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Adaptation and validation of academic resilience scale in Bengali

Riya Ahmed, Bijoy Krishna Panda, Muktipada Sinha
Department of Education, Faculty of Arts, Jadavpur University, Kolkata, India

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ABSTRACT

The purpose of the current study was to adapt and validate the Academic Resilience Scale (ARS-30) in the context of West Bengal and other Bengali-speaking regions. The research included a total of 628 participants. The data analysis occurred in three stages. Initially, confirmatory factor analysis was employed to assess the factorial validity of the Bengali version of ARS-30 scale, revealing a poor fit for the original three-factor model. Subsequently, further exploratory factor analysis (EFA) suggested a more suitable two-factor structure. In the third stage, this newly derived two-factor structure was validated through confirmatory factor analysis (CFA) with an independent sample. The adapted scale, renamed ARS-19, measures two factors related to academic resilience: negative affect and emotional response (6 items) and positive adaptation (13 items). Results from validity and reliability analyses indicated that the ARS-19 is a valid and reliable tool for assessing academic resilience in the aforementioned context. This study contributes to the literature by proposing a valid and reliable academic resilience measurement for West Bengal as well as other Bengali-speaking regions, facilitating practitioners in assessing academic resilience among higher education students.

Corresponding Author:

Riya Ahmed
Department of Education, Faculty of Arts, Jadavpur University
188, Raja Subodh Chandra Mallick Rd, Jadavpur, Kolkata, West Bengal 700032, India
Email: ahmedriya538@gmail.com

1. INTRODUCTION

Academic resilience is the capability of students to persist through academic challenges and setbacks while sustaining their motivation and dedication to achieving their goals. Academic resilience refers to an increased likelihood of achieving success in an academic context despite facing challenges [1]. Study by Martin [2] defined academic resilience as "a capacity to overcome acute and/or chronic adversity that is seen as a major threat to a student's educational development." Alva [3] described academically invulnerable students as those "who sustain high levels of achievement motivation and performance despite the presence of stressful events and conditions that place them at risk of doing poorly in school and ultimately dropping out of school." Students who have encountered adversity, such as belonging to a lower socioeconomic status, which elevates the risk of academic failure, yet persist in performing well academically, are regarded as demonstrating academic resilience [4]. Hence, academic resilience is often described as producing 'better than expected' academic outcomes [5].

Several scholars have recognized that students face unique challenges in educational settings, and their ability to bounce back from setbacks and succeed academically is a crucial aspect of resilience. Previous studies have shown that various factors are associated with academic resilience. These factors include coping styles and personality traits [6], academic self-efficacy [7], student engagement [8], self-regulated

learning strategies [9], social adjustment, mental health, and educational aspirations [10]. Furthermore, academic resilience has been found to predict academic achievement, measured by grade point average [11]. Therefore, studying academic resilience is crucial as it contributes to students' engagement, well-being, and academic success.

Upon reviewing the existing literature, it became evident that the majority of the academic resilience scales (ARS) were developed and validated in Western nations, including the USA [12]–[14], Spain [15], [16], the UK [1], Canada [17], and Australia [18]. Nevertheless, cultural differences can result in varied understandings or interpretations of the academic resilience construct. In other words, a scale that is valid and reliable in Western culture might not function effectively in a non-Western cultural context, such as South Asian countries. India, as a South Asian nation, significantly differs in terms of cultural values and belief systems from western countries. The majority of the population in West Bengal, an eastern state of India, communicate in Bengali. Due to the lack of a psychometric tool for academic resilience in the Bengal context, the present study aims to address this gap by adapting and validating a widely recognized ARS originally developed in a Western culture for application in a non-Western setting, such as Bengal.

There is no 'gold standard' for measuring the construct of academic resilience at present [19]. However previous studies have identified three distinct approaches for measuring academic resilience: "definition-driven", "process-driven", and "latent construct" approach [4], [20]. The "latent construct" approach employs continuous measures to calculate a resilience score, taking into account characteristics that reflect a student's capacity to bounce back from adversities [4]. Scholars using the latent construct approach measured academic resilience either as a unidimensional or multidimensional latent construct. Among the various unidimensional measures for academic resilience, the most popular one is the ARS, which was developed by Martin and Marsh in 2003 and later revised in 2006. This scale comprises six 'attitudinal items' designed to assess students' responses to different academic challenges, including situations like receiving a low assignment grade. On the other hand, the most widely recognized multidimensional measurement tool is the Academic Resilience Scale-30 (ARS-30), developed by Cassidy [1]. This scale includes 30 items that assess three factors: "perseverance", "reflecting and adaptive help-seeking", and "negative affect and emotional response" [1]. This scale is designed to capture students' responses to a hypothetical challenging situation in an academic context, specifically within the cognitive, affective, and behavioral domains [4]. Other available measures of academic resilience include Academic Risk and Resilience Scale (ARRS) [2]; Academic Resilience Inventory [14]; and College Resilience Questionnaire [12].

The ARS-30 scale has been translated and validated in multiple languages, such as Turkish [21], Persian [22], Spanish [16], Chinese [23], and Thai [24]. These studies have reported satisfactory psychometric properties of the scale. Translation becomes necessary while conducting a survey with individuals who communicate in a language different from the one utilized in the original study [25]. It is crucial to consider both cultural differences and linguistic variations between the original and target populations. Understanding these linguistic and cultural differences is essential in mitigating issues related to responses to translated adapted constructs [25]. Differences in cultural and linguistic aspects can result in diverse interpretations, emphasizing the need for critical examination of construct and instrument comparability across cultures before interpretations are made [26].

As reported by the All India Survey on Higher Education (AISHE) 2020-21, West Bengal had a total of 17,89,733 students pursuing undergraduate and postgraduate courses in regular mode, including 8,50,954 male and 9,38,779 female students [27]. Most of them communicate in Bengali and also study using this language. Upon reviewing the existing literature, the researchers could not find an appropriate measurement tool in the Bengali language for assessing academic resilience among students. However, developing an accurate measurement of academic resilience is crucial to understand how students in Bengal would respond to academic adversities. Furthermore, the current competitive higher education landscape leads students to constantly grapple with academic challenges, setbacks and the pressure to secure employment in a shrinking job market. The pervasive pressure to excel academically has a detrimental impact on students' mental well-being, resulting in cases of burnout, anxiety, and depression. Academic resilience acts as a protective factor, helping students to cope with and bounce back from these challenges, and thus promoting better mental health. Therefore, addressing the academic challenges encountered by the numerous students enrolled in various higher educational institutes in West Bengal is essential.

To comprehend their responses to such adversities, a valid and reliable instrument for measuring academic resilience is necessary. Hence, the present study attempted to adapt and validate ARS-30 [1] for higher education students in Bengal. The ARS-30 scale was originally validated using a sample of British undergraduate students. Due to the cultural differences between the British and Bengal student samples, it is plausible that certain items within the instrument may operate differently, potentially resulting in distinct factorial structures. The discourse of the current study was driven by the research question of whether the ARS-30 could be applied to the Bengali-speaking population or students. To examine the scale's validity, the

researchers employed the validation approach similar to that of Bofah [25] and Islam [28]. Initially, the study translated all the items of the ARS-30 scale into Bengali and subsequently assessed the scale's psychometric properties among higher education students of West Bengal. The current study has the following objectives: i) to examine the structural validity of the ARS-30 scale in the Bengal context; ii) to suggest and statistically examine an alternative factor structure if the hypothesized three-factor model does not fit the data; iii) to validate the newly derived factor structure using an independent sample drawn from the existing data; and iv) to examine the concurrent validity and reliability of the newly adapted scale.

2. METHOD

2.1. Participants

Students from several higher educational institutions in West Bengal were invited to participate in this study. A mixed-mode survey approach [29] was adopted, incorporating both online and paper-and-pencil mode of data collection, to maximize student participation across the state. A list-based sampling frame [29] was used for online surveys. On the other hand, a convenience sampling [30] method was chosen for selecting participants in the paper-and-pencil mode of data collection. Data for the current study were collected between May-July 2023. A total of 654 responses were collected. Cases containing unengaged responses, incomplete data and missing values greater than five percent were excluded from the dataset as shown in Figure 1. Finally, 628 valid responses were considered for data analysis. The questionnaire was structured in a manner that required respondents to answer all questions. Before participating in the survey, students were required to complete a consent form. To ensure voluntary responses, the survey provided the option to withdraw at any point. No personal information, such as names and contact details, was collected to maintain the anonymity of participants' data. Out of 628 participants, 197 were male and 429 were female, ranging from 17 to 32 years (M=20.62 years, SD=1.76 years). Most of them were enrolled in undergraduate-level courses (67.04%). The majority of the students were from the faculty of arts, humanities, and social sciences (89.95%). The demographic details of the participants are provided in Table 1.

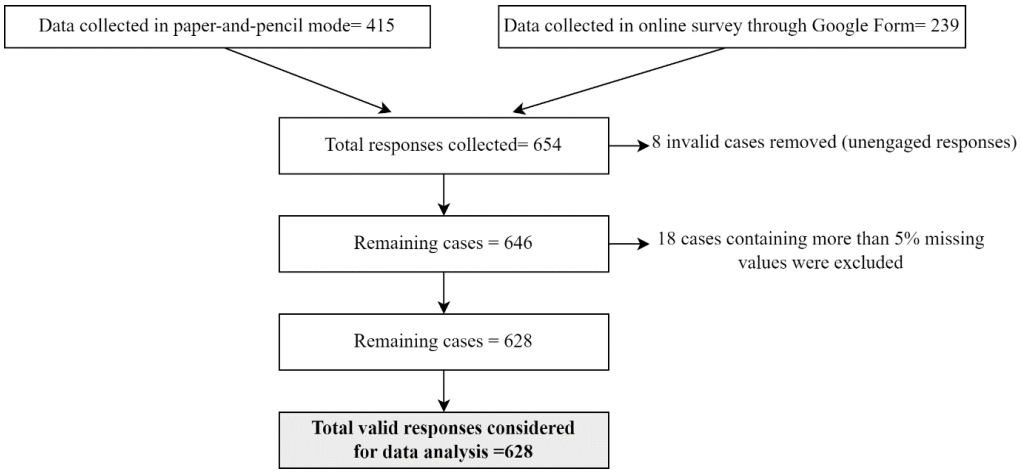

Figure 1. Flowchart describing data cleaning procedure

Table 1. Distribution of sample data based on gender, course level, semester and faculty

Variable	Levels	N	Percentage of total (%)
Gender	Male	197	31.47
	Female	429	68.53
Course level	Undergraduate	421	67.04
	Postgraduate	207	32.96
Semester	1st	2	0.32
	2nd	252	40.19
	3rd	4	0.64
	4th	226	36.04
	5th	18	2.87
	6th	125	19.94
Faculty	Science	63	10.05
	Arts, Humanities and Social Sciences	564	89.95

Note. Due to rounding errors, percentages may not equal 100%

2.2. Procedure

2.2.1. Item translation and content validity

Upon receiving consent from the corresponding author, the researchers proceeded to adapt the scale into a Bengali version using a back-translation method. They translated all 30 items, including the vignette, into Bengali. Following this, two independent bilingual experts, who had no prior knowledge of the original scale items, translated these items back into English. These two bilingual experts possess substantial experience in English translation. One expert, previously an English teacher at a prestigious school for many years, is currently involved in educational research at a public state university. The other expert, who worked as a content specialist in various companies, is currently pursuing Ph.D. in Education. These two back-translated versions were then compared to the original English version of the scale. The majority of the back-translated scale items aligned with the original version and any discrepancies identified in the translations were reviewed and modified to ensure a more precise and appropriate interpretation of the scale items. For instance, the term 'assignment' was modified to 'examination' (Pariksha) because it resonates more with students in West Bengal. Adjustments were made progressively until a consensus was reached on the Bengali translation, resolving all disagreements. The final version of the scale was confirmed by the researchers of this study. Additionally, three academic experts in the fields of psychology and education approved the scale's content validity.

2.2.2. Small tryout

Before administering the scale to all participants, a small group of students (excluded from the final study) completed it to verify the desired understanding of all items. A Likert scale ranging from 1 (very unclear) to 5 (very clear) was used to record the students' responses, assessing their comprehension of the scale item descriptions. All participants demonstrated an understanding of each scale item's meaning, indicating no need for additional modifications.

2.3. Measures

2.3.1. Academic Resilience Scale-30 (ARS-30)

The ARS-30 is a multi-dimensional scale that utilizes a latent construct approach [4] to measure academic resilience. It measures three factors related to academic resilience: "perseverance" (14 items), "reflective and adaptive help-seeking" (9 items), and "negative affect and emotional response" (7 items) [1]. This scale was chosen for its efficacy in capturing students' responses to a hypothetical challenging situation in an academic context, particularly within the cognitive, affective, and behavioral domains [4]. Considering it is validation on 532 British undergraduate students with an average age of 22.4 years [1], the scale deemed fit for application within the target population of this study. The original scale had a coefficient alpha of 0.90, and the alphas for it is three dimensions ranged from 0.78 to 0.83. Furthermore, the concurrent validity of the scale was established by calculating the correlation between ARS-30 and the General Academic Self-Efficacy Scale ($r=0.49$, $p<0.01$) [31]. Cassidy [1] also provided supporting data for the discriminant validity of the scale.

The present study utilized the Bengali (adapted) version of ARS-30. After reading a brief vignette portraying academic challenges, participants were asked to respond to the 30 scale items along a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). The vignette depicted a challenging academic scenario, where participants were required to envision themselves in that situation. The scale encompasses both positive and negative items, with positively worded items being reverse-scored; hence, a higher ARS-30 score indicates higher academic resilience. Calculation of the total academic resilience score involved summing the scores of the 30 items, resulting in a theoretical range of 30 to 150.

2.3.2. Academic resilience scale (ARS)

The ARS, developed by Bala [10], was employed to assess the concurrent validity of the Bengali-adapted version of the ARS-30 scale [1]. The original scale was in English and standardized on international students enrolled in various higher educational institutes across India. The scale consists of both negative and positive items, there are 9 negative and 35 positive items. Respondents need to choose one option among five (strongly agree, agree, undecided, disagree, and strongly disagree). Positively phrased items are scored as 5, 4, 3, 2, and 1, while negatively phrased items are reverse-scored [10]. The total academic resilience score is calculated by summing the scores of all 44 items, leading to a theoretical range of 44 to 220. The reliability of the ARS [10] yielded a high reliability coefficient of 0.92. The researchers translated the 44-item scale into Bengali language and the Cronbach's alpha of the translated version was 0.880. A student information schedule was prepared to collect specific details from students, including their gender, age, faculty affiliation, current course of study, and the semester.

2.4. Data collection procedures

The study employed both online and traditional paper-and-pencil mode of data collection. Online data collection via Google Forms began with a statement of purpose and a section for participants' consent. Form settings were adjusted, such as enabling 'limited to one response' to prevent multiple submissions from the same email address. The researchers contacted college and university teachers via email, explaining the study's purpose and seeking their assistance in sharing the Google Forms with their students. For the conventional paper-and-pencil mode of data collection, printed copies of the questionnaires comprising the student information schedule, ARS-30 scale [1], and ARS [10] were prepared. Institutional heads were approached to obtain student data in this format. After obtaining the necessary permissions from the higher authorities, the data collection process commenced. Clear instructions on questionnaire completion were provided to the students. Subsequently, questionnaire booklets, along with participant consent forms, were distributed among the students. Although no specific time limit was imposed, approximately 95% of participants completed the questionnaire within around 20 minutes.

2.5. Analytic strategies

Using FACTOR [32] the entire sample (N=628) was randomly split into two equivalent subsamples (each N=314) with the help of Solomon method for cross-validation purposes. The first subsample (N=314) was designated as the "calibration sample", while the second subsample (N=314) as the "validation sample" [25]. The splitting of the sample was done to assess the replicability of a model developed on one sample when applied to an independent sample drawn from the same population [25].

The data analysis comprised three stages. Firstly, confirmatory factor analysis was performed on the entire sample (N=628) to assess the fit of the original three-factor model with the sample of higher education students in Bengal. Secondly, as the original three-factor model showed a poor fit with the data, exploratory factor analysis was conducted to understand the reasons behind the model misfit and establish an alternative factor structure. Insights obtained from exploratory factor analyses were utilized to suggest a final factor structure based on the "calibration sample" [25]. Thirdly, again a confirmatory factor analysis was performed to examine whether the newly derived factor structure demonstrated a suitable fit with the independent "validation sample" [25]. Finally, to assess the concurrent validity of the adapted scale, the bivariate correlation between the scores of the adapted version and the ARS [10] was computed. The open-source software JASP 0.17.2.1 [33] was used for confirmatory factor analysis (CFA), while the program FACTOR [32] was utilized for exploratory factor analysis (EFA).

3. RESULTS

3.1. Stage 0: computing Cronbach's alpha for three factors of the scale (N=628)

Cassidy proposed that the academic resilience construct could be explained by three factors: "perseverance", "reflecting and adaptive help-seeking", and "negative affect and emotional response" [1]. The initial confirmatory step involved calculating Cronbach's alpha (indicators of factor reliability) for each factor. The alpha coefficients calculated for the Bengal sample met the acceptable standard [34] for "reflective and adaptive help-seeking" (0.737) as well as for "negative affect and emotional response" (0.781). For factor 1 i.e. "perseverance", the alpha coefficient (0.691) was below the acceptable threshold. The comparison of Cronbach's alpha between the original British sample and the Bengal sample revealed that the majority of factor reliabilities were considerably lower than those observed in the original British sample, as depicted in Table 2. As Cronbach's alpha fails to indicate the unidimensionality of the constructs together, it is advisable to employ a more robust approach, i.e., CFA in stage one followed by EFA in stage two, to assess the existing hypothesized model, as conducted in stage one [25].

Table 2. Comparison of Cronbach's alpha between the original British sample and the Bengal sample

Factors	Cronbach's α	
	British sample (N=532)	Bengal Sample (N=628)
1. Perseverance	0.83	0.691
2. Reflecting and adaptive help-seeking	0.78	0.737
3. Negative affect and emotional response	0.80	0.781

Note: The data for the British sample was adapted from-Cassidy [1]

3.2. Stage 1: confirmatory factor analysis (N=628)

In stage one, confirmatory factor analysis was performed on the entire sample (N=628) to test the hypothesized three-factor model. The researchers adhered to the commonly advised guideline for calculating the sample size in CFA, which suggests a participants-to-parameters ratio ranging from a minimum of 5:1 to

a maximum of 10:1 [35]. The sample size (N=628) for CFA surpassed the maximum requirement of 300, given that the scale comprises 30 items. Since the items were scored on an ordinal scale, the diagonally weighted least squares (DWLS) estimation method was chosen for the CFA [36]. The Kaiser-Mayer-Olkin (KMO) index was 0.902, exceeding the suggested threshold of 0.60 [35], [37]. Additionally, Bartlett's Test of Sphericity demonstrated statistical significance {χ^2 (435, N=628)=6909.361, p<0.001}, affirming the suitability of the data for factor analysis [35], [37]. To evaluate the model fit, the researchers have reported three widely utilized fit indices: i) comparative fit index (CFI); ii) Tucker-Lewis index (TLI); and iii) root mean square error of approximation (RMSEA). RMSEA values below 0.08 indicate an adequate model fit, while values less than 0.05 indicate a good model fit [38]. When the CFI and TLI values fall below 0.90, it is advised for researchers to seriously consider rejecting the solution. CFI and TLI values ranging between 0.90 and 0.95, could potentially indicate an acceptable model fit [38], [39].

The results of the CFA indicated that the fit indices for the hypothesized three-factor model fell below the acceptable threshold {χ^2 (402, N=628)=1675.668, p<.001, CFI=0.887, TLI=0.878, and RMSEA=0.071}. Consequently, this model was rejected. The researchers examined the parameter estimates for all 30 items and found that the parameter estimate for the ARS_29 item yielded a non-significant p-value (p=0.105). Subsequently, the model fit was re-evaluated upon removal of the ARS_29 item with the non-significant parameter estimate. However, despite this adjustment, the model fit only displayed marginal improvement {χ^2 (374, N=628)=1579.967, p<.001, CFI=0.893, TLI=0.883, RMSEA=0.072}. As the fit indices fell below the acceptable range, indicating a poor model fit, the hypothesized three-factor model was rejected. Consequently, the analysis shifted to an exploratory approach, which was conducted in stage 2.

3.3. Stage 2: exploratory factor analysis (N=314 1st subsample)

Table 3 presents the univariate descriptive statistics for the 30 items of the ARS scale, indicating that a majority of these items exhibited skewness with high kurtosis. When the univariate distributions of ordinal items show asymmetry or excessive kurtosis, it is recommended to use polychoric correlation instead of Pearson's correlations [40]. In the current study, the scoring of ARS-30 items was done using ordinal scales, and due to the asymmetric univariate distributions of these items, the researchers opted to perform exploratory factor analysis on polychoric correlations [28], [41]–[43].

Mardia's test for multivariate normality was conducted and it was found that the p-values for both skewness and kurtosis were below 0.05 as shown in Table 4. However, according to the criteria for confirming multivariate normality [44], both skewness and kurtosis statistics' p-values should be greater than 0.05. The results showed that the assumption of multivariate normality was violated for the current dataset. When the assumption of multivariate normality faces significant violations and/or when dealing with ordinal data, the DWLS method yields more precise parameter estimates [36]. Hence, for examining the internal structure of ARS-30, robust diagonally weighted least squares (RDWLS) was used as the data do not adhere to the assumption of multivariate normality [36]; along with the robust promin rotation method [45]. The choice of employing this oblique rotation method was made because the factors of ARS-30 were correlated as explained by the original scale's author [1], [46].

The researchers verified all necessary assumptions before conducting EFA. Initially, they assessed sample size adequacy. The commonly accepted standard for adequate sample size in EFA is the ratio of subjects to variables, typically set at 4:1 or 5:1 [37]. In this study, there were approximately ten times more participants than items (314 participants compared to 30 items), which was considered 'good' [47]. Monte Carlo's parallel analysis [48] and Schwarz's Bayesian Information Criterion (BIC) Dimensionality test were performed in the FACTOR program, alongside the initial analysis of Eigenvalues above 1, to identify the best factor structure for ARS-30. To retain items within each factor, researchers adhered to four recommended best practices outlined by psychometricians: i) ensuring no factors had fewer than three items; ii) excluding items that exhibited cross-loadings greater than 0.3 across factors; iii) no items with communality values less than 0.3; and iv) eliminating items with factor loadings below 0.4 [35], [49]–[51].

The KMO index was 0.85, exceeding the suggested threshold of 0.60 [35], [37]. Additionally, Bartlett's Test of Sphericity demonstrated statistical significance {χ^2 (435, N=314)=3478.8, p<0.001}, affirming the suitability of the data for factor analysis [35], [37]. The findings of the preliminary analysis indicated three factors with Eigenvalues greater than 1, explaining 28.57%, 10.1%, and 4.75% of the variance, respectively. The BIC dimensionality test suggested a solution involving two factors. Furthermore, a parallel analysis conducted with 30 items, 314 participants with 500 replications recommended a two-factor solution for the ARS scale [48]. The researchers examined both the three-factor solution (as hypothesized by Cassidy) and the two-factor solution recommended by the parallel analysis and BIC dimensionality test. Initially, the EFA with three-factor structure displayed a poor model fit, where eight items (number 1, 5, 8, 9, 10, 17, 23, 29) demonstrated low communality (<0.3). Among these, three items (5, 17, 29) displayed no loadings, five items (1, 3, 8, 10, 23) demonstrated poor factor loading (<0.4), and two items (8, 11) displayed

cross-loadings across multiple factors. Hence, these nine items (1, 3, 5, 8, 10, 11, 17, 23, 29) were considered problematic to the factor structure of the ARS-30 scale. For the above-mentioned reasons, nine items (1, 3, 5, 8, 10, 11, 17, 23, 29) were removed from further analysis. Within factor three, only one item (number 9) was loaded. As factors with fewer than three items are not considered valid, the researchers decided to discard item 9 as well as factor 3 from further analysis.

Table 3. Univariate descriptive statistics of the 30-item ARS (N=314 1st subsample)

Item	Mean	95% Confidence interval	Variance	Skewness	Kurtosis (Zero centered)
ARS_1	3.43	(3.24-3.62)	1.69	-0.50	-0.98
ARS_2	4.29	(4.18-4.40)	0.58	-1.47	3.46
ARS_3	4.10	(3.95-4.24)	1.01	-1.27	1.32
ARS_4	4.26	(4.14-4.37)	0.64	-1.65	4.20
ARS_5	2.90	(2.72-3.08)	1.52	0.15	-1.02
ARS_6	3.44	(3.27-3.61)	1.38	-0.39	-0.76
ARS_7	3.49	(3.32-3.66)	1.41	-0.50	-0.75
ARS_8	4.03	(3.90-4.17)	0.89	-1.46	2.43
ARS_9	3.69	(3.52-3.84)	1.22	-0.87	0.12
ARS_10	3.57	(3.42-3.73)	1.16	-0.77	-0.10
ARS_11	4.31	(4.20-4.42)	0.62	-1.36	2.40
ARS_12	3.07	(2.91-3.22)	1.14	0.06	-0.73
ARS_13	4.18	(4.07-4.29)	0.61	-1.37	3.14
ARS_14	3.18	(3.01-3.34)	1.23	-0.10	-0.93
ARS_15	4.24	(4.11-4.38)	0.86	-1.37	1.65
ARS_16	4.29	(4.19-4.39)	0.51	-1.45	4.25
ARS_17	3.69	(3.53-3.85)	1.27	-0.78	-0.15
ARS_18	4.21	(4.10-4.32)	0.54	-0.93	1.40
ARS_19	3.23	(3.06-3.39)	1.29	-0.30	-0.82
ARS_20	4.16	(4.06-4.27)	0.55	-1.07	1.96
ARS_21	4.23	(4.12-4.34)	0.59	-1.18	2.13
ARS_22	4.26	(4.16-4.36)	0.47	-0.99	2.18
ARS_23	3.80	(3.65-3.95)	1.08	-0.98	0.50
ARS_24	4.18	(4.07-4.29)	0.60	-1.19	2.21
ARS_25	4.11	(4.00-4.21)	0.52	-0.94	2.14
ARS_26	4.23	(4.11-4.34)	0.63	-1.20	2.13
ARS_27	4.12	(4.00-4.23)	0.66	-1.28	2.47
ARS_28	3.16	(2.98-3.34)	1.53	-0.08	-1.09
ARS_29	3.24	(3.06-3.41)	1.45	-0.41	-0.77
ARS_30	4.20	(4.08-4.32)	0.68	-1.48	3.09

Table 4. Mardia's test of multivariate normality

	Value	Statistic	df	p
Skewness	226.974	11878.292	4960	< .001
Small sample Skewness	226.974	11999.151	4960	< .001
Kurtosis	1231.185	54.834		< .001

Note: The statistic for skewness is assumed to be χ^2 distributed and the statistic for kurtosis standard normal

After removing these ten items (1, 3, 5, 8, 9, 10, 11, 17, 23, 29), the researchers proceeded to conduct the EFA using the remaining 20 items while maintaining the two-factor solution. This model also demonstrated poor fit, as one item (number 15) exhibited low communality (<0.3). After removing the item ARS_15, the researchers conducted a further EFA while maintaining the two-factor structure. This led to the identification of a parsimonious model with 19 items. The resulting model provided a precise two-factor solution that adhered to all item-retention criteria. Among the 19 items, six items (number 6, 7, 12, 14, 19, 28) loaded on the first factor, while 13 items (number 2, 4, 13, 16, 18, 20, 21, 22, 24, 25, 26, 27, 30) loaded on the second factor as shown in Table 5. 49.683% of the variance was jointly explained by these two factors.

The researchers renamed the adapted version of the scale as ARS-19. Factor 1 encompasses 6 items (items 6, 7, 12, 14, 19, 28), whereas factor 2 consists of 13 items (items 2, 4, 13, 16, 18, 20, 21, 22, 24, 25, 26, 27, 30). As factor 1 included 6 items from the negative affect and emotional response dimension of the original scale, the researchers decided to retain the same name for factor 1 in the present context. However, factor 2 contained 5 items (2, 4, 13, 16, 30) from the Perseverance dimension and 8 items (18, 20, 21, 22, 24, 25, 26, 27) from the reflecting and adaptive help-seeking dimension of the original scale. Therefore, the researchers decided to rename factor 2 as 'Positive adaptation,' which encompasses both the properties of the perseverance and reflecting and adaptive help-seeking dimensions of the original scale. The correlation between the two factors was 0.44. The internal consistency reliability of the 19-item ARS and its factors are shown in Table 6. In this study, positive adaptation refers to the ability of students to effectively respond to

academic challenges and setbacks in a constructive manner, which enables them to persist despite adversity, reflect upon their strengths and weaknesses, and seek guidance from individuals possessing greater expertise. On the other hand, negative affect and emotional response encompasses the negative emotions experienced by students during challenging academic situations, such as anxiety, stress, depression, and feelings of hopelessness [1].

Table 5. Factor loadings from EFA in stage 2 and CFA in stage 3

Item wordings	Stage 2 (N=314 1st subsample) Factor loadings (EFA)			Stage 3 (N=314 2nd subsample) Factor loadings (CFA)	
	Items	Factor1	Factor2	Factor1	Factor2
1. I would probably get annoyed.	ARS_6	0.471*	0.149	0.614	
2. I would begin to think my chances of success at university were poor.	ARS_7	0.73*	-0.013	0.703	
3. I would probably get depressed.	ARS_12	0.553*	0.036	0.653	
4. I would be very disappointed.	ARS_14	0.785*	-0.031	0.756	
5. I would begin to think my chances of getting the job I want were poor.	ARS_19	0.647*	0.041	0.65	
6. I would feel like everything was ruined and was going wrong.	ARS_28	0.777*	-0.016	0.646	
7. I would use the feedback to improve my work.	ARS_2	0.082	0.438*		0.522
8. I would use the situation to motivate myself.	ARS_4	0.037	0.502*		0.53
9. I would try to think of new solutions.	ARS_13	-0.036	0.562*		0.496
10. I would keep trying.	ARS_16	0.051	0.687*		0.691
11. I would use my past successes to help motivate myself.	ARS_18	0.095	0.709*		0.761
12. I would start to monitor and evaluate my achievements and effort.	ARS_20	0.012	0.754*		0.748
13. I would seek help from my tutors.	ARS_21	-0.064	0.697*		0.628
14. I would give myself encouragement.	ARS_22	0.157	0.58*		0.699
15. I would try different ways to study.	ARS_24	0.001	0.741*		0.708
16. I would set my own goals for achievement.	ARS_25	0.145	0.682*		0.677
17. I would seek encouragement from my family and friends.	ARS_26	-0.248	0.669*		0.401
18. I would try to think more about my strengths and weaknesses to help me work better.	ARS_27	-0.067	0.626*		0.559
19. I would look forward to showing that I can improve my grades.	ARS_30	-0.063	0.763*		0.653

Note*:* The factor extraction method for EFA was robust diagonally weighted least squares (RDWLS) with the Robust Promin rotation. Factor loadings above 0.4 are in asterisk (*). Item wordings were adapted from Cassidy [1].

Table 6. Internal consistency reliability of the 19-item ARS and its factors

ARS	McDonald's omega
19-items ARS	0.833
Factor 1: Negative affect and emotional response	0.777
Factor 2: Positive adaptation	0.852

3.4. Stage 3: confirmatory factor analysis (N=314 2nd subsample)

In order to confirm the factor structure of ARS-19, derived from the EFA in stage 2, the researchers conducted CFA on the validation sample (N=314, 2nd subsample). The researchers adhered to the commonly advised guideline for calculating the sample size in CFA, which suggests a participants-to-parameters ratio ranging from a minimum of 5:1 to a maximum of 10:1 [35]. The sample size (N=314) for CFA surpassed the maximum requirement of 190, given that the scale comprises 19 items. As the items were scored on an ordinal scale, the goodness of fit for the two-factor solution of the ARS-19 was cross-checked by performing a CFA using the DWLS estimation method [36]. The Kaiser-Mayer-Olkin (KMO) index was 0.871, exceeding the suggested threshold of 0.60 [35], [37]. Additionally, Bartlett's Test of Sphericity demonstrated statistical significance $\{\chi^2(171, N=314)=2483.726, p<0.001\}$, affirming the suitability of the data for factor analysis [35], [37]. To evaluate the model fit, several widely utilized fit indices were reported: i) the Chi-square to degrees of freedom ratio (χ^2/df), with a value of no more than 3 indicating a good fit [37]; ii) CFI; iii) TLI; iv) the GFI; v) RMSEA); and vi) SRMR. GFI values exceeding 0.90 were commonly regarded as indicative of a good fit; however, some argue that a threshold of 0.95 should be considered [37]. CFI and TLI values ranging between 0.90 and 0.95 could potentially indicate an acceptable model fit [38], [39]. Additionally, RMSEA values below 0.08 [38] and SRMR values of 0.08 or less [37] indicate an adequate model fit. In the present study, the fit indices were: χ^2/df=406.786/151=2.69, CFI=0.932, TLI=0.923, GFI=0.979, RMSEA=0.074, and SRMR=0.073. Hence, the model fit indices were found to be within the acceptable range. These results indicate that the two-factor model of the Bengali version of the ARS-19 is adequate. The model plot is shown in Figure 2.

3.5. Reliability of ARS-19 scale

Internal consistency indicates the extent to which responses provided by people on items that assess the same trait are consistent [30]. It is the most widely used estimate of reliability, indicating the extent to which the items within ARS-19 were inter-correlated [52]. The researchers reported McDonald's omega as an indicator of internal consistency, which is equivalent of Cronbach's alpha for ordinal data [53]. The omega values exhibit adequate internal consistency for both the ARS-19 scale and its two factors, as shown in Table 7.

Table 7. McDonald's omega for ARS-19 and it is factors

ARS	McDonald's omega
ARS-19	0.82
Factor 1 (Negative affect and emotional response)	0.80
Factor 2 (Positive adaptation)	0.83

3.6. Validity of ARS-19 scale

The ARS-19 scale was assessed for its internal as well as external validity [54]. The internal validity of ARS-19 was explored using its content validity and the scale's structural validity [54]. Three academic experts in the fields of psychology and education approved the scale's content validity. The scale's structural validity was established by exploratory and confirmatory factor analyses (stage 1-3). The researchers examined the concurrent validity as the external evidence of validity of the scale [54]. Concurrent validity of ARS-19 was obtained by calculating bivariate correlation (Spearman correlation) between scores of the ARS-19 scale and the ARS developed by Bala [10]. It was found that scores of the two scales were positively correlated $\rho=0.655$, $p<0.001$, indicating a satisfactory concurrent validity. Scores on both factors of ARS-19 scale demonstrated positive correlations with ARS [10] scores ($\rho=0.445$ for factor 1 and $\rho=0.575$ for factor 2, in both cases $p<0.001$).

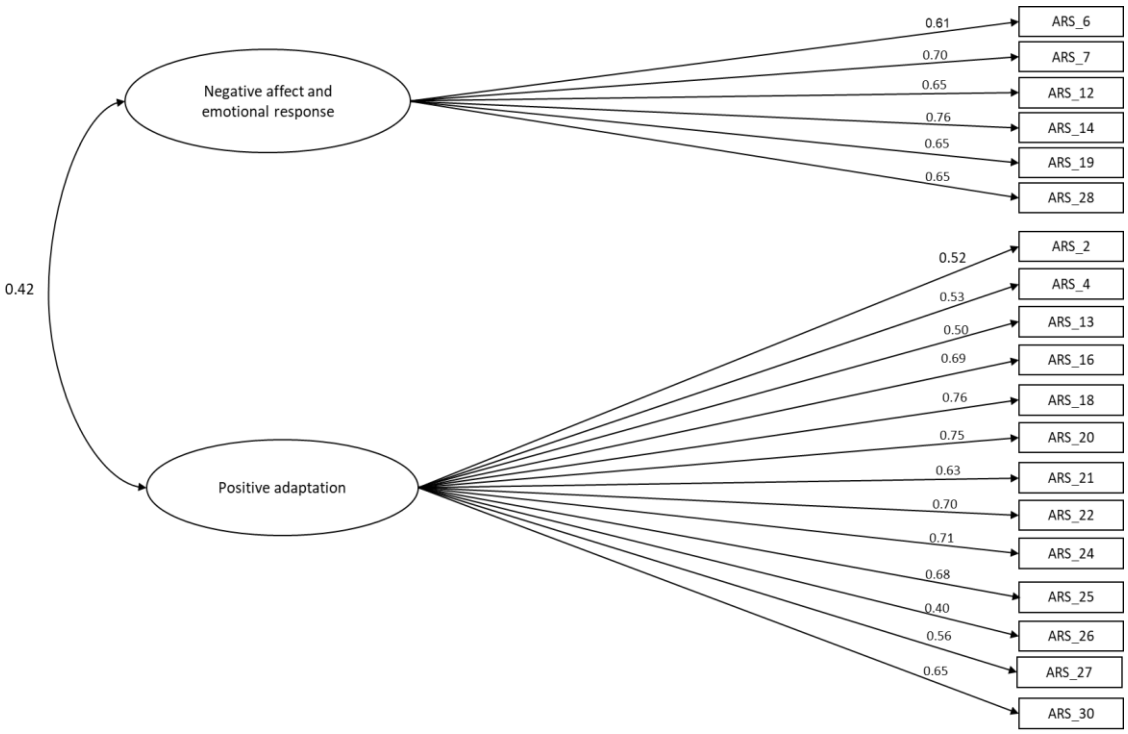

Figure 2. Factor structure of the Bengali version of ARS-19 (Standardized parameter) (N=314)

4. DISCUSSION

The purpose of the present study was to adapt and validate the ARS-30 scale specifically within the context of West Bengal, focusing on a population that shares similarities in language and culture. A total of 628 higher education students in West Bengal participated in this study. Data was analyzed in three stages. Firstly, confirmatory factor analysis was performed to test the factorial validity of the Bengali version of the

ARS-30 scale [1]. However, the original three-factor model showed a poor fit with the data. In the second stage, further EFA indicated that a two-factor structure best explains the current dataset. In the third stage, this newly derived two-factor structure was validated through CFA with an independent sample from the existing data. The adapted version of the scale was renamed ARS-19. The results obtained from validity and reliability analyses indicated that the ARS-19 is a valid and reliable measure for assessing academic resilience in the Bengal context. The response format and scoring procedure for ARS-19 is similar to the ARS-30 scale, with the only difference being that the theoretical range of academic resilience scores in ARS-19 is 19 to 95 instead of 30 to 150 in the original scale. A high ARS-19 score indicates greater academic resilience in a student. The Bengali (adapted) version of ARS-19 is available in the supplementary material.

The ARS-30 scale measures academic resilience as a multidimensional latent construct [4]. This context-specific measure captures students' responses to a hypothetical challenging situation in an academic context, specifically within the cognitive, affective, and behavioral domains [4]. ARS-30 scale has been translated and validated in different languages including Turkish [21], Persian [22], Spanish [16], Chinese [23], and Thai [24]. The target population of previous validation studies includes high school students [22]–[24], university students [16], [21], [55], and pharmacy students [13]. Previous validation studies have reported satisfactory psychometric properties of the scale in Iran [22], Spain [16], and Turkey [21] which confirmed the factor structure of the original scale, whereas the studies conducted in China [23], USA [13], Ecuador [55], and Thailand [24] reported modified version of the original scale where some of the items were deleted as shown in Table 8. In the present study, the Bengali version of the scale (ARS-19) also represents a modified version of the original scale which consists of 19 items and two factors.

Table 8. Summary of previous validation studies of ARS-30

Study	Sample	Location	Factor analysis technique	Findings
[22]	409 high school students	Iran	Principal components (Promax oblique rotation)	The factor structure of the original scale was confirmed (30 items, three-factor model)
[16]	2967 university students (aged 18–33)	Spain	EFA and CFA	The factor structure of the original scale was confirmed (30 items, three-factor model)
[21]	687 university students (mean age=21.68, SD=2.96)	Turkey	CFA	The factor structure of the original scale was confirmed (30 items, three-factor model)
[23]	569 high school students	China	CFA	The adapted version of the scale consists of 20 items with four factors (perseverance, adaptive help-seeking, self-reflection and adaption and negative affect and emotional response)
[13]	544 pharmacy students	USA	EFA	The adapted version of the scale consists of 16 items with four factors (negative affect and emotional response, reflecting and adaptive help-seeking, adaptive thought processes and perseverance). This version was renamed as Academic Pharmacy Resilience Scale (APRS-16).
[55]	788 university students	Ecuador	CFA (maximum likelihood estimation)	The adapted version consists of 24 items with a three-factor structure (perseverance, reflection and adaptive help-seeking and negative affect and emotional response)
[24]	216 junior high school students	Thailand	EFA (Principal axis factoring and oblique Promax rotation)	The adapted version consists of 16 items with a three-factor structure (emotional response, perseverance, reflecting and adaptive help-seeking).

*Note: EFA=exploratory factor analysis, CFA=confirmatory factor analysis

The factor structure of ARS-19 was different from the original version [1]. The original version had 30 items with three factors: perseverance (14 items), reflective and adaptive help-seeking (9 items), and negative affect and emotional response (7 items) [1]. However, ARS-19 had 19 items with two factors: negative affect and emotional response (6 items) and positive adaptation (13 items). The first factor includes 6 items from the negative affect and emotional response dimension of the original scale; hence it was decided to retain the same name. However, 5 items from the perseverance dimension and 8 items from the reflecting and adaptive help-seeking dimension of the original scale loaded onto the same factor, which was renamed as positive adaptation. The results of the EFA (stage 2) suggested the exclusion of eleven items from the original scale to achieve a parsimonious two-factor solution. Additional reasons for exclusion are described in Table 9. In this study, the researchers concluded that, in the given context, positive adaptation captured students' ability to respond effectively to academic adversities in a constructive manner, persist despite challenging situations, reflect upon their strengths and weaknesses, and seek guidance from individuals with greater expertise. Negative affect and emotional response encompasses the negative emotions experienced by students during challenging academic situations, such as anxiety, stress, depression, and feelings of hopelessness [1].

Table 9. Reasons for item deletion from the original ARS-30 developed by Cassidy [1]

Original items	Reasons
Item 1: I would not accept the tutors' feedback.	The results of EFA in stage 2 revealed that this item had poor factor loading (<0.4), and low communality (<0.3). This sentence does not capture the essence of perseverance. Furthermore, the incorporation of this specific item in the original scale raised some doubts due to its poor loading on the "perseverance "factor (0.146).
Item 3: I would just give up.	The results of EFA in stage 2 revealed that this item had poor factor loading (<0.4).
Item 5: I would change my career plans.	The results of EFA in stage 2 revealed that this item had low communality (<0.3) and did not load onto either of the two factors. The change in career plans may not solely be attributed to the failure in examinations but could be influenced by external factors, such as teachers or parents. In particular, in India, the career choices of youths are influenced by various factors, including expectations and guidance from parents, the availability of resources, the quality of education, access to diverse fields of study, socioeconomic status, the need for financial security, and government policy requirements for career opportunities.
Item 8: I would see the situation as a challenge.	The results of EFA in stage 2 revealed that this item showed low communality (<0.3), poor factor loading (<0.4) and cross-loading.
Item 9: I would do my best to stop thinking negative thoughts.	The results of EFA in stage 2 revealed that this item showed low communality (<0.3) and in factor three only this item loaded. As factors with fewer than three items are not considered valid, it was decided to discard item 9 as well as factor 3. Attempting to stop negative thinking is more closely associated with optimism rather than persistence in learning. Optimistic students may exhibit a lack of concern regarding such failures. Furthermore, the incorporation of this specific item in the original scale raised some doubts due to its poor loading on the "perseverance" factor (0.290).
Item 10: I would see the situation as temporary.	The results of EFA in stage 2 revealed that this item had low communality (<0.3) and poor factor loading (<0.4).
Item 11: I would work harder.	The results of EFA in stage 2 revealed that this item cross-loaded across multiple factors. Furthermore, there were three different expressions of this theme in the original scale: "*I would work harder*," "*I would keep trying*," and "*I would just give up*." The item "*I would just give up*" was deleted because EFA results indicated that it had poor factor loading (<0.4). The item "*I would keep trying*" was incorporated into the final version of the ARS-19. This specific item (number 11) was removed to avoid unnecessary repetition.
Item 17: I would not change my long-term goals and ambitions.	The results of EFA in stage 2 revealed that this item displayed low communality (<0.3) and failed to load on any of the two factors.
Item 23: I would stop myself from panicking.	The results of EFA in stage 2 revealed that this item displayed low communality (<0.3) and poor factor loading (<0.4).
Item 29: I would start to self-impose rewards and punishments depending on my performance.	The results of EFA showed that this item had low communality (<0.3) and failed to load on any of the two factors. Additionally, this item lacks a clear description of the circumstances under which one might reward or punish oneself. Rewarding poor academic performance is not advisable. Hence, this item was omitted due to concerns regarding compound concepts like rewards and punishments. Furthermore, the incorporation of this specific item in the original scale raised some doubts due to its low factor loading (0.323 on the "Reflecting and adaptive help-seeking "factor).
Item 15: I would blame the tutor.	The EFA results in stage 2 revealed that this item had low communality (<0.3). This sentence does not capture the essence of perseverance. Furthermore, the incorporation of this specific item in the original scale raised some doubts due to its low factor loading (0.260 on the "Perseverance" factor).

Students are facing unprecedented challenges in today's world, driven by globalization and technological advancements. Moreover, the COVID-19 pandemic has induced uncertainty in the education system worldwide. The UNESCO International Commission on the Futures of Education emphasizes the urgency of reevaluating the purposes of education in response to these current challenges. The new role of education should focus on incorporating "pedagogies of preparedness and frustration tolerance "to address unprecedented challenges and adversities [56]. Given the unpredictable nature of future disruptions, relying solely on fixed learning models and rigid outcomes is inadequate. Instead, learners should be equipped to handle uncertainty, confront adversity, and demonstrate resilience amidst disruptions [56]. Resilience and empowerment are identified as crucial elements of future education, enabling learners to become critical thinkers and resilient citizens [56]. Education should prepare students for an uncertain future, where they will encounter jobs, technologies, and problems that have yet to emerge. To navigate such uncertainty, students must cultivate curiosity, imagination, resilience, and self-regulation [57]. They should also learn to deal with failure and rejection, to progress forward [57]. The Organization for Economic Co-operation and Development (OECD) has initiated The Future of Education and Skills 2030 project to address these challenges. The OECD Education 2030 project has identified "Transformative Competencies" and stakeholders are working to translate these competencies into actionable constructs, where resilience is highlighted as one of the essential constructs [57].

In a world where change is the only constant, students must be equipped to confront challenges and adversities across all aspects of life, including academics and skills development. Therefore, both openness and academic resilience are equally important to navigate the forthcoming challenges in education and are required for 21st-century living. Assessing whether resilience is being nurtured in students is imperative to identify deficits and provide necessary interventions for them. Therefore, a psychometric tool assessing

students' academic resilience is crucial to understand how they are responding to academic challenges encountered during their educational journeys.

This study makes a meaningful contribution to the existing body of knowledge by adapting and validating a well-established multidimensional measurement tool of academic resilience, the ARS-30, specifically for higher education students in West Bengal. Academic resilience stands as a valuable trait necessary for students to navigate the challenges and adversities throughout their educational journeys. Upon reviewing the available literature, the researchers could not navigate to any measurement tool in the Bengali language as well as in the context of India for assessing academic resilience. Accurately assessing students' academic resilience is crucial, as it assists education stakeholders in nurturing essential qualities among students, enabling them to rebound from academic challenges. Moreover, it facilitates the development of intervention programs aimed at fostering academic resilience among students. Adapting and validating widely used instruments for academic resilience among higher education students in Bengal can offer valuable insights into detecting students' responses to academic setbacks with greater precision. The Bengali version of the ARS-19 scale can effectively evaluate the academic resilience of students who communicate in Bengali as well as study through this language.

5. CONCLUSION

This study contributes to the existing literature by adapting and validating a widely recognized measurement tool for assessing academic resilience in the context of Bengal. The study's results provide convincing evidence for reliability and validity of the ARS-19 scale among higher education students of West Bengal. This study has several limitations. Only students from West Bengal were recruited as participants, which might not be sufficiently representative of students who speak the Bengali language. A substantial number of participants from other Bengali-speaking regions e.g. Bangladesh would have contributed more to the adaptation of this scale in this language. This study only utilized self-reported measure to assess academic resilience, which is susceptible to social desirability bias. Future studies may incorporate the social desirability measure in order to control its potential effect on the responses. Factorial invariance can be established for male and female students in future research. Further research can explore how academic resilience is associated with students' psychological well-being and academic outcomes (e.g. GPA scores); and how academic resilience can be fostered through intervention programs. In this scale, only a hypothetical adverse situation is provided to assess the level of academic resilience in students. However, in reality, students may respond differently when confronted with actual academic challenges in real-time. Capturing their real-life experiences of recovery or bouncing back to their original functioning when they encounter such academic setbacks is crucial. Future studies can compare pre-adversity and post-adversity functioning to determine recovery from real academic adversities. To achieve this, phenomenological studies can be conducted to capture students' overall experiences more comprehensively.

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BIOGRAPHIES OF AUTHORS

Riya Ahmed is a research scholar affiliated with the Department of Education at Jadavpur University in Kolkata, India. She holds a Bachelor of Education degree from Baba Saheb Ambedkar Education University and a Master of Arts in Education from Jadavpur University. Her research interests encompass academic resilience, psychometrics, teacher support, peace education, and inclusive education. She can be contacted at email: ahmedriya538@gmail.com.

Bijoy Krishna Panda is working as an Assistant Professor in the Department of Education, at Jadavpur University. His area of doctoral study is intellectual humility and openness. He has undertaken several research works on resilience, emotional intelligence, technology competency, happiness and well-being. He has completed one research project on database and indexing of masters level dissertations in Education. He is presently engaged in pedagogic training of the teacher trainees at his department as well as teaching advanced research methodology courses and research designs. He can be contacted at email: bkp.education@jadavpuruniversity.in.

Muktipada Sinha is a Professor in the Department of Education, at Jadavpur University with a teaching experience of more than 20 years in higher education. He is a certified Mental Health First Aider and conducts students' counselling across different levels. At the same time, he is serving as the Joint Coordinator of the Centre for Studies in Cultural Diversity and Wellbeing, Jadavpur University. He is an active researcher as well as a popular speaker on a diverse range of educational issues relating to school and higher education. He has undertaken a dozen of research projects at national and international levels including one with Anglia Ruskin University (UK) and Adam Mickiewicz University (Poland). His area of academic expertise includes Indian philosophy, learning theories, educational administration, mental health and life skills, cognitive behavioral therapy and guidance and counselling. He can be contacted at email: muktipada.sinha@jadavpuruniversity.in.