Developing the Prediction Model of Physical Activity Levels based on Social Cognitive Predictors among Students in the Education and Training Center in Riau Indonesia

by Novita Intan Arovah Final

Developing a Prediction Model of Physical Activity Levels Based on Social Cognitive Predictors among Students in the Education and Training Center in Riau Indonesia

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Abstract

Physical inactivity is a significant public health concern among adolescents. Social cognitive factors are suggested to influence physical activity including in students, However, it is unclear how these factors influence physical activity levels among students in the Education and Training Center in Riau. This study aimed to develop a prediction model of physical activity levels based on social cognitive predictors in this population. The study was a cross-sectional study of 107 students from the Education and Training Center in Riau who completed online questionnaires on physical activity and social-cognitive correlates. Physical activity levels were measured using the Physical Activity Vital Sign, while the social cognitive correlates included self-efficacy, outcome expectations, stress levels, and motivation, which were measured using validated scales. Simple and multiple linear regression analyses were conducted to analyze the data. The results indicated that self-efficacy, outcome expectations, stress levels, and motivation significantly predicted physical activity levels among students. The results of the multiple linear regression indicated regression coefficients were 0.26, 0.31,-0.33 and 0.27 for self-efficacy, outcome expectation, stress level and motivation practice, respectively. The multiple linear regression model, which included all variables, predicted 32.9% of the variance in physical activity levels. The findings suggest that physical activity promotion programs for students should focus on improving self-efficacy, outcome expectations, stress management, and motivation. Future research can focus on developing and evaluating the efficacy of physical activity promotion interventions that target social cognitive predictors among students.

Keywords: Motivation; outcome expectation; physical activity; self-efficacy; stress.

1. Introduction

Physical inactivity is a major public health concern, with sedentary lifestyles contributing to the onset of various chronic diseases such as obesity, type 2 diabetes, hypertension, and cardiovascular disease (Mubarrok & Anik Puji Wiyanti, 2023). A growing body of research has suggested that regular physical activity can be an effective means of preventing and managing these chronic diseases, making it an important aspect of maintaining overall health and well-being (Anindita et al., 2019). One group that has been identified as having a high potential for physical activity is adolescents, particularly students, due to academic pressures and sedentary lifestyles (Arovah & Purnomo, 2022). The increase in physical inactivity among adolescents, particularly students, is alarming as it can negatively their physical and mental health (Shigeta et al., 2021). As well as decrease their academic performance. Providing them with adequate support to increase their physical activity thus is essential, while understanding the factors that influence physical activity behaviour is essential for developing effective physical activity promotion programs (Rhodes et al., 2019).

Behaviour change theories provide frameworks for understanding and predicting physical activity behaviour (Buchan et al., 2012). One of which is the Social Cognitive Theory, which suggests that behaviour is influenced by both personal and environmental factors. Self-efficacy, outcome expectation, stress level, and motivation have been identified as key factors that may predict physical activity levels among student-athletes. Self-efficacy, which refers to an individual's belief in their ability to perform a specific behaviour, has been identified as a predictor of physical activity behaviour (Iskandar, 2023). Outcome expectation refers to the anticipated outcome of the behaviour and can influence an individual's motivation to engage in physical activity (Attaimini, 2022). Stress level, on the other hand, may act as a barrier to physical activity and has been shown to be negatively associated with physical activity levels in previous research (Setiawan et al., 2021). In addition, motivation, as a construct related to the reasons for engaging in a behaviour, may provide the necessary drive to engage in physical activity (Ramirez et al., 2012).

While studies have been conducted to evaluate the association of social cognitive predictors have been conducted in general population in Indonesia (Arovah et al., 2023), to date, the relationship between the predictive capacity of these four factors and physical activity levels in students in Indonesia has not been fully explored. Therefore, there is a need to investigate the predictive ability of these four factors on physical activity levels among students. By analyzing data from a sample of students, this study seeks to examine the associations between self-efficacy, outcome expectation, stress level, motivation, and physical activity level that is essential to confirm to determine how and to what extent self-efficacy, outcome expectation, stress level and motivation are associated with physical activity levels.

The findings from this study may have important implications for promoting physical activity among students. Understanding factors that influence physical activity can inform the development of targeted interventions aimed at increasing physical activity levels in this population (Arovah, N. I, 2022). Additionally, this study may contribute to a broader understanding of the psychological and behavioural factors that influence physical activity, with potential implications for the development of interventions in other populations. This study, therefore, aimed to develop a prediction model of physical activity levels among students based on social-cognitive predictors, which include self-efficacy, outcome expectations, stress level and motivation.

2. Method

Study design and participants

This research is a descriptive analysis research using quantitative research cross-sectional research design. The study participants were 107 students involved in the Education and Training Center in Riau. Of these participants, 74% of participants were male and 26% were female. Overall, the average age of the research subjects was $17\pm0,4$ years old. They participated in several sports which include football, basketball, volleyball, and athletics. The selection of the centre as this research setting was because they represented a specific population that aligned with the objectives of this study as well as due to the availability of access. The study utilized a purposive sampling technique targeting students who were actively engaged in the Education and Training Center for the duration of our data collection which was in March 2022. The sample size was calculated using the G*Power 3.1 software based on the F statistics for the liner multiple regression test, using estimation of a medium effect size of 0.12 , power of 80%, error of probability of 0.05 and for 4 predictors in the model. The calculation reveals that the sample size required for this study was 105, thus the participants in this study met the requirement. The participants were asked to complete online questionnaires measuring physical activity levels and social cognitive factors. They were provided with informed consent which was embedded in the online questionnaires.

Outcome measures

Physical activity levels

Physical activity levels were measured using the Physical Activity Vital Sign (PAVS) (Pamela G. Bowen et al., 2019). The PAVS consists of two questions that ask about the amount of moderate and vigorous physical activity a person engages in on a weekly basis. The questions include the number of the days per week participants engage in moderate-intensity exercise or sports activities (e.g., brisk walking, bicycling, swimming, or jogging) for at least 30 minutes and the number of days per week participants engages in vigorous-intensity exercise or sports activities (e.g., running, aerobics, heavy yard work, or competitive sports) for at least 20 minutes. The patient's responses are used to calculate their total weekly minutes of moderate and vigorous physical activity. Studies have suggested PAVS has a god validity and reliability (Ball, T., 2014).

Social cognitive factors

The instrument in this study used a questionnaire) which was presented with a structured questionnaire which assessed self-efficacy, outcome expectations, stress level and motivation using validated instruments that have been validated in the Indonesian context conducted by Arovah & Heesch (2022). Self-efficacy was measured using the Self-Efficacy for Exercise (SEE) (Resnick & Jenkins, 2000). The Self-Efficacy for Exercise Scale is designed to measure an individual's confidence in their ability to engage in regular physical exercise. The scale consists of nine items that assess an individual's level of confidence in their ability to overcome barriers to exercise and to maintain a regular exercise routine. Respondents rate their level of confidence on a scale of 0-10 for each item, with 0 indicating "not at all confident" and 10 indicating "completely confident." The SEE has demonstrated good validity and reliability for use in the Indonesian contex(Arovah & Heesch, 2022).

Outcome expectations were measured using the Multidimensional Outcome Expectations for Exercise (MOEE) (Wójcicki et al., 2009). The MOEE assesses an individual's beliefs about the outcomes they expect to experience as a result of engaging in regular physical exercise. The MOEE consists of 15 items that assess an individual's beliefs about the outcomes of exercise across five domains: physical, social and self-evaluative domain. Respondents rate their level of agreement with each item on a scale of 1-5, with 1 indicating "strongly disagree" and 5 indicating "strongly agree." The MOEE has been shown to have good reliability and validity for the use in the Indonesian context (Arovah & Heesch, 2022).

Stress levels were measured using the Perceived Stress Scale (PSS) (Cohen et al., 1983). The Perceived Stress Scale (PSS) is a psychometric instrument designed to measure an individual's perception of stress in their life. The PSS consists of 4 items that assess an individual's feelings of stress and their ability to cope with stressful situations. Respondents rate their level of agreement with each item on a scale of 0-4, with 0 indicating "never" and 4 indicating "very often." The PSS has been shown to have good reliability and validity, and has been used in a variety of populations, including in college students.

The motivation was assessed using the Sports Motivation Scale (SMS) (Pelletier et al., 2016). individual's motivation for participating in sports and physical activity. The SMS consists of 28 items that assess motivation across six subscales: intrinsic motivation to know, intrinsic motivation to accomplish, intrinsic motivation to experience stimulation, extrinsic motivation-identified regulation, extrinsic motivation-introjected regulation, and extrinsic motivation-external regulation. Respondents rate their level of agreement with each item on a scale of 1-7, with 1 indicating "does not correspond at all" and 7 indicating "corresponds exactly." The SMS has been shown to have good reliability and validity and has been used in a variety of populations, including athletes, exercisers, and non-athletes.

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It has also been used to evaluate the effectiveness of sports and physical activity interventions and to identify factors that influence motivation for sports and physical activity (Arovah & Heesch, 2022).

Statistical analysis

Descriptive analysis was conducted to calculate the mean and standard deviation of each variable. A multilinear correlation matrix then was conducted using Spearman correlation to assess the correlation among variables to account for the non-normal distribution of the data. Simple and multiple linear regressions to generate prediction equations for physical activity level based on the social cognitive predictors, using stepwise regression to obtain the final model. The goodness of fit and precision of the regression equations were evaluated using adjusted multiple coefficients of determination (adjusted R^2) and a standard error of estimation (SEE) in the model. All analyses were conducted using Statistical Package for Social Sciences (SPSS) v. 27.0, and a significance level of 5% was used for all data analysis.

3. **Result**

Participants characteristics

The subjects of this study consisted of 107 athletes, 74% of participants were male and 26% Female. Overall, the average age of the research subjects was $17 \pm 0,4$ years old.

Summary statistics of the physical activity and the social cognitive predictors

The mean physical activity level was 182 ± 110, ranging from 30 to 420 minutes per week. Figure 1 further illustrates the summary statistics of the social cognitive predictors which include the interquartile range, mean and median of the self-efficacy, outcome expectations, stress level and motivation scores.
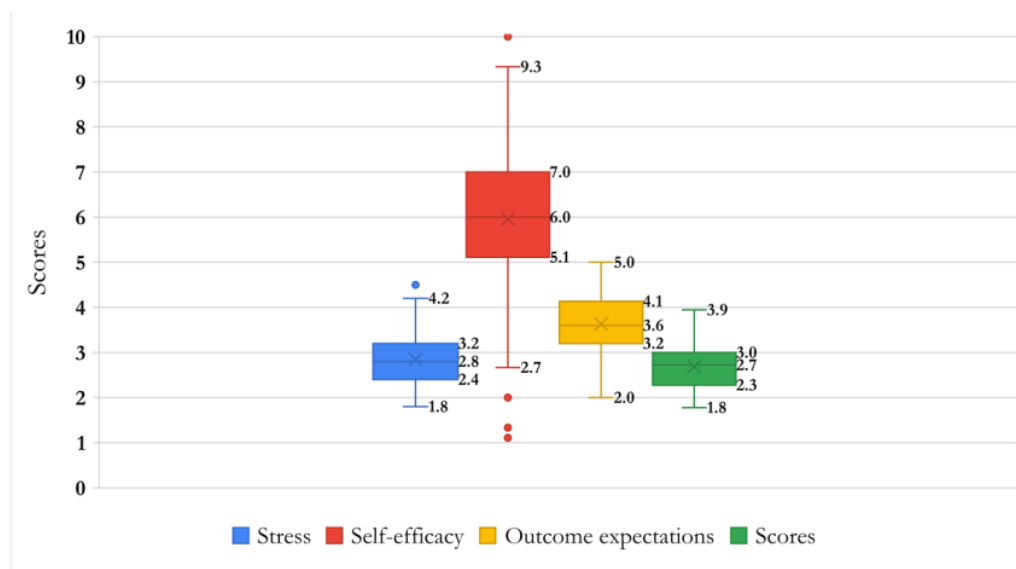

Figure 1. The Descriptive Statistics of the Predictors

Bivariate correlations among variables

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Table 2 further summarizes the bivariate correlation among physical activity and social-cognitive correlates. As seen in the table that the social cognitive variables only significantly correlated with physical activity. Stress was weakly and negatively correlated with physical activity (r=-0.19), while self-efficacy, outcome expectation and motivation were moderately and positively correlated with physical activity, ranging from 0.27-0.33). There was no evidence of collinearity among social cognitive variables, as none of these social cognitive variables significantly correlated with each other, thus supporting the use of all variables in developing predicting model of physical activity in a regression equation.

Table 2. Multicorrelation Matrix Among Variables

	S	SE	OE	M	PA
S	1				
SE	0.17	1			
OE	0.024	0.18	1		
M	-0.12	0.01	-0.05	1	
PA	**-0.19**	**0.33**	**0.33**	**0.27**	1

Note: Bold = significant, darker shades representing higher correlation coeeficient, S= Stress, Se=self efficacy, OE=Outcome expectation, M= Motivation and PA = Physical Activity

Regression equation predicting physical activity levels based on the social cognitive predictors

Prior to the model building in the multiple linear regression, the assumptions for linear regression were confirmed. The scatterplot between the dependents variable and predictors followed forming a roughly straight-line pattern and while the residuals were randomly scattered around the zero line and showed no discernible pattern. The multiple regressions for predicting physical activity based on the four social cognitive predictors, therefore, were modeled as seen in Table 3

Table 3. Simple and multiple linear regression equation predicting physical activity levels based on the social cognitive predictors

| | Simple Regression | | | | Multiple Regression | | | |
	Intercept	Coefficient	β	P	Intercept	Coefficient	β	P
SEE	372.7	5.2	0.27	0.005	-188.4	5.1	0.26	0.002
OEE	30.4	11.4	0.36	0.000		10.3	0.33	0.000
Stress	1077.1	-11.4	-0.36	0.003		-15,8	-0.31	0.000
Motivation	163.1	10.1	0.29	0.002		9.5	.027	0.001

Based on Table 3, the physical activity level can be predicted by these four predictors variables. Physical activity level was -188.34 + (5.1 x Self Efficacy) + (10.3 x Outcome Expectation) + (115.8 x Stress Level) + (9.5 x Motivation). Table 4 further indicates that the multiple linear regression improved the R^2 and standard error of estimates suggesting that all predictors were important in predicting physical activity levels.

Table 4. The linear regressions to predict physical activity level

	Adjusted R²	Standard Error of Estimates
Simple Linear Regression		
Self-efficacy	0.07	288.56
Outcome expectation	0.12	279.37
Stress	0.07	286.88
Motivation	0.08	286.87
Multiple Linear Regression	0.32	244.29

4. Discussion

Although previous studies have studied the association between social cognitive correlates with physical activity, and have also developed prediction model, to the best of our knowledge this study is the first study that develop prediction model of physical activity based on the social cognitive predictors in the Indonesian context including, in the the Education and Training Center in Riau. The results indicated that self-efficacy, outcome expectations, stress levels, and motivation significantly predicted physical activity levels among students. This finding suggests that physical activity promotion programs for students should focus on improving these social cognitive predictors to increase physical activity levels.

The finding in this study is in line with previous research that suggests that social cognitive factors such as self-efficacy, outcome expectations, and motivation are important determinants of physical activity behaviour among adolescents and young adults (Arovah, N. I, 2022) . The study's finding that self-efficacy, outcome expectations, stress levels, and motivation significantly predicted physical activity levels among students is consistent with previous research (Prodaniuk et al., 2004). These findings, thus, suggest that physical activity promotion programs for students should focus on improving these social cognitive predictors to increase physical activity levels.

The findings of this study are also in line with the results of previous studies. Research conducted by (Anderson et al., 2006) reported that outcome expectations, self-efficacy, and self-regulation had a significant relationship with the physical among older adults. The study shows that internal factors have a more significant relationship to the patient's physical activity than external factors, so for making an effective physical activity promotion program for patients, the program must focus on internal factors. Previous research also stated th Mathematics at the social restriction policy limits athletes' physical activities and even causes the cessation of training in some sports (Anung Ahadi Pradana, Casman, 2020). Another study reports that the hKigher motivation to practice, the better one's physical activity (Mills & Boardley, 2016). Furthermore, multiple linear regression analysis shows that self-efficacy, outcome expectation, the overall level of stress, and motivation to practice can simultaneously predict the level of physical activity among students. Therefore, policymakers need to focus on supporting athletes to increase self-efficacy, outcome expectations, and trained motivation and minimize stress levels to optimize the athlete's activity level.

Overall, this study has contributed to the growing body of literature on the importance of social cognitive factors in predicting physical activity behavior among students. However, this study subject

to several limitations. First, the study used a cross-sectional design, which precludes establishing causality. While the results suggest that self-efficacy, outcome expectations, stress levels, and motivation significantly predict physical activity levels among students, it is unclear whether these social cognitive factors cause changes in physical activity behavior or vice versa. Future research should use longitudinal designs to examine the relationship between social cognitive predictors and physical activity behavior over time. Second, the study was conducted with a relatively small sample size recruited in a training centre, which may limit the generalizability of the findings to those with different characteristics. Future research should aim to replicate the study with larger and more diverse samples to enhance the external validity of the findings. Third, the study relied on self-report measures to assess physical activity levels and social cognitive factors. Self-report measures are subject to biases such as social desirability bias and recall bias, which may affect the accuracy of the results. Future research should incorporate objective measures of physical activity levels, such as accelerometers, to provide more accurate assessments of physical activity behaviour. Finally, the study only examined a limited set of social cognitive predictors of physical activity behaviour among students. Other factors, such as environmental and cultural factors, may also play important roles in determining physical activity behaviour among students. Future research should examine a broader range of factors to develop a more comprehensive understanding of physical activity behaviour among students.

5. Conclusion and Recommendation

In conclusion, this study aimed to develop a prediction model of physical activity levels among students based on social cognitive predictors. The results of the study indicated that self-efficacy, outcome expectations, stress levels, and motivation significantly predicted physical activity levels among students. The multiple linear regression model that included all four variables predicted of the variance in physical activity levels. These findings suggest that physical activity promotion programs for students should focus on improving self-efficacy, outcome expectations, stress management, and motivation. While there are limitations to this study, such as the small sample size and reliance on self-report measures, the findings provide valuable insights into the factors that influence physical activity behaviour among students. These insights can inform the development of effective physical activity promotion programs for students and contribute to the broader public health goal of reducing physical inactivity among adolescents. Future research could further investigate the effectiveness of interventions targeting social cognitive predictors and employ objective measures of physical activity behaviour to enhance the accuracy of the results. Overall, this study contributes to the growing body of research on the importance of social cognitive factors in promoting physical activity behaviour among students.

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