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Psychosocial Determinants of University Students' Intention to Avoid Drug Abuse: A Structural Equation Modeling Approach with DWLS Estimation

By

Hasanah¹, Subian Saidi², Misgiyati³, Netti Herawati⁴

¹²³⁴Department of Mathematics, Faculty of Mathematics and Natural Sciences, University of Lampung, Bandar Lampung 35145, Indonesia.



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Abstract

Structural Equation Modeling (SEM) is widely employed to investigate complex relationships among latent variables. However, the Maximum Likelihood estimator commonly used in covariance-based SEM relies on the assumption of multivariate normality, which is often violated when indicators are measured using ordinal Likert scales. To address this issue, this study applies the Diagonally Weighted Least Squares (DWLS) estimator to model the relationships between psychosocial factors and University of Lampung students' intention to avoid drug abuse. The measurement model was evaluated using validity and reliability criteria, while the structural model was assessed through path coefficients, coefficient of determination, and goodness-of-fit indices. The results show that the proposed model explains 58.8% of the variance in intention to avoid drug abuse ($R^2 = 0.588$). Emotional distress ($\beta = 0.439, p < 0.001$), self-development activities ($\beta = 0.510, p < 0.001$), and social relationships ($\beta = 0.367, p < 0.001$) significantly affect students' intention to avoid drug abuse. Furthermore, the model exhibits an excellent fit to the observed data, with $CFI = 0.997$, $TLI = 0.996$, $RMSEA = 0.031$, and $SRMR = 0.050$. These findings indicate that SEM with DWLS estimation provides a robust and reliable approach for modeling latent-variable relationships involving ordinal data and offers an effective alternative to conventional estimation methods in covariance-based SEM.

Keywords: Structural Equation Modeling; Diagonally Weighted Least Squares; Covariance-Based SEM; Ordinal Data; Latent Variables; Psychosocial Factors; Intention to Avoid Drug Abuse.

1. Introduction

Structural Equation Modeling (SEM) has become one of the most widely used multivariate statistical techniques for analyzing complex relationships among latent variables because it integrates measurement and structural models within a unified analytical framework [1], [2]. This approach enables simultaneous estimation of relationships between latent constructs and their corresponding indicators, making it particularly useful for investigating abstract concepts in social and behavioral sciences. In covariance-based SEM, Maximum Likelihood (ML) estimation is commonly employed due to its desirable asymptotic properties and statistical efficiency [3]. However, ML estimation relies on the assumptions of multivariate normality and continuous indicators, which are frequently violated when questionnaire responses are measured using ordinal Likert scales [4].

Since ordinal data are prevalent in social and behavioral research, several alternative estimation procedures have been proposed to overcome the limitations of Maximum Likelihood estimation. Among these approaches, Diagonally Weighted Least Squares (DWLS) has been recommended because it provides more accurate parameter estimates and more reliable goodness-of-fit indices for ordinal variables [5], [6], [7], [8], [9]. Compared with conventional ML estimation, DWLS is less sensitive to violations of normality assumptions and is more appropriate when indicators are measured on limited categorical scales. Therefore, DWLS has been recognized as a robust alternative estimator for covariance-based SEM involving ordinal data.

Psychosocial factors such as emotional distress, self-development activities, and social relationships are abstract concepts that cannot be measured directly and are generally represented through multiple observed indicators [1]. Previous



studies have shown that these factors are associated with various health-related behaviors and psychological outcomes among young adults [10], [11]. Consequently, these psychosocial dimensions are naturally formulated as latent variables, requiring a statistical framework capable of simultaneously modeling measurement and structural relationships. In this context, SEM provides an appropriate approach for analyzing the complex interrelationships among latent constructs.

Drug abuse remains one of the major public health concerns worldwide and continues to pose serious challenges to individuals and society. According to the United Nations Office on Drugs and Crime (UNODC), approximately 292 million people used drugs in 2022, representing a substantial increase over the previous decade [12]. Young adults, particularly university students, constitute a vulnerable population due to academic pressures, emotional instability, and social influences encountered during the transition to adulthood [13], [14]. Drug abuse may negatively affect physical health, psychological well-being, academic achievement, and social functioning. Therefore, identifying factors that strengthen students' intention to avoid drug abuse is essential for developing preventive strategies and promoting healthy lifestyles among young adults.

Numerous studies have investigated psychosocial factors associated with substance use and addiction. However, most previous studies have primarily focused on treatment and recovery rather than preventive behavior. For example, Jha and Singh [15] examined psychosocial determinants related to substance abuse recovery and emphasized rehabilitation and post-addiction outcomes. In contrast, studies investigating psychosocial factors that influence individuals' intention to avoid drug abuse before substance-related problems emerge remain relatively limited, particularly among university students. Therefore, understanding preventive behavior toward drug abuse constitutes an important issue that deserves further investigation.

From a methodological perspective, many previous studies have employed conventional regression techniques or covariance-based SEM with Maximum Likelihood estimation. Limited attention has been devoted to the application of covariance-based SEM using the Diagonally Weighted Least Squares estimator, despite the inherently ordinal nature of Likert-scale responses [6], [7]. Furthermore, several SEM studies require indicator elimination and extensive model modifications to achieve satisfactory goodness-of-fit, potentially affecting construct representation and interpretability [8], [16]. In contrast, all indicators used in this study were measured on a four-point Likert scale and retained in the final model without elimination. Therefore, evaluating the applicability of SEM-DWLS for modeling latent-variable relationships involving four-point ordinal indicators remains an important methodological issue.

Based on these considerations, this study aims to analyze the effects of emotional distress, self-development activities, and social relationships on University of Lampung students'

intention to avoid drug abuse using Structural Equation Modeling with the Diagonally Weighted Least Squares estimator. Unlike previous studies emphasizing substance abuse recovery, this study focuses on preventive behavior by investigating psychosocial determinants associated with intention to avoid drug abuse among university students. In addition, this study demonstrates the applicability of the DWLS estimator in covariance-based SEM involving four-point ordinal indicators while maintaining all observed variables in the final model without elimination. Therefore, this study is expected to provide a reliable framework for modeling latent-variable relationships involving ordinal data and contribute to the development of SEM applications in social and behavioral research.

2. Materials and Methods

2.1 Data and Sampling

This study utilized primary data collected through a structured questionnaire designed to measure psychosocial constructs associated with students' intention to avoid drug abuse. The investigated constructs comprised namely emotional distress (X_1), self-development activities (X_2), social relationships (X_3), and intention to avoid drug use (Y). Since these constructs are latent variables that cannot be directly observed, each construct was represented by several observable indicators adapted from previous studies [1], [2].

The target population consisted of active undergraduate students at the University of Lampung. A purposive sampling technique was employed to ensure that respondents fulfilled the inclusion criteria relevant to the objectives of the study, particularly students who actively participated in academic and campus-related activities. Purposive sampling is frequently applied in behavioral and social science research because it enables researchers to select participants possessing characteristics that are consistent with the phenomenon under investigation [3].

A total of 300 respondents participated in this study. To ensure proportional representation, respondents were selected from eight faculties. In addition, participants were drawn from the 2022–2024 cohorts because these students were considered to have sufficient exposure to academic and social environments that may influence psychosocial conditions and behavioral decision-making processes.

2.2 Variables and Measurement

This study involves four latent constructs, namely emotional distress (X_1), self-development activities (X_2), social relationships (X_3), and intention to avoid drug use (Y). Latent variables represent abstract concepts that cannot be measured directly and therefore require multiple observed indicators to capture their underlying characteristics [4], [5].

The indicators used in this study were adapted from previous behavioral and psychological studies and subsequently translated into questionnaire statements appropriate to the context of university students. All constructs were specified as reflective measurement models because the indicators were assumed to reflect the underlying latent variables [6].

All questionnaire items were measured using a four-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). The four-point scale was intentionally adopted to avoid neutral responses and encourage respondents to express clear opinions regarding each statement. Since Likert-scale responses are inherently ordinal, an estimation procedure capable of handling ordinal indicators is required to obtain reliable parameter estimates [7], [8].

The operational definitions and measurement indicators used in this study are summarized in Table 1

Table 1. Measurement indicators of latent variables

Variable	Code	Indicator
Emotional Distress X_1	X_{11}	Academic or daily pressures often cause uncontrollable anxiety
	X_{12}	Disturbing thoughts affect sleep patterns
	X_{13}	Increased mental burden makes it difficult to relax
	X_{14}	Emotional tension increases in unfavorable situations
	X_{15}	Excessive worry occurs even in manageable situations
Self-Development Activities	X_{21}	Engaging in activities that help maintain focus and balance
	X_{22}	Actively participating in organizations, training, or workshops
	X_{23}	Physical or routine activities increase daily energy
	X_{24}	Activities contribute to a more positive and optimistic mindset
	X_{25}	Engaging in calming activities such as journaling, meditation, or hobbies
Social Relationships X_3	X_{31}	Interactions with others provide emotional comfort and support
	X_{32}	Communication with friends or family helps reduce mental burden
	X_{33}	Feeling accepted and valued in the social environment
	X_{34}	Social environment supports balance in daily life
	X_{35}	Supportive individuals help manage stress more effectively

Variable	Code	Indicator
Intention to Avoid Drugs Y	Y_{11}	Choosing positive activities helps avoid risky behaviour
	Y_{12}	Avoiding drugs is important

		for a better future
	Y_{13}	Avoiding environments that may trigger negative influences
	Y_{14}	Personal attitudes support decisions to avoid harmful behaviour
	Y_{15}	Avoiding unhealthy influences is considered a personal responsibility

2.3 Structural Equation Modeling with DWLS Estimation

The relationships among latent variables were analyzed using covariance-based Structural Equation Modeling (CB-SEM) with the Diagonally Weighted Least Squares (DWLS) estimator. SEM is a multivariate statistical technique that simultaneously incorporates measurement and structural models within a unified framework, allowing researchers to investigate relationships among latent constructs and their observed indicators [4], [9].

Compared with Maximum Likelihood estimation, DWLS has been shown to perform better when indicators are ordinal and when the assumption of multivariate normality is violated [7], [10]. Furthermore, DWLS produces robust parameter estimates and more reliable goodness-of-fit indices for categorical and ordinal variables [11].

Therefore, DWLS was selected because all indicators in this study were measured using a four-point Likert scale.

The structural model investigated in this study can be expressed as.

$$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \zeta$$

where Y denotes the intention to avoid drug abuse, X_1 represents emotional distress, X_2 denotes self-development activities, X_3 represents social relationships, $\beta_1, \beta_2, \beta_3$ are structural coefficients indicating the effects of the exogenous latent variables on the endogenous latent variable, and ζ denotes the residual term.

Parameter estimation was performed using the Diagonally Weighted Least Squares method based on the polychoric correlation matrix. This approach minimizes a weighted least squares fitting function and has been shown to provide more accurate estimates and reliable goodness-of-fit measures for ordinal indicators [10], [12]. Consequently, DWLS is considered an appropriate alternative estimator for covariance-based SEM involving categorical and ordinal data.

2.4 Measurement Model Evaluation

The measurement model was evaluated to assess construct validity and reliability. Indicator reliability was examined through standardized factor loadings, where values greater than 0.50 indicate acceptable indicator reliability [9].

Convergent validity was assessed using the Average Variance Extracted (AVE). AVE values exceeding 0.50 indicate that a

latent construct explains more than half of the variance of its indicators [12]. Internal consistency reliability was evaluated using Composite Reliability (CR), where values greater than 0.70 are considered satisfactory [13].

2.5 Structural Model Evaluation

After establishing the adequacy of the measurement model, the structural model was evaluated to investigate relationships among latent variables. The coefficient of determination R^2 was used to assess the proportion of variance in the endogenous construct explained by the exogenous constructs [15].

The significance of path coefficients was determined using z-statistics and p-values at a significance level of 5%. The overall model fit was evaluated using several goodness-of-fit indices, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Parsimony Goodness-of-Fit Index (PGFI). Values of CFI and TLI above 0.90, RMSEA below 0.08, and SRMR below 0.08 indicate an acceptable model fit [10], [16].

Finally, the estimated structural relationships were interpreted to explain the effects of emotional distress, self-development activities, and social relationships on students' intention to avoid drug abuse.

3. Results and Discussion

3.1 Measurement Model Evaluation

3.1.1 Indicator Reliability

The measurement model was first evaluated through standardized factor loadings to assess indicator reliability. Factor loadings greater than 0.50 indicate that the observed variables adequately represent their corresponding latent constructs [17]. As shown in Table 2, all indicators exhibit loading values ranging from 0.609 to 0.868, exceeding the recommended threshold. Therefore, all indicators were retained in the final model without elimination.

Table 2. Standardized Factor Loadings

Variable	Indicator	Loading	Validity
Emotional Distress (X_1)	X_{11}	0.847	Valid
	X_{12}	0.786	Valid
	X_{13}	0.789	Valid
	X_{14}	0.811	Valid
	X_{15}	0.699	Valid
Self-Development Activities (X_2)	X_{21}	0.809	Valid
	X_{22}	0.783	Valid
	X_{23}	0.750	Valid
	X_{24}	0.732	Valid
	X_{25}	0.649	Valid

Social Relationships (X_3)	X_{31}	0.868	Valid
	X_{32}	0.743	Valid
	X_{33}	0.609	Valid
	X_{34}	0.795	Valid
	X_{35}	0.795	Valid
Intention to Avoid Drug Abuse (Y)	Y_{11}	0.842	Valid
	Y_{12}	0.828	Valid
	Y_{13}	0.674	Valid
	Y_{14}	0.759	Valid
	Y_{15}	0.777	Valid

3.1.2 Convergent Validity and Composite Reliability

Convergent validity was assessed using the Average Variance Extracted (AVE), where as Composite Reliability (CR) was employed to evaluate internal consistency reliability. AVE values exceeding 0.50 and CR values greater than 0.70 indicate that the latent constructs possess satisfactory validity and reliability [17], [18].

Table 3. Convergent Validity and Composite Reliability

Variable	AVE	CR	Interpretation
Emotional Distress	0.621	0.891	Valid and Reliable
Self-Development Activities	0.557	0.862	Valid and Reliable
Social Relationships	0.588	0.876	Valid and Reliable
Intention to Avoid Drug Abuse	0.605	0.884	Valid and Reliable

The results indicate that all latent variables satisfy the recommended criteria for convergent validity and reliability. Consequently, the measurement model is considered adequate for further structural analysis.

3.2 Measurement and Structural Models

Figure 1 illustrates the final Structural Equation Modeling estimated using the Diagonally Weighted Least Squares (SEM-DWLS) approach. The model consists of

distress (X_1), self-development activities (X_2), social relationships (X_3), and intention to avoid drug abuse (Y), which are measured by their respective observed indicators. The arrows connecting the latent variables to the indicators represent the measurement model, whereas the arrows among latent variables represent the structural relationships. In the figure, thicker lines indicate stronger standardized loadings or path coefficients, while thinner lines represent relatively weaker contributions. Therefore, the line thickness provides a visual representation of the magnitude of the relationships estimated in the model.

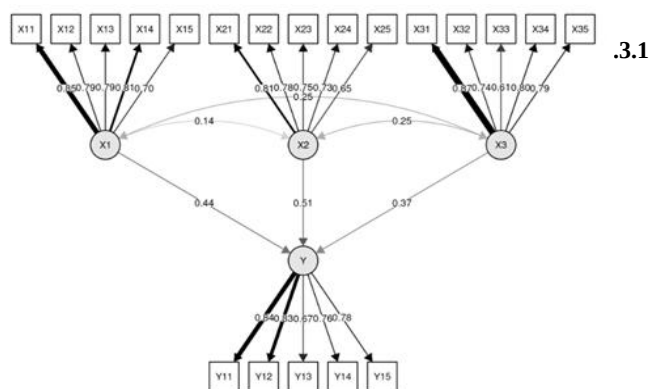


Figure 1. Final SEM-DWLS Model

The measurement model represents the relationships between latent variables and their corresponding indicators. Based on the standardized factor loadings, the measurement equations are given by

1. Emotional Distress (X_1) :

$$X_1 = 0.847X_{11} + 0.786X_{12} + 0.789X_{13} + 0.811X_{14} + 0.699X_{15}$$
2. Self-Development Activities (X_2) :

$$X_2 = 0.809X_{21} + 0.783X_{22} + 0.750X_{23} + 0.732X_{24} + 0.649X_{25}$$
3. Social Relationships (X_3) :

$$X_3 = 0.868X_{31} + 0.743X_{32} + 0.609X_{33} + 0.795X_{34} + 0.795X_{35}$$
4. Intention to Avoid Drug Abuse (Y) :

$$Y = 0.842Y_{11} + 0.828Y_{12} + 0.674Y_{13} + 0.759Y_{14} + 0.777Y_{15}$$

Based on these equations, all indicators exhibit loading values above 0.60, indicating satisfactory convergent validity. Among the indicators measuring emotional distress, indicator X_{11} has the highest loading factor (0.847). For self-development activities, indicator X_{21} contributes the most to the construct with a loading factor of 0.809. Similarly, indicator X_{31} is the most dominant indicator of social relationships with a loading factor of 0.868. Meanwhile, indicator Y_{11} exhibits the highest contribution to the intention to avoid drug abuse construct with a loading factor of 0.842. These findings indicate that all indicators adequately represent their respective latent variables.

The structural model describes the causal relationships among the latent variables. Based on the estimated standardized path coefficients, the structural equation is expressed as

$$Y = 0.439X_1 + 0.510X_2 + 0.367X_3 + \zeta$$

The structural equation indicates that all exogenous variables positively influence students' intention to avoid drug abuse. Among the three predictors, self-development activities (X_2) exhibit the strongest effect, with a standardized path coefficient of 0.510, followed by emotional distress (0.439) and social relationships (0.367). These findings suggest that students' participation in organizations, training programs, social activities, and other self-development initiatives plays a crucial role in strengthening their intention to avoid drug abuse.

3.3 Structural Model Evaluation Goodness-of-Fit Assessment

The adequacy of the proposed model was evaluated using several goodness-of-fit indices. Table 4 presents the fit indices obtained from the SEM-DWLS analysis.

Table 4. Goodness-of-Fit Index

Fit Index	Value	Rules of Thumb	Status
Chi-Square	212.011	Smaller values indicate better fit	Good
GFI	0.989	≥ 0.90	Good Fit
AGFI	0.983	≥ 0.90	Good Fit
NFI	0.985	≥ 0.90	Good Fit
CFI	0.997	≥ 0.95	Good Fit
TLI	0.996	≥ 0.95	Good Fit
IFI	0.997	≥ 0.90	Good Fit
RMSEA	0.031	≤ 0.08	Good Fit
SRMR	0.050	≤ 0.08	Good Fit

The results demonstrate that all fit indices satisfy the recommended criteria. In particular, the values of CFI and TLI exceed 0.95, while RMSEA and SRMR are below 0.08. These findings indicate that the SEM-DWLS model provides an excellent fit to the observed data.

3.3.2 Coefficient of Determination

The coefficient of determination (R^2) was employed to assess the explanatory power of the structural model. The estimated R^2 value for the intention to avoid drug abuse variable was 0.588, indicating that emotional distress, self-development activities, and social relationships collectively accounted for 58.8% of the variation in students' intention to avoid drug abuse. The remaining 41.2% of the variance may be explained by other factors outside the scope of the present study.

This result suggests that the proposed SEM-DWLS model possesses satisfactory explanatory capability. In other words, the psychosocial variables considered in this study provide substantial information for explaining preventive behavior among university students. Nevertheless, the unexplained proportion of variance indicates that other determinants, such as family environment, peer influence, religious values, self-control, or psychological resilience, may also contribute to students' intention to avoid drug abuse and warrant further investigation.

3.3.3 Hypothesis Testing

The hypotheses examined in this study are formulated as follows.

1. Emotional Distress and Intention to Avoid Drug Abuse
 $H_0 : \gamma_1 = 0$ (There is no effect of emotional distress on students' intention to avoid drug abuse.)
 $H_1 : \gamma_1 \neq 0$ (There is an effect of emotional distress on students' intention to avoid drug abuse.)

2. Self-Development Activities and Intention to Avoid Drug Abuse

$H_0 : \gamma_2 = 0$ (There is no effect of self-development activities on students' intention to avoid drug abuse.)

$H_1 : \gamma_2 \neq 0$ (There is an effect of self-development activities on students' intention to avoid drug abuse.)

3. Social Relationships and Intention to Avoid Drug Abuse

$H_0 : \gamma_3 = 0$ (There is no effect of social relationships on students' intention to avoid drug abuse.)

$H_1 : \gamma_3 \neq 0$ (There is an effect of social relationships on students' intention to avoid drug abuse.).

The results of hypothesis testing are summarized in Table 5.

Table 5. Structural Path Coefficients

Relationship	Path Coefficient	z-value	p-value	Decision
$X_1 \rightarrow Y$	0.439	10.265	<0.001	Reject H_0
$X_2 \rightarrow Y$	0.510	13.199	<0.001	Reject H_0
$X_3 \rightarrow Y$	0.367	9.311	<0.001	Reject H_0

The results indicate that all path coefficients are positive and statistically significant at the 5% significance level. Therefore, emotional distress, self-development activities, and social relationships significantly influence students' intention to avoid drug abuse. Among these variables, self-development activities exhibit the strongest standardized effect, followed by emotional distress and social relationships.

3.4 Discussion

The results indicate that emotional distress, self-development activities, and social relationships significantly influence students' intention to avoid drug abuse. Emotional distress exhibits a positive effect, suggesting that students experiencing psychological pressures tend to develop greater awareness regarding the importance of maintaining physical and mental well-being. This finding supports previous studies showing that emotional and psychological conditions are closely associated with health-related behaviors and substance-use prevention among young adults. Unlike the study conducted by Jha and Singh, which mainly focused on rehabilitation and recovery among individuals with substance-related problems, the present study emphasizes preventive behavior among university students. Therefore, emotional distress in this study should be viewed as a psychosocial factor that enhances awareness and encourages healthier behavioral choices rather than as a factor leading to substance abuse.

Among the three predictors, self-development activities exhibit the strongest effect on students' intention to avoid drug abuse. This finding indicates that involvement in organizations, training programs, social activities, and other constructive engagements contributes to strengthening self-control and promoting positive lifestyles. Similar findings have been reported in previous studies, which highlighted the

roles of resilience, emotional competence, and constructive engagement as protective factors against risky behaviors among university students. These results imply that programs aimed at improving students' self-development and active participation in positive activities may represent effective strategies for drug abuse prevention.

Social relationships also show a significant positive effect on students' intention to avoid drug abuse. Supportive interactions with family, friends, and the surrounding environment provide emotional support and reinforce positive social norms. Previous studies have demonstrated that social support and a sense of belonging contribute to lower tendencies toward substance use and psychological distress among college students. Although the effect of social relationships is relatively smaller than those of emotional distress and self-development activities, the results suggest that a supportive social environment remains an important protective factor in strengthening preventive behavior.

From a methodological perspective, this study demonstrates the applicability of covariance-based Structural Equation Modeling with the Diagonally Weighted Least Squares (SEM-DWLS) estimator for analyzing latent constructs measured using four-point ordinal indicators. Unlike many SEM studies that require indicator elimination to achieve satisfactory model fit, all indicators in the present study were retained while still producing excellent goodness-of-fit indices. Moreover, the model explained 58.8% of the variance in students' intention to avoid drug abuse, indicating satisfactory explanatory power.

Overall, the findings indicate that emotional distress, self-development activities, and social relationships positively influence students' intention to avoid drug abuse. Among these factors, self-development activities exerted the strongest effect, highlighting the importance of engaging students in constructive activities as a preventive strategy against drug abuse. These findings suggest that SEM-DWLS provides a reliable and robust approach for investigating psychosocial factors in behavioral and preventive studies involving ordinal data [18].

4. Conclusion

This study applied Structural Equation Modeling with the Diagonally Weighted Least Squares (SEM-DWLS) estimator to investigate the effects of emotional distress, self-development activities, and social relationships on students' intention to avoid drug abuse. The results indicated that all three psychosocial factors exert positive and significant effects on intention to avoid drug abuse. Among these variables, self-development activities exhibited the strongest influence, followed by emotional distress and social relationships. Furthermore, the proposed model demonstrated excellent goodness-of-fit indices and explained 58.8% of the variation in students' intention to avoid drug abuse, indicating satisfactory explanatory power.

From a methodological perspective, this study demonstrates that SEM-DWLS provides a reliable approach for modeling

latent constructs measured using four-point ordinal scales without requiring indicator elimination. In practical terms, the findings suggest that strengthening students' participation in constructive activities and fostering supportive social environments may contribute to drug abuse prevention among university students. Future studies are recommended to incorporate additional factors, such as family environment, self-control, resilience, and religious values, and to consider broader populations in order to improve the explanatory capability and generalizability of the model.

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