

Development and Standardization of a Multidimensional Scale of Self-Regulation for Post Graduate Students

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Abstract

The researcher conducted the study because there was no culturally appropriate self-regulation scale available for post-graduate students in West Bengal. In this regard, the main objective of the study was to develop a standardized self-regulation scale for post-graduate students in West Bengal. To achieve this objective, a 90-item test was prepared for the initial phase and after expert review and data analysis, 41 items were retained. The descriptive survey research design was employed, and the sample size was 185. Sampling adequacy was measured by KMO and Bartlett's test, and the KMO value was 0.825, confirming very good sampling adequacy for factor analysis. Principal component analysis was conducted using a Varimax rotation with Kaiser normalization to examine the latent structure of the scale. Overall, the results demonstrate a clear and interpretable multidimensional structure. The excellent internal consistency and reliability of the scale, with Cronbach's Alpha of 0.912 and standard item Cronbach's Alpha of 0.916, indicate high internal consistency among the items.

Keywords: Self-regulation, Post-Graduate Students, Exploratory Factor Analysis, Construct Validity, & Reliability

1. Introduction

Albert Bandura introduced Social Cognitive Theory, and a paradigm shift occurred by introducing a foundational model of Self-regulation, where he mentioned that human behaviour was influenced by three major functions, e.g. a) self-observation of one's own behaviour, b) self-judgement or self-evaluation and c) self-reflection. He also remarked that self-regulation includes self-efficacy, and it can be affected by social

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factors (Bandura, 1991). The self-regulation construct is related to personality disposition (De La Fuente et al., 2022; Hoyle, 2010) and self-efficacy, as a major component of the social-cognitive architecture of personality, plays a crucial role in how one can regulate one's own thoughts and behaviour (Cervone et al., 2004). Through self-regulated learning, students proactively manage their cognitive processes, motivational states, behaviour, and immediate environments to reach specific academic goals (Panadero, 2017; Usher & Schunk, 2017; B. Zimmerman J., 2001). Rather than functioning as an isolated skill, this concept is now conceptualized as a multi-dimensional construct that integrates cognitive, meta-cognitive, behavioural, motivational, affective, social and environmental factors (Boekaerts & Corno, 2005; Obenza et al., 2025; Panadero, 2017). Self-regulation has a significant influence on academic success, psychological well-being, and sociocultural domains. Empirical evidence in educational research indicates that self-regulated learners achieve higher academic outcomes, display greater resilience, possess better problem-solving skills, and experience greater satisfaction with the learning process (B. J. Zimmerman, 2008). From a psychological viewpoint, self-regulation promotes emotional resilience, mental health, and reinforces individuals' sense of self-efficacy and successfully cope with both academic and personal challenges (Bandura, 1997). Learners who can successfully regulate their emotions and behaviours are less vulnerable to anxiety, procrastination, burnout and academic disengagement. As higher education transitions towards technology-driven education, students must independently navigate self-directed learning tasks (Broadbent & Poon, 2015; Caixia et al., 2025; Russell et al., 2022; Yurt, 2025).

2. Related Reviews

The literature shows broad agreement that self-regulation is best understood as a multidimensional construct. A psychometric validation scale on self-regulation for AI-based learning identified four major dimensions and nine subdimensions, with strong reliability and criterion validity linked to GPA, digital literacy and technology interest (Yurt, 2025). A recent study developed and validated a scale on whether self-regulation is required for online e-learning in the Indian context. In conclusion, psychometric analysis confirms that the online self-regulation learning quotient scale serves as a valid and reliable instrument for measuring self-regulation among Indian students in the context of e-learning (Gupta & Bamel, 2024). Researchers reduced the 63-item self-regulation questionnaire to a 31-item short version, which is highly reliable with alpha .92 and showed a strong correlation with the original scale. The brief version demonstrated excellent convergent validity and suitability for the young adult population (Carey et al., 2004). The authors developed the Chinese self-regulated learning questionnaire by item analysis, factor analysis, validity and reliability, which employed a mixed-method approach. After data analysis, 38 items were retained and showed a variance of 63.71%, reliability spanning from 0.81 to 0.90, and construct validity with correlations ranging from 0.51 to 0.59. The theoretical framework was validated by confirmatory factor analysis results (Shi & Yang, 2025). A quantitative cross-sectional study was conducted in the South African context to validate a short self-regulation questionnaire by using psychometric properties. It was found that this scale showed satisfactory reliability, and factor analysis yielded five interpretable sub-constructs supported by a theoretical framework. The short self-regulation questionnaire and other self-regulation measures demonstrated significant correlations,

which supported criterion-related validity (Vosloo et al., 2013). The short version of the self-regulatory inventory showed a single general factor alongside a five-factor structure and demonstrated convergent and discriminant validity. It is a useful example of scale shortening with retained psychometric evidence (Ashkezari et al., 2011).

3. Multidimensional Nature of Self-Regulation

Contemporary theoretical frameworks emphasize that self-regulation is a multidimensional construct rather than a single phenomenon (Ramírez-Velásquez et al., 2025). For example, research differentiates self-control into two categories: inhibitory self-control-the resistance of immediate impulses and initiatory self-control, which uses proactive strategies. Concurrently, other frameworks break self-regulation processes into distinct phases, specifically forethought, volitional control, and self-reflection (Sarikaya et al., 2023). A study identified five factors of academic self-regulation, which are self-planning, self-monitoring, self-instruction, self-evaluation, and self-reaction (Akhtar & Mahmood, 2013). This hierarchical complexity demands multifaceted measurement tools. This study also emphasized on the multidimensional nature of self-regulation and pinpointed six major factors, namely, i) Emotional Regulation, ii) Self-reflection, iii) Self-awareness, iv) Self-instructions, v) Self-reinforcement, and vi) Self-evaluation.

i) Emotional Regulation: In a foundational review, Gross defines emotion regulation as the way people manage which emotion they feel, when they feel them, and how they express them. Crucially, this framework clarifies and distinguishes between related concepts like coping, mood regulation, defence mechanisms and affect regulation (Gross, 1998). Emotion regulation functions as a subordinate component of self-regulation rather than a distinct process. A review study points out that self-regulation encompasses emotions, attention, behaviour and cognition, whereas emotion regulation specifically alters the internal experience and outward expression of emotions (Gagne et al., 2021). Thompson and Calkins argued that emotion regulation is a subcomponent of a multilevel self-regulatory system through the dynamic interplay between biological and behavioural processes (Thompson et al., 2008).

ii) Self-reflection:

Self-reflection denotes to focusing attention inward to analyze one's own thoughts, memories, feelings, and actions. The study treats it as a measurable construct (Philippi & Koenigs, 2014). Another study defines reflection as analyzing and evaluating one's thoughts, emotions, actions, and values to ultimately foster enhanced self-regulation and conscious behaviour (Achilova, 2026).

Metacognitive reflection is conceptualized as an elevated state of internal observation, monitoring, and regulation governing one's own knowledge, experiences, and emotions. Authors establish a formal conceptual bridge connecting reflection directly to self-regulation (Merkebu et al., 2024).

iii) Self-awareness:

Self-awareness reflects the capacity to focus attention directly on oneself (Morin, 2011). It involves a reflective self-consciousness, shifting consciousness to make the self the primary object of attentional focus, existential contemplation, and metacognition (Denton, 2006). A cross-sectional study on medical students indicated that emotional self-awareness, cognitive flexibility, and self-regulation are significantly correlated. The authors concluded that self-awareness depends on cognitive flexibility to shape functional self-regulation (Göksel & Korkmaz, 2026).

iv) Self-instruction:

The review defines self-instruction training as a cognitive-behavioural self-control technique that depends on children's covert speech to modify their behaviour (Fish & Pervan, 1985). A study analyzed the component of self-regulatory strategy development, which identified self-instruction as a core component of self-regulation when students use private statements to actively manage emotions and behaviours during writing (Geres-Smith, 2015).

v) Self-reinforcement:

Within an operant context, self-reinforcement differs because the individual autonomously establishes their own reward criteria, instead of depending on external authority (Goldiamond, 1976). Social learning theory identified self-reinforcement as a key operational component of self-regulation that involves managing behaviour by making self-reward conditional upon meeting personal standards (Bandura, 1976). A meta-analytic study included self-reinforcement as a component of self-regulation (Febbraro & Clum, 1998).

vi) Self-evaluation:

As a core component of the self-regulatory process, self-evaluation means judging one's own behaviour against personal standards, which is influenced by one's motivation, emotions, and future actions (Bandura, 1991). Self-evaluation is when learners judge their own learning process and results against specific standards, creating feedback to improve future planning and strategies (B. J. Zimmerman, 2002).

4. Need of the Study

Self-regulation is linked with better outcomes in higher education. It is connected to academic persistence, achievement motivation, academic satisfaction, and academic achievement (Darmawan et al., 2023; Kausar & Haroon, 2025; Obenza et al., 2025). So, there is a need to develop a psychometrically sound self-regulation questionnaire because this construct is very much related to academic outcomes. To measure self-regulation, many psychometric scales have been developed in different specific cultural and educational contexts. Psychometric scales require local validation because their effectiveness changes across different cultures and regions. But based on the literature search and review, there was no standardized multidimensional self-regulation scale available for post-graduate students in West Bengal. Hence, the researchers identified a critical need to develop a multidimensional self-regulation scale for post-graduate students in West Bengal.

5. Objectives of the Study

The primary objective of the study is to develop a multidimensional self-regulation scale for post-graduate students in West Bengal. Therefore, some specific objectives are to identify major dimensions of self-regulation and to generate items based on a theoretical framework. To confirm the psychometric properties, the study aimed to examine the internal consistency reliability and to measure construct validity.

6. Research Question

This study addresses possible research questions are as follows:

- Does the self-regulation scale show satisfactory validity?
- Does the scale possess adequate validity?
- Can the developed scale be a multidimensional measure of self-regulation among post-graduate students?

7. Method & Administration of the Scale

The researchers employed a descriptive survey research design to measure self-regulation among post-graduate students in West Bengal. The study followed a systematic scale development process which includes item generation, content validation, pilot testing and psychometric assessment.

Based on the literature review, at first the authors identified six major dimensions (emotional regulation, self-reflection, self-awareness, self-instructions, self-reinforcement and self-evaluation) for item generation. Subsequently, from each dimension, 15 items were developed, resulting in an initial pool of 90 items in the item generation phase. Each dimension contains 10 positive and 5 negatively worded statements. So, in the initial phase, 60 items were worded positively, and the remaining 30 were worded negatively. The scale used only Bengali for the item statements, as most students in West Bengal have a Bengali background. The questionnaire was administered using a five-point Likert response scale to assess participants' levels of agreement with each statement. Positive items were scored from 5 to 1, where 5=strongly agree, 4=agree, 3=undecided, 2=disagree, and 1=strongly disagree. Negatively worded items were coded as the reverse of positive items. Proceeding from this, the questionnaire was reviewed by the subject experts to assess item clarity, content validity and contextual appropriateness. Following expert evaluation and review, ambiguous items were systematically pruned and reworded to refine the preliminary instrument. The researchers adopted a convenience sampling technique for sample selection, and the sample size was $n=185$, selected from only the arts stream of post-graduate students belonging to University of North Bengal, Darjeeling, West Bengal. After an initial expert review, a pilot survey was administered to the selected sample. Then, statistical analysis was done based on respondents' data, and finally 41 items were retained for the final scale.

8. Results

8.1 Scale Statistics & Item Statistics

The 41-item self-regulation scale yielded mean 156.68 of total score, variance=362.121, and $SD=19.029$ (Table 1). The scale demonstrated adequate psychometric properties, and the descriptive statistics indicated satisfactory variability in participants' responses, confirming that the scale possesses good discriminative properties across individuals. Item statistics revealed that each item's mean ranged from 2.89 to 4.42 and SD from 0.711 to 1.327 ($n=185$). But most items had a mean above the midpoint of the scale, suggesting respondents showed positive endorsement towards the items.

Table 1: Scale Statistics

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
156.68	362.121	19.029	41

8.2 KMO and Bartlett's Test for Sampling Adequacy

Sampling adequacy was measured by KMO and Bartlett's test to determine whether the data are suitable or not for factor analysis. The KMO value was 0.825, confirming very good sampling adequacy for factor analysis. Bartlett's Test of Sphericity was highly significant, $\text{Chi-Square}=3081.454$, $df=820$, and $p<.001$, proving that the correlation matrix was fundamentally different from an identity matrix and validating the data for exploratory factor analysis.

Table 2: KMO and Bartlett's Test

<i>KMO and Bartlett's Test</i>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.825
Bartlett's Test of Sphericity	Approx. Chi-Square	3081.454
	df	820
	Sig.	.000

8.3 Exploratory Factor Analysis

Principal component analysis was conducted using a Varimax rotation with Kaiser normalization to examine the latent structure of the scale. The rotation stabilized after 11 iterations and resulted in a six-component solution consisting of 41 items. The factor loadings spanned from 0.370 to 0.761, with the majority of items showing loadings above 0.40. Component D-1 (Emotional Regulation) includes nine items with factor loadings from 0.370 to 0.624. Component D-2 (Self-reflection) contains seven items with factor loadings spanning from 0.401 to 0.653. Component D-3 (Self-awareness) consisted of eight items, which had factor loadings ranging from 0.426 to 0.652. Component D-4 (Self-instruction) comprised six items with factor loadings of 0.487 to 0.761. Component D-5 (Self-reinforcement) consisted of six items with factor loadings ranging from 0.397 to 0.676. Component D-6 included five items with factor loadings ranging from 0.475 to 0.561. It was observed that items 55, 58, 29 and 46 showed the strongest factor loadings of 0.761, 0.751, 0.701 and 0.695, respectively. These items also indicated a strong association with dimension 4. Item no 21 and 56 exhibited relatively low factor loadings of 0.370 and 0.397, which required further evaluation. Overall, the results demonstrate a clear and interpretable multidimensional structure. The extracted communalities range between 0.310 to 0.644, indicating the retained components account for 31% to 64.4% of the variance in individual items. Most of the items had communalities above 0.40, showing that the extracted components well represent most items.

Table 3: Factor Structure of Self-regulation Scale (N=185)

<i>Rotated Component Matrix</i>						
	Component					
	D-1	D-2	D-3	D-4	D-5	D-6
I_1	.624					
I_3	.619					
I_5	.555					
I_7	.546					
I_9	.540					
I_11	.505					
I_17	.495					
I_19	.451					
I_21	.370					
I_20		.653				
I_24		.620				
I_26		.599				

I_68		.562				
I_12		.547				
I_4		.463				
I_6		.401				
I_35			.652			
I_37			.592			
I_39			.577			
I_41			.543			
I_45			.497			
I_49			.482			
I_51			.434			
I_57			.426			
I_55				.761		
I_58				.751		
I_29				.701		
I_46				.695		
I_38				.569		
I_44				.487		
I_63					.676	
I_74					.611	
I_78					.597	
I_80					.416	
I_61					.409	
I_56					.397	
I_53						.561
I_31						.553
I_77						.544
I_81						.519
I_64						.475
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 11 iterations.						

The final scale includes 41 items distributed across six dimensions, featuring 30 positively worded statements and 11 negatively worded statements (Table 4).

Table 4: Scale Overview

Dimensions/Factors	Total item	Item Sl. No.	Example of Items
D-1: Emotional regulation (ER)	Positive (7)	1,7,13,19,25,31,36	7. কষ্ট পলেও আমি কান্নায় ভেঙে পড়িনি।
	Negative (2)	39,41	41. আবগেরে বশে আমি অনেকে কথা বলি।
D-2: Self-reflection (S-REFL)	Positive (5)	14,20,26,32,37	20. কাউকে আঘাত দিলে আমি ক্ষমা চায়ে নছি।
	Negative (2)	2,8	8. অন্যায় করলেও আমি সগুনো সহজেই ভুলে যাই।

8.5 Reliability Analysis and Item-Total Statistics

The reliability analysis revealed excellent internal consistency and reliability of the scale. The analysis yielded a Cronbach's Alpha of 0.912 and standard item Cronbach's Alpha of 0.916, indicating high internal consistency among the items. Analysis of item total statistics indicated satisfactory internal consistency for the 41-item scale. Corrected item total correlations ranged between 0.295 to 0.622, meaning most items exceeded the recommended 0.30 criterion. The results support the high internal consistency and reliability of the tool.

Table 6: Reliability Statistics

<i>Reliability Statistics</i>		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.916	41

8.6 Analysis of Variance

Analysis of Variance showed significant differences among the mean responses to the items, $F(40,7360)=30.876$, $p<0.001$. The between-items sum of squares was 961.194 (mean square=24.030), while the residual mean square was 0.778. This significant F value confirmed that the item means were not identical, suggesting that respondents responded differently across the various items. The Grand Mean was 3.82, indicating relatively high overall responses across the scale.

Table 7: ANOVA

<i>ANOVA</i>						
		Sum of Squares	df	Mean Square	F	Sig.
Between People		1625.126	184	8.832		
Within People	Between Items	961.194	40	24.030	30.876	.000
	Residual	5727.976	7360	.778		
	Total	6689.171	7400	.904		
Total		8314.297	7584	1.096		
Grand Mean = 3.82						

Discussion

The main objective of the study was to develop and standardize a multidimensional scale of self-regulation for post-graduate students. To achieve this objective, the researchers prepared a 90-item questionnaire in the preliminary phase. After expert review and a pilot survey, data analysis was conducted, and 41 items were retained for the final scale. The findings empirically establish both the reliability and construct validity of the scale. Descriptive statistics showed the discriminative properties among the items. KMO and Bartlett's Test proved that the data were adequate for factor analysis. Principal component analysis with varimax rotation revealed the multidimensional structure of the scale. The scale is composed of six dimensions. Inter-dimensional correlation analysis indicated that there was a significant positive correlation across the six dimensions and also a positive correlation between the total scale score with all factors. The reliability analysis demonstrated the internal consistency and reliability of the scale, with Cronbach's Alpha of 0.912 and standard item Cronbach's Alpha of 0.916. A previous study (Šebeňa et al., 2018) also found a

multidimensional nature of self-regulation through confirmatory factor analysis, which supports the findings of the study. Another study (Gajda et al., 2022) confirmed a three-factor structure and psychometric properties of the self-regulation scale by exploratory and confirmatory factor analysis, which is consistent with the present study results. Overall, the findings of the study pointed out that the developed self-regulation scale is valid and reliable for measuring self-regulation for post-graduate students in West Bengal.

Conclusion

To fulfil the objectives, a multidimensional self-regulation scale was developed by the researcher, which has psychometric properties and is culturally appropriate for the targeted population. The study has some limitations like sample was only from the arts stream, only post-graduate students being taken, and the study not examining test-retest reliability. To confirm broader generalizability, the study needs further validation across diverse institutions and geographic regions. The instrument provides significant utility for educational researchers and practitioners, as it will help to identify the students' regulatory strengths and weaknesses, ultimately guiding targeted interventions to improve post-graduate academic performance and well-being.

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