Indonesian Technology and Education Journal
E-ISSN: 2985-8216; P-ISSN: 2985-8208
https://journal.diginus.id/index.php/ITEJ

The Mediating Role of Self-Regulation Between Microsystem Environment and Subjective Well-Being in Senior High School Students

Roza Ferawati[1*], Agus Triyanto[1]
[1,2]*Universitas Negeri Yogyakarta, Yogyakarta, Indonesia*
Corresponding Email: rozaferawati2019@gmail.com

ARTICLE INFO

Keywords:
Microsystem environment;
Self-regulation;
Senior high school students;
Subjective well-being;
PLS-SEM

Article History
Received: April 10, 2026
Revised: July 04, 2026
Accepted: August 05, 2026

ABSTRACT

Subjective well-being (SWB) is an important indicator of adolescents' psychological adjustment, yet limited evidence explains how proximal social environments are associated with students' well-being through internal self-regulatory mechanisms. This study examined the mediating role of self-regulation in the relationship between the microsystem environment and subjective well-being among senior high school students. A quantitative cross-sectional explanatory design was employed involving 263 students selected through proportionate stratified random sampling. The microsystem environment encompassed family, teacher, and peer support, while self-regulation reflected students' emotional, behavioral, and cognitive regulation. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with 5,000 bootstrap subsamples. The results showed that the microsystem environment was positively associated with self-regulation ($\beta = 0.604$, $p < .001$) and subjective well-being ($\beta = 0.356$, $p < .001$). Self-regulation was also positively associated with subjective well-being ($\beta = 0.391$, $p < .001$). Mediation analysis demonstrated a significant indirect association between the microsystem environment and subjective well-being through self-regulation ($\beta = 0.237$, 95% CI [0.134, 0.356], $p < .001$), indicating partial mediation. The model explained 36.5% of the variance in self-regulation and 44.9% of the variance in subjective well-being. These findings indicate that students' well-being is associated not only with supportive family, teacher, and peer environments but also with their capacity to regulate emotions, behavior, and cognition. The study highlights self-regulation as an important psychological mechanism linking proximal social support with adolescent well-being and suggests that school-based well-being initiatives should integrate environmental support with systematic development of students' self-regulation skills. Because the study used a cross-sectional design, the findings should be interpreted as statistical associations rather than causal relationships.

To cite this article: Ferawati, R., & Triyanto, A. (2026). The Mediating Role of Self-Regulation Between Microsystem Environment and Subjective Well-Being in Senior High School Students. *Indonesian Technology and Education Journal. 4(*2), 308-326. Doi. 10.61255/itej.v4i2.1412

INTRODUCTION

A school succeeds not only when its students perform well academically, but also when the learning process itself sustains their psychological health and character growth. Subjective well-being (SWB) is one of the clearest markers of this underlying psychological condition. According to Diener (1984), SWB denotes how a person subjectively appraises their own life, spanning life satisfaction, the relative weight of positive affect, and the relative absence of

negative affect. For senior high school students specifically, SWB shows up as an ability to find enjoyment in learning, a sense of satisfaction with school life, and emotional steadiness under academic and social pressure (Borualogo & Casas, 2024). Several recent studies converge on a similar pattern: adolescents with higher SWB tend to learn with stronger motivation, engage more actively in school activities, and adjust more smoothly on the social and emotional fronts, and this relationship also runs in the opposite direction, with engagement itself feeding back into well-being over time (Cui et al., 2023; Datu & King, 2018; Diener et al., 2015).

This ideal picture, however, does not yet match everyday reality. Today's senior high school students contend with considerable pressure that comes both from academic demands and from the broader turbulence of adolescent development. Heavy workloads, examination preparation, rising achievement expectations, and the pull toward social acceptance regularly translate into stress that erodes students' psychological well-being. Nationally, the 2022 Indonesia–National Adolescent Mental Health Survey (I-NAMHS) reports that a sizeable share of Indonesian adolescents experience some form of mental health difficulty, underscoring academic stress and emotional pressure as a live concern rather than a marginal one (Indonesia National Adolescent Mental Health Survey [I-NAMHS] Consortium, 2022). Evidence from other settings points in the same direction: test anxiety and exam-related pressure have been documented as common, and at times severe, sources of strain among senior high school students elsewhere in Asia (Xing et al., 2024). Left unaddressed, this kind of sustained pressure can erode life satisfaction and amplify negative affect, a pattern also documented among Indonesian adolescents during periods of heightened stress (Borualogo & Casas, 2024).

A similar pattern emerges locally at SMAN 2 Pangkalan Kerinci. Situated in Pelalawan Regency—an area marked by industrial activity and rapid urbanization the school operates within a community that places comparatively high expectations on students' academic achievement, expectations that come from families, the school itself, and the wider social environment alike. On top of formal academic demands, students also carry the weight of being seen as a vehicle for their family's social mobility. In preliminary interviews, the school's guidance and counseling teacher estimated that around 30–40% of students who came in for counseling cited academic stress test anxiety, trouble managing study time, fatigue from heavy workloads as a contributing factor. A small preliminary survey of 30–40 students pointed in the same direction, with roughly a third reporting moderate-to-low life satisfaction.

Yet students who sit in the same classrooms and face broadly comparable academic demands do not end up with the same level of subjective well-being. Some stay motivated and continue to find the learning process enjoyable; others struggle with anxiety, mental fatigue, and a general dissatisfaction with school life. That divergence is itself telling: it suggests the environment by itself is not what fixes a student's level of subjective well-being. Something internal to the student appears to filter how the surrounding environment is experienced and acted upon.

Bronfenbrenner's (1979) ecological systems theory offers one way to make sense of this: individual development unfolds across nested environmental layers, and the microsystem is the layer sitting closest to the individual. For a senior high school student, that microsystem is made up of family, the school most notably the student–teacher relationship and peers. It is through proximal processes, the intensive and repeated back-and-forth a student has with this immediate environment, that psychological development takes shape. Recent applications of the theory to school settings continue to support this view, treating teacher relationships, family involvement, and peer acceptance as proximal processes that shape students' developmental outcomes, including their sense of belonging and well-being (El Zaatari & Maalouf, 2022;

Navarro & Tudge, 2022). Emotional support at home, positive rapport with teachers, and acceptance among peers are each thought to lift students' subjective well-being, with large-sample evidence showing that all three sources of support make an independent, cumulative contribution to young people's mental wellbeing (Butler et al., 2022) and that the quality of peer friendship in particular carries a robust, well-documented association with adolescent subjective well-being (Alsarrani et al., 2022). Even so, the evidence is not unanimous that environmental influence on SWB operates in a straightforward, uniform way.

The fact that students respond so differently to a broadly similar environment points to an internal factor that connects environment to subjective well-being, and in this study, that factor is self-regulation. Zimmerman (2000) frames self-regulation as a person's capacity to deliberately steer their own thoughts, emotions, and behavior toward goals while adapting to whatever the environment demands. Longitudinal work on adolescents reinforces this picture, showing conscious self-regulation to be a meaningful predictor of how psychological and school-related well-being develop over time (Morosanova et al., 2021). For students specifically, self-regulation is what allows study time to be managed, anxiety to be kept in check, motivation to be sustained, and academic pressure to be interpreted in adaptive rather than overwhelming terms.

Positioning self-regulation as the mediating variable rests on both theoretical and practical grounds. On the theoretical side, the interactionist view holds that the environment merely supplies a stimulus, or input, that development actively processes rather than simply absorbs (Bronfenbrenner, 1979; Tong & An, 2024), while subjective well-being, as the resulting psychological output, hinges largely on how that input is processed through internal, self-regulatory mechanisms—consistent with evidence that dispositional resources such as optimism and self-efficacy mediate the translation of external circumstances into subjective well-being (Liu et al., 2018). Self-regulation operates as the cognitive-affective mechanism that turns environmental support—or environmental pressure—into an adaptive psychological response, a role documented directly among secondary school students, where self-regulated learning is associated with academic stress and subjective well-being through its statistical association with procrastination (García-Ros et al., 2023), a mediating function that recent adolescent research has documented in other domains as well, such as the link between physical activity habits and subjective well-being (Fuentealba-Urra et al., 2023). On the practical side, self-regulation is not a fixed trait; it is a capacity that schools can cultivate through interventions such as classical guidance services, emotion-management training, and self-management-oriented learning strategies.

Research on SWB is hardly scarce, yet most of it has tended to isolate either external or internal factors rather than tracing how they work together. Cross-national evidence has examined social support and adolescent subjective well-being in aggregate, identifying parental and peer support as the most consistent global predictors (Wu & Lee, 2022), and other work has examined self-regulation and academic stress as a stand-alone pair, showing that self-regulatory capacity is associated with stress and well-being through its statistical association with procrastination (Ragusa et al., 2023), but the specific pathway by which the microsystem environment is associated with SWB through self-regulation particularly among Indonesian senior high school students remains comparatively underexplored. This study therefore offers conceptual novelty by positioning self-regulation as a mediator linking the microsystem environment to students' subjective well-being.

Building on this rationale, the present study sets out to analyze a model of students' subjective well-being by examining the mediating role of self-regulation in the relationship between the microsystem environment and SWB among students at SMAN 2 Pangkalan Kerinci. Four hypotheses follow from this aim: H1, the microsystem environment is positively associated with students' subjective well-being; H2, self-regulation is positively associated with students' subjective well-being; H3, the microsystem environment is positively associated with students' self-regulation; and H4, self-regulation statistically mediates the association between the microsystem environment and subjective well-being. The study is intended to contribute theoretically to the literature on adolescent subjective well-being while also offering schools practical direction for strengthening both supportive social environments and students' self-regulation skills.

METHOD

Research Design

This study used a quantitative, explanatory research design an approach suited to testing hypothesized statistical relationships among variables formulated in advance (Creswell, 2014). That fit is what motivated the choice: the aim here is precisely to determine how strongly, and in what direction, the microsystem environment and self-regulation, separately and together, are statistically associated with the subjective well-being of students at SMAN 2 Pangkalan Kerinci. Because the design is a cross-sectional survey rather than an experimental or longitudinal design, the relationships reported throughout this study are statistical associations and predictive relationships rather than confirmed causal effects.

Quantitative explanatory work of this kind draws on numerical data gathered through structured measurement instruments and then analyzed statistically to test hypotheses and arrive at objective conclusions. Creswell (2014) describes explanatory research of this kind as oriented toward theory testing and toward examining directional, hypothesized relationships through inferential analysis. Within this framework, the independent variables in the present study were the microsystem environment (X1) spanning family support, school support, and peer support and self-regulation (M), spanning emotional, behavioral, and cognitive regulation. Subjective well-being (Y), the dependent variable, was likewise broken down into life satisfaction, positive affect, and negative affect.

Empirical data were gathered through a survey design built around a Likert-scale questionnaire as the main instrument a practical choice given how efficiently surveys capture data across a large student population, and one that gave the researchers a quantitative picture of how students perceived and experienced the psychological variables under study, consistent with the survey method's general suitability for measuring behavior, attitudes, and perceptions across a population (Creswell, 2014).

This explanatory survey design let the researchers trace how variation in the microsystem environment and self-regulation predicts students' subjective well-being, which matches the study's broader objective of explaining statistical relationships rather than simply describing them. Structural Equation Modeling with Partial Least Squares (SEM-PLS) was used for the analysis because it evaluates the measurement and structural models at the same time and handles both direct and indirect (mediated) associations among latent constructs well. Given the quantitative, cross-sectional nature of the relationships being tested here, this strategy was intended to yield empirical findings that describe and predict rather than establish causal claims about students' subjective well-being based on their immediate environment and their self-regulation capacity.

Population, Sample, and Sampling Technique

This study was conducted at SMAN 2 Pangkalan Kerinci (NPSN 10494513), located on Jl. Batu Ampar, Pangkalan Kerinci District, Pelalawan Regency, Riau Province. The school was chosen as the research site through purposive selection. The population comprised every student enrolled at SMAN 2 Pangkalan Kerinci during the 2023/2024 academic year 1,056 students in total, according to school records, spread across Grades X, XI, and XII. Because these students shared the characteristics relevant to this study (being adolescents undergoing formal education within the same school environment), the population was treated as contextually homogeneous and finite, which provided the basis for drawing a sample representative of students' subjective well-being, microsystem environment, and self-regulation.

The sample size was determined with consideration for population representativeness and the feasibility of statistical analysis. The Slovin formula, commonly used to determine sample size for a finite population when the population variance is unknown, was applied as follows:

$$n = N / [1 + N(e)^2]$$

where n is the sample size, N is the population size, and e is the margin of error. This study applied a 5% margin of error (e = 0.05), a standard threshold in social and educational research. With a population (N) of 1,056 students, the calculation proceeded as follows:

$$n = 1{,}056 / [1 + 1{,}056(0.05)^2] = 1{,}056 / [1 + 1{,}056(0.0025)] = 1{,}056 / (1 + 2.64) = 1{,}056 / 3.64 \approx 290$$

Grade level (X, XI, XII) was accounted for through the sampling design rather than as a covariate in the structural model, since the academic pressure students face tends to differ by year. Grade X students typically face adjustment pressure tied to the transition into senior high school and unfamiliar academic demands; Grade XI students carry a heavier academic workload alongside decisions about their stream of specialization; and Grade XII students face the most intense pressure, bound up with final-examination preparation and planning for what comes next. Because these differences in pressure across grade levels could plausibly affect students' subjective well-being, grade level was built into the sampling design via proportionate stratification, described below so that each grade level's share of academic-pressure variation would be proportionally represented in the sample, rather than statistically controlled for at the analysis stage. For that reason, the sampling technique used was proportionate stratified random sampling, stratified by grade level (X, XI, and XII). Stratifying in this way kept each grade level proportionally represented in the sample, which made it possible to statistically account for grade-related variation in academic pressure and strengthened the accuracy and generalizability of the findings to the wider student population at SMAN 2 Pangkalan Kerinci.

Questionnaires were distributed to students across the three grade strata following the proportionate stratified random sampling procedure described above. Following data cleaning which excluded responses with incomplete answers, straight-lining (identical responses across all items), or other internal inconsistencies the final analytic sample comprised 263 students, short of the approximately 290 respondents indicated by the Slovin calculation. Recalculating the margin of error for the achieved sample (N = 263 against a population of 1,056) yields approximately 5.34%, only marginally above the 5% margin of error originally targeted; this shortfall is therefore judged unlikely to have materially compromised the precision of the estimates reported below. Of the 263 respondents, 262 had a codable grade-level entry in the raw response data: 97 (36.9%) from Grade X, 90 (34.2%) from Grade XI, and 75 (28.5%) from

Grade XII. The remaining respondent's grade-level entry in the raw dataset could not be classified into a valid grade category; because grade level was used only to structure the sampling procedure and was not entered as a covariate in the structural model, this respondent was retained in the analytic sample. This study therefore involved three main variables: the independent variable, the microsystem environment (X_1); the mediating (intervening) variable, self-regulation (M); and the dependent variable, subjective well-being (Y).

Variables and Research Instrument

The independent variable in this study was the microsystem environment, operationalized through three dimensions family support, school/teacher support, and peer support and measured with 18 items (six items per dimension). The mediating variable, self-regulation, was operationalized through emotional, behavioral, and cognitive regulation and measured with 15 items (five items per dimension). The dependent variable, subjective well-being, was operationalized through life satisfaction, positive affect, and negative affect, following Diener's (1984) tripartite conceptualization, and was likewise measured with 15 items (five items per dimension). All three instruments used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) and were developed by the researchers from the theoretical dimensions described above drawing on Bronfenbrenner's (1979) ecological systems framework for the microsystem environment, Zimmerman's (2000) self-regulation model for self-regulation, and Diener's (1984) conceptualization for subjective well-being and were reviewed for content validity by a panel of expert judges in educational psychology and guidance and counseling before being piloted with a small sample of students ahead of the main data collection; items were retained on the basis of expert consensus and acceptable pilot-stage item–total correlations, and no items required removal following the pilot. Negative-affect items (Y10–Y15) were reverse-scored prior to analysis, consistent with Diener's (1984) tripartite conceptualization of subjective well-being as reflecting life satisfaction, positive affect, and the relative rather than literal absence of negative affect; this is also consistent with all fifteen SWB indicators, including Y10–Y15, loading positively (0.702–0.915) on a single reflective construct in Table 7 and Appendix Table A1, which would not be expected if the negative-affect items had entered the model in their original, non-reversed direction. Each construct's three theoretical dimensions were modeled as indicators of a single reflective first-order construct, rather than as a formative or higher-order structure, because Bronfenbrenner (1979), Zimmerman (2000), and Diener (1984) each conceptualize these dimensions as interchangeable, positively correlated manifestations of one underlying latent construct rather than as distinct components that jointly form it; the consistently high inter-item loadings and composite reliabilities reported in Table 10 support this reflective specification.

Data Analysis Technique

Data were analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS) in SmartPLS, following the two-stage procedure recommended by Hair et al. (2022). The measurement model (outer model) was evaluated first, for convergent validity (outer loadings ≥ 0.70), discriminant validity (the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio, HTMT < 0.90), and construct reliability (Cronbach's alpha and composite reliability ≥ 0.70). The structural model (inner model) was then evaluated using the coefficient of determination (R^2), predictive relevance (Q^2), and path coefficients. Hypothesis testing relied on a bootstrapping procedure with 5,000 subsamples, the convention recommended for PLS-SEM (Hair et al., 2022), with paths considered statistically significant when the t-statistic exceeded 1.96 and the p-value fell below .05. The mediating role of self-regulation was tested by

examining the significance of the indirect effect of the microsystem environment on subjective well-being through self-regulation.

Ethical Considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki (World Medical Association, 2013). Ethical approval was granted by the Research Ethics Committee of Universitas Negeri Yogyakarta (No. B/UN34.13/HK.06.02/2024) prior to the commencement of data collection. All participants were informed of the study's purpose, procedures, anticipated risks and benefits, the voluntary nature of participation, and their right to withdraw at any stage without penalty. Written consent was obtained from each participant; because respondents were students under 18 years of age, written parental or guardian consent was obtained in advance through the school administration, and student assent was confirmed individually at the time of data collection. All data were anonymized before analysis and used solely for the research purposes described in this study.

RESULT AND DISCUSSION

This section presents the results of the descriptive analysis to characterize the data for each research variable. As outlined in the Method section, data obtained from 263 respondents were processed to determine basic statistics and score categorization. The descriptive results for the microsystem environment (X1), self-regulation (M), and subjective well-being (Y) are presented below.

Descriptive Statistics

Microsystem Environment (X_1)

The first variable analyzed was the microsystem environment. The basic statistical profile of this variable, including the minimum, maximum, and mean values of students' responses, is presented in Table 1.

Table 1. Descriptive Statistics of X_1

N	263
Minimum	34
Maximum	90
Mean	71.67
Std. Deviation	15.06

Table 2. Frequency Distribution of Student Responses on X_1

Category	Score Interval	Frequency	Percentage
High	X ≥ 86.73	34	12.93%
Moderate	56.61 ≤ X < 86.73	194	73.76%
Low	X < 56.61	35	13.31%
Total		**263**	**100%**

Table 2 puts most students 194, or 73.76% in the moderate category for the microsystem environment (X1), suggesting that the environmental conditions students at SMAN 2 Pangkalan Kerinci experience were generally conducive rather than either especially strong or especially weak. A further 34 students (12.93%) fell into the high category, while 35 (13.31%) perceived their environment as less supportive.

Self-Regulation (M)

The next variable analyzed was self-regulation. The descriptive data on respondents' self-management are presented in Table 3.

Table 3. Descriptive Statistics of M

N	**263**
Minimum	18
Maximum	75
Mean	59.41
Std. Deviation	8.45

Table 4. Frequency Distribution of Student Responses on M

Category	**Score Interval**	**Frequency**	**Percentage**
High	X ≥ 67.86	47	17.87%
Moderate	50.96 ≤ X < 67.86	176	66.92%
Low	X < 50.96	40	15.21%
Total		**263**	**100%**

A comparable pattern shows up for self-regulation in Table 4, where 176 students (66.92%) sit in the moderate category an indication that students at SMAN 2 Pangkalan Kerinci generally manage themselves adequately, neither markedly strong nor markedly weak in this respect. The high self-regulation group accounted for 47 students (17.87%), and the low category for 40 (15.21%).

Subjective Well-Being (Y)

The final part of the descriptive analysis addresses the dependent variable, subjective well-being. Table 5 summarizes the statistics describing students' general psychological well-being.

Table 5. Descriptive Statistics of Y

N	**263**
Minimum	17
Maximum	75
Mean	60.00
Std. Deviation	10.39

Table 6. Frequency Distribution of Student Responses on Y

Category	**Score Interval**	**Frequency**	**Percentage**
High	X ≥ 70.39	44	16.73%
Moderate	49.61 ≤ X < 70.39	181	68.82%
Low	X < 49.61	38	14.45%
Total		**263**	**100%**

Subjective well-being follows the same shape: Table 6 shows 181 students (68.82%) in the moderate category, pointing to an adequate, middle-of-the-road level of SWB overall among students at SMAN 2 Pangkalan Kerinci. Forty-four students (16.73%) fell into the high-SWB group, and 38 (14.45%) into the low category.

Measurement Model Evaluation (Outer Model)

Convergent Validity

Convergent validity was assessed by examining the outer loading value of each indicator on its respective construct, using the final research data. The structural model estimation results, generated using SmartPLS, are presented in the path diagram in Figure 1.

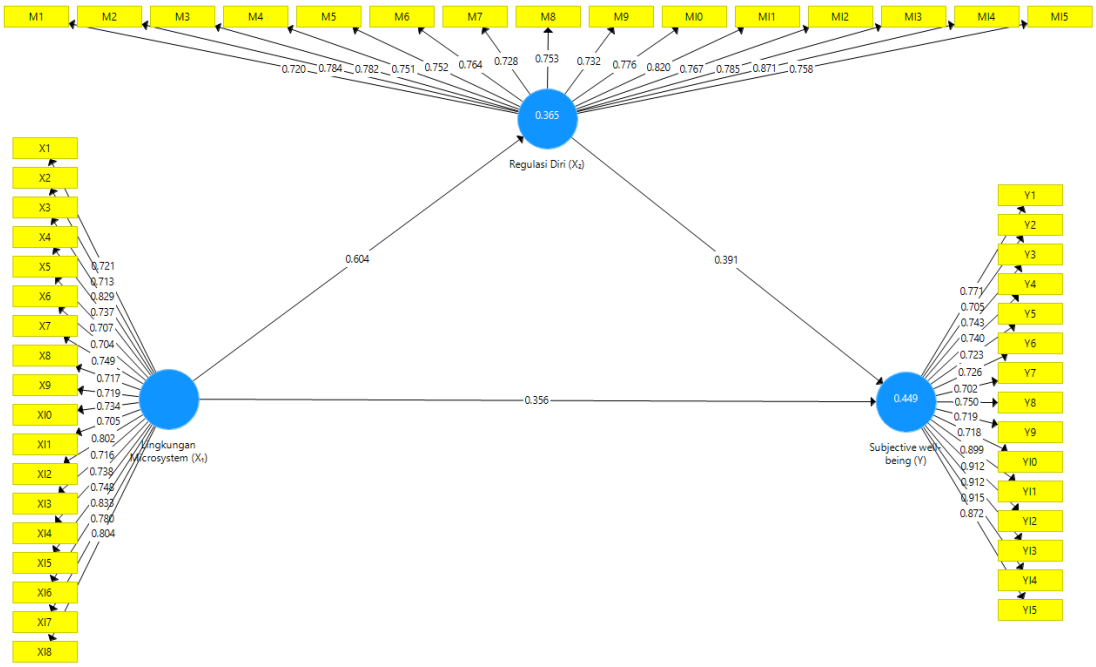

Figure 1. PLS Algorithm structural model results (SmartPLS)

Table 7. Summary of Outer Loading Results

Variable	Indicator	Outer Loading	Description
Microsystem Environment	X1–X18	0.704–0.833	Valid
Self-Regulation	M1–M15	0.720–0.871	Valid
Subjective Well-Being	Y1–Y15	0.702–0.915	Valid

Table 7 confirms that every indicator across the three constructs cleared the 0.70 outer-loading threshold, which means each questionnaire item adequately represents its underlying latent construct and the convergent validity criterion was met.

Discriminant Validity

Whether each construct stood empirically apart from the others was checked next, using two criteria: the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT).

Fornell–Larcker Criterion

For the Fornell–Larcker test, the square root of each construct's Average Variance Extracted (AVE), shown in bold, was checked against its correlations with the other constructs.

Table 8. Fornell–Larcker Criterion Results

Variable	Microsystem Environment (X1)	Self-Regulation (M)	Subjective Well-Being (Y)
Microsystem Environment (X1)	0.749		
Self-Regulation (M)	0.604	0.770	
Subjective Well-Being (Y)	0.593	0.607	0.792

Table 8 bears this out: each construct's square-root AVE (bold) sits above its correlations with the other constructs. The microsystem environment, for instance, has a square-root AVE of 0.749, which is higher than its correlation with self-regulation (0.604) and with subjective well-being (0.593). The Fornell–Larcker criterion is therefore satisfied, and each construct shows adequate discriminant validity.

Heterotrait–Monotrait Ratio (HTMT)

As a cross-check, discriminant validity was also examined through the HTMT ratio, where values below 0.90 are taken as adequate.

Table 9. Heterotrait–Monotrait Ratio (HTMT) Results

Variable	Microsystem Environment (X1)	Self-Regulation (M)	Subjective Well-Being (Y)
Microsystem Environment (X1)			
Self-Regulation (M)	0.626		
Subjective Well-Being (Y)	0.615	0.626	

Table 9 shows HTMT ratios ranging from 0.615 to 0.626 across the constructs comfortably under the 0.90 threshold so no discriminant validity concerns surfaced in this model, and each latent construct can be regarded as conceptually distinct.

Construct Reliability

Internal consistency of the indicators making up each construct was assessed next, using Cronbach's alpha and composite reliability (CR); Table 10 reports the results.

Table 10. Reliability and Convergent Validity Results

Variable	Cronbach's Alpha	Composite Reliability	AVE	Description
Microsystem Environment (X1)	0.954	0.958	0.561	Highly Reliable
Self-Regulation (M)	0.951	0.956	0.593	Highly Reliable
Subjective Well-Being (Y)	0.956	0.961	0.627	Highly Reliable

Table 10 shows that all constructs have Cronbach's alpha and composite reliability above 0.95, well above the 0.70 minimum, indicating strong internal consistency. The Average Variance Extracted (AVE) values 0.561 for the microsystem environment, 0.593 for self-

regulation, and 0.627 for subjective well-being all exceed the 0.50 threshold, confirming adequate convergent validity for each construct (Hair et al., 2022).

Structural Model Evaluation (Inner Model)

Coefficient of Determination (R^2)

R^2 captures how much of the variance in the dependent variable the independent variables account for; the values from the PLS algorithm are as follows:

Table 11. PLS Algorithm Results

Variable	R-square	R-square adjusted
Self-Regulation	0.365	0.363
Subjective Well-Being	0.449	0.444

Table 11 shows that the microsystem environment is statistically associated with 36.5% of the variance in self-regulation (R^2 = 0.365), while the microsystem environment and self-regulation together account for 44.9% of the variance in students' SWB (R^2 = 0.449). Following the R^2 thresholds proposed by Hair et al. (2022)—0.25 weak, 0.50 moderate, 0.75 substantial—both values fall in the weak-to-moderate range, with the SWB model approaching the moderate threshold.

Predictive Relevance (Q^2)

Table 12. Predictive Relevance (Q^2) Results

Variable	SSO	SSE	Q^2 (=1−SSE/SSO)
Microsystem Environment (X_1)	4734	4734	—
Self-Regulation (M)	3945	3121.014	0.209
Subjective Well-Being (Y)	3945	2878.574	0.270

Predictive relevance was assessed using the blindfolding procedure, comparing the sum of squared observations (SSO) against the sum of squared prediction errors (SSE) for each endogenous construct. Table 12 shows Q^2 values of 0.209 for self-regulation and 0.270 for subjective well-being, both well above zero, which indicates that the model possesses predictive relevance for both endogenous constructs (Hair et al., 2022).

Path Coefficients

Path coefficients capture the direction and strength of relationships among variables in the structural model the closer to +1, the stronger the positive relationship and Table 13 reports these based on the SmartPLS output.

Table 13. Path Coefficients Among Constructs

Hypothesis	Relationship	Path Coefficient	Direction
H1	Microsystem Environment -> Subjective Well-Being	0.356	Positive
H2	Self-Regulation -> Subjective Well-Being	0.391	Positive
H3	Microsystem Environment -> Self-Regulation	0.604	Positive

Every hypothesized relationship in Table 13 was positive. The microsystem environment was positively and significantly associated with students' subjective well-being (β = 0.356), and self-regulation was also positively associated with subjective well-being (β = 0.391). The microsystem environment was additionally positively and significantly associated with self-regulation (β = 0.604), suggesting that students who perceive their environment as more supportive also tend to report higher self-regulation capacity.

Collinearity Assessment and Effect Sizes

Inner model collinearity was assessed using the Variance Inflation Factor (VIF) for each predictor; effect size was evaluated using Cohen's f^2. Table 14 reports these values. The VIF for the microsystem environment as a predictor of SWB and the VIF for self-regulation as a predictor of SWB are both 1.576 (below the conservative threshold of 3.3; Hair et al., 2022), confirming that collinearity is not a concern in the structural model. The microsystem environment–self-regulation path shows a large effect size (f^2 = 0.576); of the two paths leading to SWB, the microsystem environment–SWB path shows a small effect size (f^2 = 0.146, just below the 0.15 medium threshold), while the self-regulation–SWB path shows a medium effect size (f^2 = 0.176), following Cohen's (1988) thresholds.

Table 14. Inner VIF and Effect Size (f^2) for Structural Paths

Path	VIF	f^2	Effect Size
ME → Self-Regulation	1.000	0.576	**Large**
ME → SWB	1.576	0.146	**Small**
SR → SWB	**1.576**	**0.176**	**Medium**

Note. ME = Microsystem Environment; SR = Self-Regulation; SWB = Subjective Well-Being; VIF = Variance Inflation Factor; f^2 thresholds: 0.02 = small, 0.15 = medium, 0.35 = large (Cohen, 1988).

Hypothesis Testing

The hypothesized relationships among variables were then put to the test. Figure 2 shows the bootstrapping output, generated in SmartPLS, indicating the direction and significance of each path among the constructs.

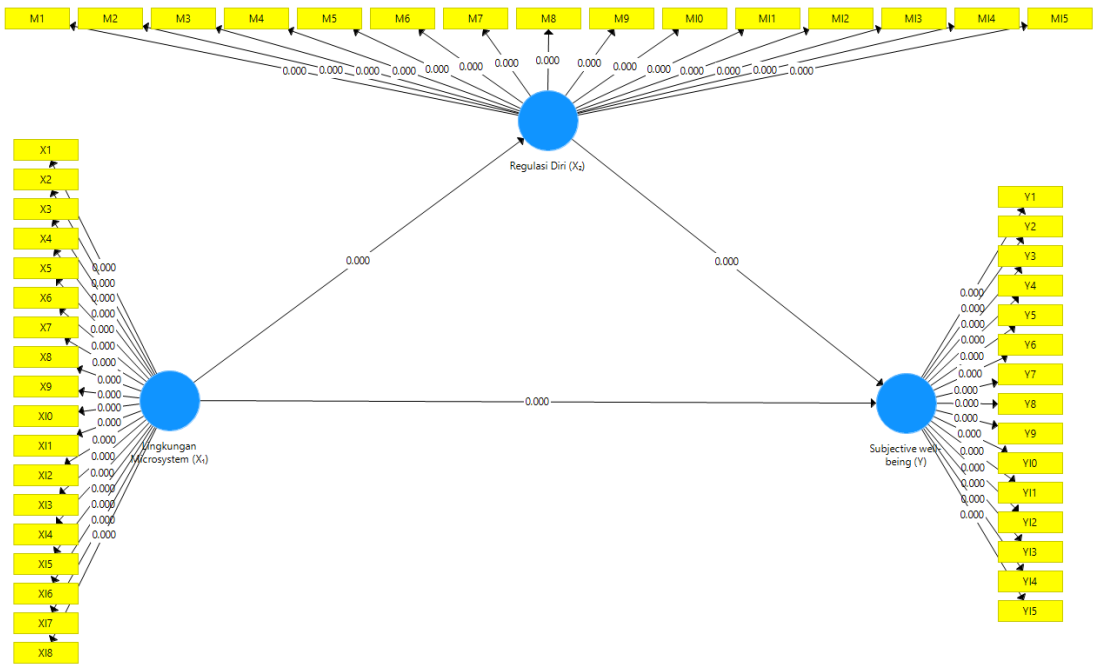

Figure 2. Bootstrapping results (SmartPLS)

Note. Values displayed along the indicator paths are p-values from the bootstrapping procedure; values shown as 0.000 represent p < .001 rather than an exact probability of zero.

A bootstrapping procedure was run on this output to test the significance of each relationship, and Table 15 reports the direct-effect results in line with the study's conceptual framework.

Table 15. Hypothesis Testing Results via the Bootstrapping Procedure

Path	Original Sample (O)	Sample Mean (M)	SD (STDEV)	T Statistics	P Values	95% CI Lower	95% CI Upper
Microsystem Environment -> Self-Regulation	0.604	0.617	0.058	10.364	<.001	0.471	0.705
Microsystem Environment -> Subjective Well-Being	0.356	0.361	0.072	4.926	<.001	0.204	0.484
Self-Regulation -> Subjective Well-Being	0.391	0.391	0.080	4.869	<.001	0.229	0.548

Every path came back with p-values below .001 and t-statistics well past the 1.96 threshold, so all three direct-effect hypotheses (H1–H3) were supported. The microsystem environment was positively and significantly associated with both self-regulation (t = 10.364) and subjective well-being (t = 4.926), and self-regulation was in turn significantly associated with subjective well-being (t = 4.869)—indicating that both the proximal social environment and internal self-regulatory capacity are meaningful predictors of students' psychological well-being. The 95% bias-corrected confidence intervals for all three direct effects, reported in Table 14, lie entirely above zero (0.471 to 0.705 for the microsystem environment–self-regulation path; 0.204 to 0.484 for the microsystem environment–SWB path; 0.229 to 0.548 for the self-regulation–SWB path), consistent with the significant t-statistics.

Mediation Test

Table 15. Mediation Test Results

Path	Original Sample (O)	Sample Mean (M)	SD (STDEV)	T Statistics	P Values	95% CI Lower	95% CI Upper
Microsystem Environment -> Self-Regulation -> Subjective Well-Being	0.237	0.242	0.059	4.016	<.001	0.134	0.356

Table 15 indicates that self-regulation acts as a significant partial mediator between the microsystem environment and subjective well-being, evidenced by a significant indirect effect of 0.237 (95% CI [0.134, 0.356]; t = 4.016 > 1.96; p < .001), with the confidence interval excluding zero. With both the direct effect (β = 0.356) and the indirect effect reaching significance, the microsystem environment is associated with students' well-being both directly and indirectly, via its statistical association with self-regulation as an intervening variable—lending support to H4.

Putting these pieces together: the microsystem environment is directly, positively, and significantly associated with students' subjective well-being at SMAN 2 Pangkalan Kerinci (β = 0.356; t = 4.926), and self-regulation shows a somewhat stronger association with subjective well-being (β = 0.391; t = 4.869). The mediation analysis adds to this picture by identifying self-regulation as a significant mediating variable (indirect effect = 0.237; t = 4.016) in the statistical relationship between the microsystem environment and students' subjective well-being—in fact, the total association between the microsystem environment and SWB, direct plus indirect, reaches 0.593 (t = 12.226; p < .001). All four hypotheses were therefore supported, suggesting that gains in students' well-being are associated both with a supportive environment and with stronger self-regulation.

Discussion

This study set out to analyze a model of students' subjective well-being (SWB) by treating self-regulation as a mediator of the microsystem environment's statistical association with SWB among students at SMAN 2 Pangkalan Kerinci. What emerges is that both the microsystem environment and self-regulation are associated with students' SWB—directly, and indirectly through the mediating mechanism—which lines up with the broader view that adolescents' subjective well-being reflects the interplay between external and internal factors.

Descriptively, most students landed in the moderate category for the microsystem environment (73.76%), self-regulation (66.92%), and SWB (68.82%) alike—a pattern suggesting that students generally receive adequate social support from family, teachers, and peers and have a reasonably adequate capacity to manage themselves, without being concentrated at either extreme. A subset of students nonetheless remained in the low category across all three variables, which points to a pocket of vulnerability to academic and social pressure that a purely aggregate picture would otherwise mask. This pattern is consistent with Diener's (1984) account of SWB as a subjective evaluation of one's life shaped by life satisfaction, emotional experience, and the quality of one's social relationships.

Bronfenbrenner's (1979) ecological systems theory frames the microsystem as the developmental layer closest to the individual, made up of family, school, and peers; it is through proximal processes—intense, repeated interaction with this environment—that students' psychological development takes shape. The present findings fit this framing: the microsystem environment is positively and significantly associated with SWB (β = 0.356; t = 4.926), suggesting that family support, positive teacher relationships, and peer acceptance are linked to students' life satisfaction and positive affect. This mirrors what has been found in cross-national and Indonesian samples alike—large-scale international evidence identifies parental and peer support as the most consistent global predictors of adolescent subjective well-being (Wu & Lee, 2022), converging with graded, cumulative evidence that family, school, and peer support each make an independent contribution to young people's mental wellbeing (Butler et al., 2022), and a recent SEM-PLS study of Indonesian secondary students likewise finds that perceived support from teachers and parents predicts students' sense of belonging at school (Adinata et al., 2025). Taken together, these results are consistent with the broader idea that social harmony and the quality of interpersonal relationships function as an important source of adolescents' psychological well-being in the Indonesian context.

The structural model also shows the microsystem environment explaining 36.5% of the variance in self-regulation (R^2 = 0.365; β = 0.604)—a result that lines up well with Bandura's (1991) social-cognitive theory of self-regulation and Zimmerman's (2000) self-regulation model, both of which treat self-regulatory capacity as something that develops through social

learning and environmental interaction rather than in isolation. Support from family, teachers, and peers appears to function as exactly this kind of social stimulus, helping students manage their emotions, regulate study-related behavior, and sustain academic motivation—a pattern corroborated by a recent cross-cultural study of Indonesian and Turkish students, in which family social support predicted self-regulated learning, which in turn statistically mediated the association with students' academic resilience (Suud et al., 2024).

Together, the microsystem environment and self-regulation account for 44.9% of the variance in students' SWB (R^2 = 0.449), and self-regulation is independently and significantly associated with SWB (β = 0.391; t = 4.869). This is consistent with Zimmerman's (2000) view of self-regulation as the capacity to direct one's thoughts, emotions, and behavior toward specific goals; for senior high school students, that capacity appears to function as both a learning strategy and a coping mechanism for academic and social pressure. The finding also aligns with Self-Determination Theory (Ryan & Deci, 2000), which holds that psychological well-being is optimally supported when three fundamental psychological needs are fulfilled: autonomy (acting from self-endorsed values and self-directed regulation), competence (effectively engaging with and managing one's environment), and relatedness (feeling genuinely connected to significant others). In this study, the microsystem environment's significant positive association with SWB may partly reflect how family, teacher, and peer relationships satisfy the need for relatedness and foster competence, while self-regulation represents the autonomous dimension of this process. The pattern is consistent with findings among secondary school students elsewhere, where stronger academic self-regulation was associated with lower procrastination and academic stress and, in turn, better subjective well-being and academic outcomes (García-Ros et al., 2023; Ragusa et al., 2023).

The central finding here is that self-regulation acts as a partial mediator between the microsystem environment and SWB (indirect effect = 0.237; t = 4.016). That result speaks directly to the interactionist view that the environment does not translate into subjective well-being automatically, but has to pass through an individual's internal psychological processing first. Statistically, the findings suggest that the family, teacher, and peer environment is associated with self-regulation, which in turn is associated with psychological well-being, consistent with self-regulation functioning as an intervening variable in this relationship. Strengthening students' SWB, then, calls for more than simply making the environment more conducive—it also calls for deliberately strengthening self-regulation, whether through guidance and counseling services, self-management training, or building academic coping skills directly into school programs.

Research Limitations

A few limitations are worth flagging. First, the data come from a cross-sectional design at a single school and a single point in time, which limits causal inference and constrains how far the findings can be generalized to other school contexts. Second, all three constructs were measured concurrently through self-report questionnaires, a design choice that opens the door to common-method bias and to social-desirability effects, particularly given that respondents were adolescents (Podsakoff et al., 2003). Third, while the sampling technique aimed for proportional representation across grade levels, full random assignment was not feasible, and variables outside the microsystem environment and self-regulation constructs—individual personality traits or family socioeconomic status, for instance—were not controlled for. Fourth, the absence of longitudinal follow-up limits what can be said about how the relationships among the microsystem environment, self-regulation, and subjective well-being might shift over

time. Fifth, the microsystem environment, self-regulation, and SWB instruments were developed by the researchers rather than adapted from a previously validated scale; although they were checked for content validity and piloted before the main data collection, this still leaves open the possibility of measurement error that a more extensively validated instrument might have avoided, and the relatively high response rate within the sampled grade strata should also be interpreted with this instrument-development context in mind.

Research Implication

These findings carry both theoretical and practical weight. Theoretically, the study extends Bronfenbrenner's ecological systems theory and Zimmerman's self-regulation framework by showing empirically that self-regulation functions as a statistically significant partial mediator linking the proximal social environment to adolescents' subjective well-being—clarifying, in other words, the psychological pathway through which environmental support is statistically associated with well-being. Practically, school counselors and educators would do well not to lean on strengthening the social environment alone (family engagement programs, teacher–student relationship building, peer support programs, and the like) as the route to better student well-being; guidance and counseling interventions that explicitly target self-regulation skills—emotion-management training, goal-setting exercises, academic coping strategies—deserve a place alongside those environmental efforts. Folding self-regulation development into classical and group guidance services, as a complement to environmental-support initiatives, seems particularly worth considering for students who fall into the low-SWB or low-self-regulation categories.

CONCLUSION

This study examined the mediating role of self-regulation between the microsystem environment and subjective well-being among students at SMAN 2 Pangkalan Kerinci, and all four hypotheses were statistically supported. The microsystem environment is positively and significantly associated with students' subjective well-being. Hypothesis testing showed a significant direct association ($\beta = 0.356$; $t = 4.926$; $p < .001$), indicating that stronger social support from family, teachers, and peers is associated with higher levels of students' subjective well-being. The microsystem environment is likewise positively associated with students' self-regulation: model evaluation indicated a path coefficient of 0.604, a t-statistic of 10.364, and a $p < .001$, suggesting that a more supportive social environment is associated with students' capacity to manage emotions, regulate behavior, and organize academic activities more adaptively. Self-regulation, in turn, is positively and significantly associated with students' subjective well-being ($\beta = 0.391$; $t = 4.869$; $p < .001$), indicating that students with stronger self-regulation tend to report higher levels of subjective well-being.

Self-regulation also functions as a significant partial mediator in the relationship between the microsystem environment and students' subjective well-being. The mediation test showed a significant indirect effect (indirect effect = 0.237; $t = 4.016$; $p < .001$), and because both the direct and indirect effects were statistically significant, the microsystem environment is associated with students' subjective well-being both directly and indirectly, via its statistical association with self-regulation. The microsystem environment and self-regulation jointly account for 44.9% of the variance in SWB ($R^2 = 0.449$), a weak-to-moderate value under PLS-SEM criteria (Hair et al., 2022), while Q^2 values of 0.270 for SWB and 0.209 for self-regulation, obtained via blindfolding, confirm predictive relevance.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to SMAN 2 Pangkalan Kerinci for granting permission and providing support during the implementation of this study. The authors also thank the students, teachers, and school counselors who participated in and supported the research process. Appreciation is also extended to Universitas Negeri Yogyakarta for academic guidance and support throughout the preparation of this manuscript. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTION STATEMENT

RF contributed to the conceptualization of the study, research design, data collection, statistical analysis, and initial manuscript drafting. AT contributed to supervision of the research process, methodological refinement, validation of the study framework, interpretation of findings, critical revision of the manuscript, and final approval of the submitted version. Both authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

AI DISCLOSURE STATEMENT

The authors declare that AI-assisted tools were used to support language translation, grammar refinement, and formatting consistency during manuscript preparation. The authors did not use AI tools to generate research data, conduct statistical analysis, interpret findings, or substitute scholarly judgment. All intellectual content, methodological decisions, data interpretation, and final manuscript revisions were reviewed and approved by the authors.

REFERENCES

Adinata, R. S., Srisayekti, W., & Jatnika, R. (2025). The role of perceived teacher, peer, and parental support in school belonging among vocational high school students. International Journal of Adolescence and Youth, 30(1), Article 2526459. https://doi.org/10.1080/02673843.2025.2526459

Alsarrani, A., Hunter, R. F., Dunne, L., & Garcia, L. (2022). Association between friendship quality and subjective wellbeing among adolescents: A systematic review. BMC Public Health, 22(1), Article 1637. https://doi.org/10.1186/s12889-022-14776-4

Bandura, A. (1991). Social cognitive theory of self-regulation. Organizational Behavior and Human Decision Processes, 50(2), 248–287. https://doi.org/10.1016/0749-5978(91)90022-L

Borualogo, I. S., & Casas, F. (2024). Subjective well-being of children and adolescents during the COVID-19 pandemic in Indonesia: Two data collections. Current Psychology, 43(14), 13120–13132. https://doi.org/10.1007/s12144-022-03346-x

Bronfenbrenner, U. (1979). The ecology of human development: Experiments by nature and design. Harvard University Press.

Butler, N., Quigg, Z., Bates, R., Jones, L., Ashworth, E., Gowland, S., & Jones, M. (2022). The contributing role of family, school, and peer supportive relationships in protecting the mental wellbeing of children and adolescents. School Mental Health, 14(3), 776–788. https://doi.org/10.1007/s12310-022-09502-9

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.

Cui, H., Bi, X., Chen, W., Gao, T., Qing, Z., Shi, K., & Ma, Y. (2023). Gratitude and academic engagement: Exploring the mediating effects of internal locus of control and subjective well-being. Frontiers in Psychology, 14, 1287702. https://doi.org/10.3389/fpsyg.2023.1287702

Datu, J. A. D., & King, R. B. (2018). Subjective well-being is reciprocally associated with academic engagement: A two-wave longitudinal study. Journal of School Psychology, 69, 100–110. https://doi.org/10.1016/j.jsp.2018.05.007

Diener, E. (1984). Subjective well-being. Psychological Bulletin, 95(3), 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E., Oishi, S., & Lucas, R. E. (2015). National accounts of subjective well-being. American Psychologist, 70(3), 234–242. https://doi.org/10.1037/a0038899

El Zaatari, W., & Maalouf, I. (2022). How the Bronfenbrenner bio-ecological system theory explains the development of students' sense of belonging to school? SAGE Open, 12(4). https://doi.org/10.1177/21582440221134089

Fuentealba-Urra, S., Rubio, A., González-Carrasco, M., Oyanedel, J. C., & Céspedes-Carreno, C. (2023). Mediation effect of emotional self-regulation in the relationship between physical activity and subjective well-being in Chilean adolescents. Scientific Reports, 13, 13386. https://doi.org/10.1038/s41598-023-39843-7

García-Ros, R., Pérez-González, F., Tomás, J. M., & Sancho, P. (2023). Effects of self-regulated learning and procrastination on academic stress, subjective well-being, and academic achievement in secondary education. Current Psychology, 42(30), 26602–26616. https://doi.org/10.1007/s12144-022-03759-8

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). A primer on partial least squares structural equation modeling (PLS-SEM) (3rd ed.). SAGE Publications.

Indonesia National Adolescent Mental Health Survey [I-NAMHS] Consortium. (2022). Indonesia – National Adolescent Mental Health Survey (I-NAMHS) report. Center for Reproductive Health, Universitas Gadjah Mada.

Liu, C., Cheng, Y., Hsu, A. S. C., Chen, C., Liu, J., & Yu, G. (2018). Optimism and self-efficacy mediate the association between shyness and subjective well-being among Chinese working adults. PLoS ONE, 13(4), Article e0194559. https://doi.org/10.1371/journal.pone.0194559

Morosanova, V. I., Fomina, T. G., & Bondarenko, I. N. (2021). The dynamics of the interrelationships between conscious self-regulation, psychological well-being and school-related subjective well-being in adolescents: A three-year cross-lagged panel study. Psychology in Russia: State of the Art, 14(3), 46–63. https://doi.org/10.11621/pir.2021.0303

Navarro, J. L., & Tudge, J. R. H. (2022). Technologizing Bronfenbrenner: Neo-ecological theory. Current Psychology. https://doi.org/10.1007/s12144-022-02738-3

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Ragusa, A., González-Bernal, J., Trigueros, R., Caggiano, V., Navarro, N., Minguez-Minguez, L. A., Obregón, A. I., & Fernandez-Ortega, C. (2023). Effects of academic self-regulation on procrastination, academic stress and anxiety, resilience and academic performance in a

sample of Spanish secondary school students. Frontiers in Psychology, 14, Article 1073529. https://doi.org/10.3389/fpsyg.2023.1073529

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Suud, F. M., Agilkaya-Sahin, Z., Na'imah, T., Azhar, M., & Kibtiyah, M. (2024). The impact of family social support on academic resilience in Indonesian and Turkish students: The mediating role of self-regulated learning. International Journal of Adolescence and Youth, 29(1), Article 2361725. https://doi.org/10.1080/02673843.2024.2361725

Tong, P., & An, I. S. (2024). Review of studies applying Bronfenbrenner's bioecological theory in international and intercultural education research. Frontiers in Psychology, 14, Article 1233925. https://doi.org/10.3389/fpsyg.2023.1233925

World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA, 310(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053

Wu, Y.-J., & Lee, J. (2022). The most salient global predictors of adolescents' subjective well-being: Parental support, peer support, and anxiety. Child Indicators Research, 15(5), 1601–1629. https://doi.org/10.1007/s12187-022-09937-1

Xing, X.-Y., Wang, G.-M., Li, Y., Zhang, W.-X., & Shen, X.-D. (2024). Current status and influencing factors of test anxiety of senior one students in Yanji, China: A cross-sectional study. Frontiers in Psychology, 15, 1414215. https://doi.org/10.3389/fpsyg.2024.1414215

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 13–39). Academic Press.