learning Motivation	Skinny	28	110,464	1	23,957	0,142	0,867	There is no difference
	Normal	42	112,786	1				
	Fat	25	111,280	1				

Based on Table 10, learning motivation does not differ significantly across BMI categories. This conclusion is drawn from hypothesis testing using MANOVA, where significance is determined by an alpha (α) level of 0.05. A p-value of ≤ 0.05 indicates a significant difference, while a p-value of ≥ 0.05 suggests no significant difference in learning motivation based on BMI.

Table 11. Test multiple comparisons data PF, learning motivation, and PE learning outcome

Variable Dependent	BMI	(J) BMI	Mean Difference (I-J)	Std. Error	Sig
Learning Motivation	Skinny	Normal	1,68	3,366	0,872
		Gemuk	1,18	3,726	0,946
	Normal	Kurus	-1,68	3,366	0,872
		Gemuk	-0,49	3,070	0,986
	Fat	Kurus	-1,18	3,726	0,946
		Normal	0,49	3,070	0,986

Based on Table 11, it can be concluded that there is no significant difference in learning motivation between normal and thin students. Furthermore, there is no significant difference in PF between normal and obese students, while there is also a significant difference between thin and

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obese students. Table 12 shows the results of the hypothesis testing of PE learning outcomes based on BMI through MANOVA.

Table 12. Test of between subjects affects data on PE learning outcomes based on student BMI

Variable Dependent	BMI	N	Mean	DK	MS	F_{Count}	Sig	Description
Learning Outcomes	Skinny	28	86,321	1	648,757	258,555	0,000	There is a difference
	Normal	42	92,690	1				
	Fat	25	84,360	1				

Based on Table 12, PJOK learning outcomes differ significantly across BMI categories. This conclusion is drawn from hypothesis testing using MANOVA, where significance is determined by an alpha (α) level of 0.05. A p-value of ≤ 0.05 indicates a significant difference, while a p-value of ≥ 0.05 suggests no significant difference in PJOK learning outcomes based on BMI.

Table 13. Multiple comparisons test of PE learning outcomes data based on student BMI

Variable Dependent	BMI	(J) BMI	Mean Difference (I-J)	Std. Error	Sig
Learning Outcomes	Skinny	Normal	-6,37**	0,388	0,000
		Fat	1,96*	0,442	0,000
	Normal	Skinny	6,37*	0,388	0,000
		Fat	8,33*	0,401	0,000
	Fat	Skinny	-1,96*	0,442	0,000
		Normal	-8,33*	0,401	0,000

Based on Table 13, it can be concluded that there is a significant difference in PE learning outcomes between normal and thin students, between normal and obese students, and between thin and obese students.

DISCUSSION

A multivariate test Using Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root shows that there are significant differences in PF, learning motivation, and student PE learning outcomes based on BMI. Differences are influenced by physical conditions, namely factors from within the individual. Hidayat (2022) also revealed a relationship between nutritional status and PE learning outcomes. PF is a demand in life to be healthier and more productive. As part of the PE program in schools, PF coaching is very strategic because it supports the learning capacity of students and intensifies student participation as a whole (Wicaksono, 2022). According to Kapti and Winarno (2022), Children's PF universally has the potential to improve students' academic achievement, including academic achievement and grades, time on tasks, concentration, and attention. Pranata (2022) Explains some of the factors that significantly affect a person's PF, including (1) age, (2) gender, (3) genetics or heredity, and (4) physical activity. Further explanations can be elaborated as follows. A fit person means dynamically healthy. Dynamic health supports physical and psychological activity (Ananda et al., 2023). A person's fitness will have a positive influence on a person's performance and will also have a positive influence on work or study productivity (Oktaviani & Wibowo, 2021). Good PF is important for all students to have because by having good PF, a student can do daily physical activities for a relatively long time without excessive fatigue so that they can still enjoy the remaining free time with practical activities and have a positive impact on improving student learning achievement (Suryadi & Rubiyatno, 2022).

A person's physical condition is one of the things that affects motivation (Ginting et al., 2022). One way to determine whether we are overweight can be done by measuring the BMI (BMI). BMI is one of the factors that affect learning motivation, namely internal factors or factors that come from within a person, with a difference in a person's posture will affect students' motivation to learn (Ishar

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et al., 2023). According to Hidayat et al. (2023), Motivation can also be a series of efforts to provide certain conditions so a person desires to do something. If he does not have the desire, he will try to eliminate or avoid the feeling of dislike. Perdana and Valentina (2022) Explaining the factors that affect student learning motivation, we can distinguish them into three types, namely, (1) internal factors (factors from within the child), namely the physical and spiritual condition of the child, (2) factors of learning approach, (3) external factors (factors from outside the child), namely the condition of the socio-cultural environment around the child such as school environment, the environment around the residence, and the family environment, especially parents. In addition to PF and learning motivation, students' PE learning outcomes are also influenced by the student's BMI. According to Ratmono et al. (2022), Malnutrition affects a person's growth, energy production, body defense, and behavior.

The Test of Between-Subjects Effects and Multiple Comparisons results indicate a significant difference in students' PF based on their BMI. Students with a normal BMI have better PF than those who are thin or obese, while thin students have better PF than obese students. These findings confirm that the hypothesis is accepted. PF is a demand in life to be healthier and able to be productive (Kapti & Winarno, 2022). As part of the PE program in schools, PF coaching is very strategic because it supports the learning capacity of students and intensifies student participation as a whole (Wicaksono, 2022). Health related to PF refers to our body's ability to function efficiently and effectively and is an important indicator of health (Putro & Winarno, 2022). In line with Suryadi and Rubiyatno (2022), PF demands being healthier and more productive. As part of the PE program in schools, PF coaching is very strategic because it supports the learning capacity of students and intensifies student participation as a whole. Furthermore, according to Suryadi and Rubiyatno (2022), PF is the best index of health conditions at any age.

Rudiyanto et al. (2022) It shows that fitness students are generally diverse, integrated, evolving, and reflect the complexity of fitness concepts, and are strongly influenced by contextual factors such as teacher values and beliefs. In line with that, Wicaksono (2022) explained that PF mirrors the ability to function of systems in the body that can improve the quality of life in every physical activity. Next Gunarsa and Wibowo (2021) Explains that PF is the ability of one's body to perform tasks without causing significant fatigue. To achieve excellent PF conditions, a person needs to do physical exercises that involve PF components with the proper exercise method (Rizqullah et al., 2023). A fit person means dynamically healthy. Dynamic health supports physical and psychological activity (Chaeroni et al., 2021). A person's fitness will have a positive influence on a person's performance and will also have a positive influence on work or study productivity (Arta & Fithroni, 2021). Good PF is important for all students to have because by having good PF, a student can do daily physical activities for a relatively long time without excessive fatigue so that they can still enjoy the remaining free time with practical activities and have a positive impact on improving student learning achievement (Putra et al., 2022).

Children's PF universally can improve students' academic achievement, including academic achievement and grades, time on tasks, concentration, and attention (Aprilia & Januarto, 2022). PF is a factor that supports the implementation of good education for students; on the other hand, poor PF of students will affect the quality of the child's education; that is one of the reasons why PJOK subjects are applied to students (Fadilla & Pudjijuniarto, 2022). Many students are deficient or overnourished, so they do not have an ideal body (Afandi & Avandi, 2022). One way to determine whether we are overweight can be done by measuring the BMI. With a difference in a person's posture, there will also be a difference in a person's PF.

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By Test Between Subjek Effect and Test Multiple Comparisons This shows no significant difference in students' learning motivation based on their BMI. The results indicate that students with a normal BMI have higher learning motivation than thin and obese students, while obese students have higher learning motivation than thin students. These findings suggest that the hypothesis is not supported. According to Susanto (2022), Learning motivation is the overall motivation in students that gives rise to learning activities so that the goals that the subject (students) want to achieve are achieved. Learning motivation is a psychological factor that is non-intellectual. Its distinctive role fosters passion, pleasure, and enthusiasm for learning (Arifin, 2021). According to Ginting et al. (2022), Motivation is a driving force that encourages a person to learn; if a person is motivated to learn, he will do learning activities within a certain period. The absence of this difference is due to many other factors that affect learning motivation apart from the student's BMI (Sumbayak, 2021).

According to Rozi et al. (2023), In the context of PE, students who are highly motivated to be independent tend to be more physically active, even outside the PE class. Beyond physical activity, motivation involved in PE was also found to be positively related to cognitive and affective outcomes such as self-esteem and quality of life related to health, appearance, and concentration; being physically active, cognitive, and affective was one of the factors that increased motivation (Pratama, 2019). The attention given by parents can increase the motivation to learn from children. Parents pay attention to their children in the form of affection and tenderness. Affection and tenderness will close the relationship between parents and children (Maftukhah et al., 2022). Parental attention to children can manifest in the form of parental support. Subrata (2023) explaining that parental support for their children's education concerns two main things, namely moral (psychological) support and material support; psychological support includes (1) creating a home climate that supports children to learn, (2) providing enough time to be involved in children's learning activities, (3) giving rewards or positive responses to each child's achievements, (4) educating children democratically, (e) providing tutoring at home, (5) supervision of children's learning, (6) giving awards to children. (7) Material support in fulfilling physical needs includes education fees, learning facilities, tools, and books for learning needs. These things can motivate children to learn (Eliyanti et al., 2023).

Based on the Test Between Subjects Effect and the Multiple Comparisons test, it was shown that there was a significant difference in students' PE learning outcomes based on their BMI, where normal students achieved better PE learning outcomes compared to thin and obese students. Thin students demonstrated better PE learning outcomes than obese students, confirming the acceptance of the hypothesis. These differences are influenced by factors that affect learning outcomes. Two factors affect learning outcomes, namely internal factors and external factors. Internal factors are factors that come from students, which include (1) physiological or physical factors of individuals that are innate or obtained from learning, (2) psychological factors, both innate and hereditary, including intellectual factors and non-intellectual factors, (3) maturity factors, both physical and psychological. Factors that come from outside the student include (1) social factors consisting of family environmental factors, school environmental factors, community environmental factors, and group environmental factors; (2) cultural factors, such as customs, science and technology, and arts, (3) physical environmental factors, such as home facilities, learning facilities, and climate, (4) spiritual factors or religious environment (Efendi & Meria, 2022).

Based on this opinion, it can be concluded that the child's physical condition influences the quality of a child's education; therefore, suitable physical activities are needed in PJOK lessons. Physical activity is related to nutritional status. Normal students have good learning outcomes

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because they are related to the physical activities they do. Thin students are better than fat students because thin students perform better physical activities than obese students. Obese students have limitations in doing physical activities. The physical activities carried out can have an impact on learning outcomes. According to Mutiaramses et al. (2023), Learning outcomes are changes that occur in students, both related to cognitive, affective, and psychomotor aspects as a result of learning activities. In simple terms, the meaning of learning outcomes is the result of achievements obtained by students after going through learning activities. Based on this description, it is concluded that learning outcomes are changes that occur in students, both related to cognitive, affective, and psychomotor aspects as a result of learning activities. Learning activities are devoted to PE learning activities. PE is part of the overall education process.

According to Destriana et al. (2022), PE is an educational process that utilizes physical activities systematically designed to develop and improve individuals organically, neuromuscularly, perceptual, cognitively, and emotionally within the framework of the national education system. In line with that, Darsana et al. (2021) explained that PE learning is a learning process to move and learn through movement. In addition to learning and being educated through movement to achieve teaching goals, PE teaches it to move; through experience, changes will be formed in its physical and spiritual aspects. Furthermore, according to Kesuma et al. (2021), "PE is an educational process that utilizes physical activity and health to produce holistic changes in individual qualities, both physically, mentally, and emotionally." Based on this, it can be concluded that PE learning outcomes are influenced by physical activities, which will impact nutritional status.

Furthermore, the Test Between Subjects Effect and Multiple Comparisons results on the variable learning motivation show no significant difference in students' learning motivation based on BMI. This finding is supported by the research results Indrawati (2024), which explain that there is no difference in students' learning motivation in the obese and normal categories in the "not good" category. Munandar (2016) his research also revealed no difference in student motivation in PJOK learning. The teaching and learning activities necessary for PJOK learning are interactions that create active learning. One element that supports learning motivation is the environment, in this case, the teacher. Learning motivation in PJOK learning can be created through the learning process. PJOK learning can increase student activity through motivation to carry out activities (Arisqa et al., 2024). Teachers can be supporters to increase student learning motivation in PJOK learning (Habibi & Astra, 2023). Low student learning motivation can be caused by the use of media, not by the characteristics of students and the characteristics of the material in PE learning.

The limitation of this study is the study's sampling. The sample taken in this study was one class for each level, so it needs to be studied more for further researchers with a broader sample size, not only in one school. Besides, this study has limitations related to PJOK learning outcome data, where the researcher did not conduct direct treatment. However, the researcher obtained the PJOK learning outcome data from the PJOK teacher with one-semester report card scores. Further researchers can take direct action on students related to PJOK learning outcomes.

CONCLUSION

The results of this study indicate a significant difference between differences in PF, learning motivation, and PE learning outcomes based on the student's BMI, and there are differences in students' PF based on BMI. There was no difference in student motivation based on BMI. There are differences in students' PE learning outcomes based on BMI. From these results, it can be concluded that teachers at school must always pay attention to the characteristics of each student in order to

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develop the right learning model and maintain student motivation in PE, sports, and health. In order to carry out learning activities, students have high motivation to follow each learning process seriously. Schools must provide pull-up facilities to help students strengthen their muscles, as TKJI test results indicate poor performance in the pull-up test. Regular fitness assessments are also necessary to collect PF data, enhance students' overall fitness levels, and boost their learning motivation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this matter.

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