

RESEARCH ARTICLE

Assessing learning strategies among Indigenous University researchers: A comparative analysis of the brief ACRA scale

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ABSTRACT

Learning strategies have been critical due to a large body of evidence verifying their association with various outcomes such as academic success, creativity, critical thinking, life satisfaction, self-efficacy, metacognitive awareness, emotional intelligence, and student motivation. Therefore, identifying better learning strategies can benefit students and teachers. Learning strategies have been widely examined on several scales, among which the ACRA brief scale for university students is the most popular, especially in Spain. In Pakistan, validation of the ACRA scale is important so that indigenous researchers can use it according to their context and culture. The present study examined the factor structure of the ACRA brief scale using a cross-validation approach that involves an exploratory and confirmatory factor analysis in a sample of 951 (M = 533, F = 417) students from Pakistani Universities. The results proposed a 17-item version with three factors: micro-strategies, keys for memory and metacognition, and emotional-social support with satisfactory psychometric properties. Furthermore, the key for memory and metacognition factors is significantly associated with the CGPA of students and is higher in women than in men; however, the effect sizes of these findings are small. The validated version of the brief ACRA scale can be used to assess the learning strategies. In addition, it is suggested that national researchers and MS and Ph.D. students can use the validated scale version in their research studies, including project papers, theses, and dissertations. Directly teaching students about the techniques and benefits of learning strategies can help them overcome their hesitation.

Keywords: learning strategies; indigenous; university researchers; brief ACRA scale

1. Introduction

In its Vision 2025, the Pakistan Higher Education Commission (HEC) outlines a strategic plan to improve the quality of higher education to make universities the highest learning center ^[1]. So far, progress on this vision has been hazy, as higher education institutes in Pakistan are beset by many challenges, such as limited finances, low-quality infrastructure, untrained faculty, governance issues, flawed educational policies, and lack of international collaboration^[2]. In Pakistan, untrained teachers are a major hurdle because they rely on

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traditional teaching methods that promote memorization of information^[3,4]. Teacher-related factors, such as pedagogical practice and knowledge, influence student learning^[5]. Likewise, the failure of untrained teachers to impart more effective means of learning leads students to commonly rely on recitation as a learning strategy, which, according to^[6], is a significant factor affecting the academic integrity of students in Pakistan. This is because such learning methods, including recitation, do not involve higher-order cognitive skills required for critical thinking^[7,8]. In this way, they are antithetical to the demands of modern higher education, which aims to instill critical thinking among students^[9-12].

An indicator of supreme importance when attaining and maintaining quality education is student achievement^[13] or student performance^[14]. Student achievement in higher education can be improved by managing essential factors such as staff quality, reliance on technology, and suitable learning strategies^[15]. Learning strategies have been particularly identified as important due to a large body of evidence verifying their association with various outcomes such as academic success^[16], creativity^[17], critical thinking^[18], life satisfaction^[19], self-efficacy or metacognitive awareness^[20], emotional intelligence^[21] and student motivation^[22]. Therefore, identifying better learning strategies can have various benefits for students. For this purpose, it is significant to understand what learning strategies are.

1.1. Defining learning strategies

McCombs^[23] pinpoints the earliest use of the term “learning strategies” to earlier research on study skills and memory strategies^[24-27]. Research on the importance of advanced organizers in student learning, a cognitive theory, is another likely origin of this concept^[28-31], as suggested by McCombs^[23]. Dewey^[32] and Thorndike^[33] have also been credited for the origin of this concept, as have Zimmerman and Schunk^[34].

Ghalebi et al.^[35] define learning strategies as a collection of approaches that learners use to acquire knowledge, for example, taking notes, summarizing, organizing information, and coding. Learning strategies in cognitive psychology are the means and processes by which students deliberately choose to recover their knowledge to achieve their educational goals. In such formal educational contexts, these cognitive processes are a strategic problem-solving tool^[36] and activate in response to a learning task^[37]. Using learning strategies, it can be inferred that students are active participants in learning: They can build their knowledge using tools and mental processes that encourage self-learning to obtain information more efficiently^[38].

1.2. Theoretical framework

There have been different ways to conceptualize strategies. First, a dichotomist view by Kirby^[39] differentiates strategies into micro and macrostrategies. Macro strategies consist of tasks like planning and self-regulation that are metacognitive and more generalizable. In contrast, the underlining and summary tasks correspond to micro-strategies limited to specific situations.

Another understanding of learning strategies has been given by Oxford^[40,41], who differentiates them into direct and indirect strategies and has provided another understanding. Memory, cognitive, and compensation strategies are considered direct strategies. Social, affective, and metacognitive strategies are grouped as indirect strategies. On the other hand, Weinstein and Mayer^[42] rank strategies into levels so that each subsequent level presents a gradual increase in levels of control and elaboration: repetition, elaboration, organization, and regulation. The highest level in Weinstein and Mayer's^[42] conceptualization, regulation, is similar to the concept of metacognition, a higher-order process demonstrated by learners^[43]. Flavell^[36], the pioneer of metacognition research^[23], defined metacognition as knowledge acquired about cognitive processes to control cognitive processes.

Weinstein and Mayer^[42] also incorporate affective-emotional strategies into their model, which aim to regulate the environment, control emotions, and drive effort. Emotions are integral to learning^[44], and positive emotions can lead to better academic performance^[45]. This point further underscores the importance of

learning strategies, as flexible use among students has been linked to better control of the learning process^[46]. Perception of better control over the learning process combines with the perceived value of a task to predict achievement emotions according to the Control Value Theory^[47]; according to this theory, emotions, cognitive assessments, and learning strategies are linked to the learning environment and a dynamic cycle. This is because strategies arise from shared learning processes and social settings^[48]. This is why learning strategies are contextualized in their sociocultural environment^[49].

Jimenez et al.^[49] review the concept of learning strategies by suggesting that learning strategies involve deciding which procedures are the most appropriate means of fulfilling the objectives of each particular context. It is important to create social situations that can accelerate these processes. Additionally, learning occurs effectively in formal settings rather than in space.

The literature above points to two conclusions. First, examining learning strategies in different cultures can shed light on the different ways and inform us about students' learning strategies preferences. Second, it is possible to change these strategies through training and adjustment^[50], for which the university provides an ideal platform where these learning strategies can be encouraged by teachers^[51].

1.3. Review of the literature on previous scales

However, assessment is required to know which strategies are critical in university classrooms. Weinstein^[42] originally developed the Learning and Study Strategies Inventory tool, which Nunez et al.^[52] adopted. Pintrich et al.^[53] originally developed the Motivated Strategies for Learning Questionnaire (MSLQ), which was adapted by Roces et al..^[54] For language learning, Oxford^[40] proposed a strategy inventory proposed by Oxford^[40] aimed at measuring direct and indirect strategies. The most widely used scale for evaluating learning strategies in Spanish-speaking countries is the ACRA^[55], which stands for Acquisition, Codification, Retrieval, and Support Strategies^[56].

Initially, Roman and Gallego^[57] designed a brief ACRA scale for secondary school students in a Spanish setting. Other researchers adapted the brief ACRA scale for use with university students due to its supreme importance^[58] and its good psychometric properties. We also considered the brief ACRA scale for our study but adopted the solution of Jiménez et al.^[49], who conducted exploratory and confirmatory factor analyzes on data obtained from 809 psychology university students to propose an ACRA brief scale in Spain. Their solution (scale) consisted of 17 items grouped into three factors: micro-strategies, memorizing keys and metacognition, and emotional-social support.

Various studies^[49,58] have already established the importance of the brief ACRA scale in university contexts, but this importance was not seen in Pakistan; therefore, we applied it to Pakistani university students. Many studies have cited the association between the use of learning strategies and academic performance^[55,59] as measured by the brief ACRA scale; therefore, the scale mentioned stands out as an important case for us in Pakistan. The findings also suggest the existence of differences between age groups^[60] and the gender of the students^[55]. There is also evidence that women use more efficient and diverse learning strategies than men^[59], as assessed by the ACRA scale. Jimenez et al..^[49] However, they could not find conclusive evidence for gender differences in the use of strategies in ACRA due to the statistical invariance of their sample. Therefore, a more balanced sample is needed to validate ACRA. They also did not assess academic performance as a measure of validity, which appears to be a research gap that our study needs to fill.

Noticing the importance of this phenomenon, we felt that it must be investigated in the Pakistani context because the evidence of learning strategies with university samples is limited in Pakistan. The learning strategies investigated in Pakistan are mostly within the language learning context, which further provides a research gap. For example, language learning strategies among university students have also been investigated^[61,62]. In addition, school-level learning strategies by Kazi et al.^[63] have also been explored in

different subject groups. Evaluation of learning strategies by university students in Pakistan was carried out by Iqbal et al. ^[64], who used the Learning and Study Strategies Inventory (LASSI), which, being a comprehensive and lengthy measure that contains ten subscales, is not ideal for short administration.

To summarize, it has been conclusively observed from the above literature review that a brief ACRA scale in university contexts for Pakistani university students has not been validated in our context through exploratory and confirmatory factor analysis. For us, the current study is of supreme and extraordinary importance and significance. To fill these research gaps, we came up with the following objectives.

- To study the construct validity (factor analysis EFA & CFA) of the brief ACRA scale in the sample of Pakistani universities.
- To analyze the psychometric properties of the brief ACRA scale so indigenous researchers can use it on the Pakistani research platform.
- Assess gender (variances) on the short ACRA scale in Pakistani universities.

2. Methods

2.1. Design and sample

The present research was a cross-sectional psychometric study using a quantitative method involving participants from public and private universities in Pakistan. We sought approval to get the questionnaire filled out by the respondents because the study was based on voluntary participation. In the first part of the data collection questionnaire, it was mentioned that respondents were not bound to fill out the questionnaire by hook and crook; rather, they had the right to deny our request to fill out our questionnaire.

The G-Power calculator determined the sample size limit (two-tailed test, effect size $r = 0.3$, alpha error = 0.05, and power 1-beta error = 0.95) to be 134. However, since a large sample was required for separate computation of exploratory and confirmatory factor analyses, it aimed to collect as much data as possible in one month. The final sample consists of 950 students from different departments in universities in Pakistan. These students were approached at different universities in Pakistan. Of the total of students, 533 are men and 417 are women. Further demographic details are provided in **Table 1**.

Table 1. Frequencies and percentage of demographic variables (N = 711).

Demographics	f (%)	Demographics	f (%)
Gender		Marital Status	
Male	533(56.1)	Married	189(19.9)
Female	417(43.9)	Unmarried	761(80.1)
Age		Area	
18-22 years old	243(25.6)	Rural	443(46.6)
22-26 years old	307(32.3)	Urban	507(53.4)
26-30 years old	204(21.5)		
Above 30	23(2.4)		
Degree Level			
BS	492(69.2)		
1.5 (B.Ed.)	175(24.6)		
2.5(B.Ed)	44(6.2)		
MPhil	293(30.8)		

2.2. Instruments

To validate the instrument, researchers used the brief version of the ACRA scale proposed by Jiménez et al. [49]. Reliability estimates for all three of its subscales were greater than 0.70 in their study. The ACRA brief is a four-point Likert-type scale comprising micro-strategies, memorizing keys and metacognition, and emotional-social support. The internal consistency of all three components is greater than 0.70. This scale adapts a brief version of the proposed ACRA. Román and Gallego [57](1994) originally designed this scale for secondary school students. De la Fuente and Justicia [58] adapted it for use with university students.

2.3. Procedure and ethical considerations

In the framework of university tutoring, students from various private and public universities in Pakistan provided the information. The study was carried out with the approval of the university ethics committee. Students were approached on their university campuses. Willing participants received informed consent listing the purpose of the survey, eligibility criteria for participation, and instructions. Furthermore, the benefits of participation, the voluntary nature of participation, the rights of confidentiality, and the rights of data protection were also conveyed.

2.4. Data analysis

To analyze the data, the researchers used SPSS version 21. Descriptive statistics were used to identify the ACRA indicators in summary. Exploratory factor analysis (EFA) was also calculated/computed using SPSS. Additionally, the Alpha reliabilities and Pearson's correlations were calculated to assess internal consistencies and the association of scale factors with a variable of interest. The researchers used AMOS version 21 to perform a confirmatory factor analysis (CFA). Furthermore, an independent sample t-test was performed to determine gender differences in scores.

3. Results

An EFA was calculated with the first half of the sample ($n = 457$) to explore the structure of the brief scale ACRA. Initially, a five-factor solution emerged with five factors having eigenvalues greater than 1 (see **Figure 1**).

Keeping in line with the method Jimenez et al. [49] followed, a parallel analysis suggested a three-factor solution. Oblimin rotation was used to extract this three-factor solution, which retains all 17 items ($KMO > .80$; Bartlett's statistic $p > .001$; 40.48% explained variance).

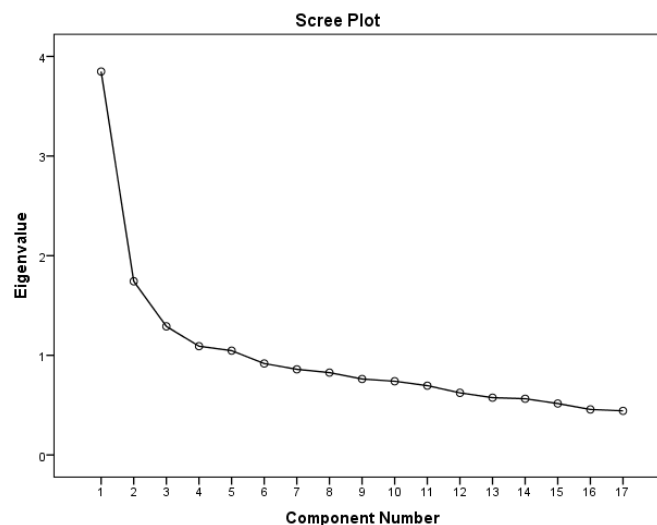


Figure 1. Scree plot showing eigenvalues for extracted factors of ARCA.

Table 2 groups the elements according to their load on micro-strategies, memory and metacognition, and emotional and social support. For this sample size, a loading of about 0.30 or more is considered significant^[65], which, according to **Table 2**, is possessed by all elements. It should be noted that the present factor structure is like the one discovered by Jimenez et al. ^[49] except for item number 5, which is now loading on factor II: Keys to Memory and Metacognition. In the original ACRA brief, it belonged to factor I: Micro-Strategies.

Table 2. The oblimin method was used to analyze the factor loadings of 17 elements (N = 457).

Item	Factors		
	I	II	III
1. I make summaries after underlining.	.182	.692	.017
2. I make summaries at the end of each topic.	.209	.653	.011
3. I summarize after each topic lesson or write down the most important things.	.239	.446	.131
4. Diagrams of underlined material and summaries.	-.082	.587	.002
5. I memorize summaries, diagrams, conceptual maps, etc.	.616	-.007	-.017
6. I use signs and drawings to highlight important information.	.385	.240	.028
7. I am aware of the importance of using elaboration strategies.	.566	.206	.060
8. I recognize the role of learning strategies for memorizing.	.584	.045	.123
9. It helps me if I remember events or anecdotes to remember.	.678	-.038	-.038
10. I recall drawings, images, and metaphors to elaborate information.	.654	.055	-.043
11. I study hard to be proud of myself.	-.214	.198	.599
12. I avoid distractions when studying.	-.052	.061	.606
13. I sort out family problems to concentrate on studying.	-.089	.177	.608
14. I solve conflicts with fellow students, lecturers, or family.	.136	-.059	.563
15. I talk to fellow students, lecturers, or family to clarify study doubts.	.099	-.129	.688
16. It gives me satisfaction when others value my work positively.	.266	-.268	.518
17. I encourage and help my fellow students to be academically successful.	.267	-.213	.441
Cumulative Variance	22.64	32.89	40.48
Variance	22.64	10.25	7.59
Eigen Value	3.84	1.74	1.29

Note. Bold-faced loadings indicate the items retained under the relevant factor.

The final version of the ACRA brief was approved with the same three factors as the original, i.e., micro-strategies, the key to memory and metacognition, and emotional and social support, but with four elements in the first factor, six in the second factor, and seven in the third factor with their internal consistencies 0.60, 0.68, 0.70, respectively. This version of the ACRA brief can be viewed in **Annexure A**.

Then, a CFA (**Table 3**) was performed in another sample ($n = 493$). Recommendations about goodness-of-fit indices were followed that were given by DiStefano and Hess (2005); $\chi^2/df < 5$; NFI $> .80$; RMSEA $< .08$; CFI $> .90$; SRMR $< .08$, Byrne (1994; GFI $> .90$; CFI $> .90$) and Bentler and Bonett (1980; TLI $> .90$).

Table 3. CFA (model adjustment indicates) for the ACRA scale (N = 493).

Indices	$\chi^2(df)$	χ^2/df	GFI	CFI	IFI	TLI	RMSEA	SRMR
M 1	239.41(116)	2.06	.94	.89	.89	.87	.04	.04
M 2	171.33(112)	1.53	.96	.95	.95	.93	.03	.04

Note. $\chi^2(df)$ = chi-square; χ^2/df = normed chi-square; GFI = Goodness of Fit Index; CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Squared Error of Approximation; SRMR = Standardized Root Mean Square. M1 = Default Model; M2; After adding error covariance.

According to conventions, the CFI, IFI, and TLI indices of model 1 are below the acceptable threshold. A covariance matrix was drawn between the error terms of the first and third factors (see **Figure 2**) based on the modification indices. Specifically, covariances were drawn between item 1 (I make summaries after underlining) and item 2 (I make summaries at the end of each topic), item 1 and item 3 (I summarize after each topic, lesson, or write down the most important things); item 12 (I avoid distractions when I study) and item 13 (I sort out family problems to concentrate on studying); item 13 and item 17 (I encourage and help my fellow students to be academically successful).

Correlation estimates for micro-strategies and emotional and social support factors were calculated to understand these covariances. The highest correlations were observed between items 1 and 2 and items 1 and 3. These findings suggest that the relationship between these items is not simply accounted for by the factors under which they are grouped.

For instance, in the case of Items 12 and 13, there is a chance that a latent variable that pertains to a drive to avoid distractions might explain these correlations. In the case of items 13 and 17, a prosocial tendency is reflected. However, the commonalities of the themes may not be the only reason for high error correlations. A likely possibility for high error among items 1, 2, and 3 could be their similar formulations and close placement on the questionnaire, as suggested by Bollen and Lennox ^[66].

Model 2 shows an improvement in all modification indices, supporting the assumption that the three-factor solution of the ACRA brief is valid for the present sample.

Figure 2 represents the graphical picture of the ACRA brief measurement model for its three subscales: micro-strategies, key memory and metacognition, and emotional and social support. The factor loadings of the micro-strategies scale range from 30 to 65. For memory and metacognition keys, the loadings range from 33 to 60. On the contrary, emotional and social support ranges from 35 to 62. All these factor loadings are within the range Reyes et al. (2021) obtained in their ACRA CFA brief. Furthermore, it is clear from **Figure 2** that the factor structure obtained from the previous sample has been retained in the current one.

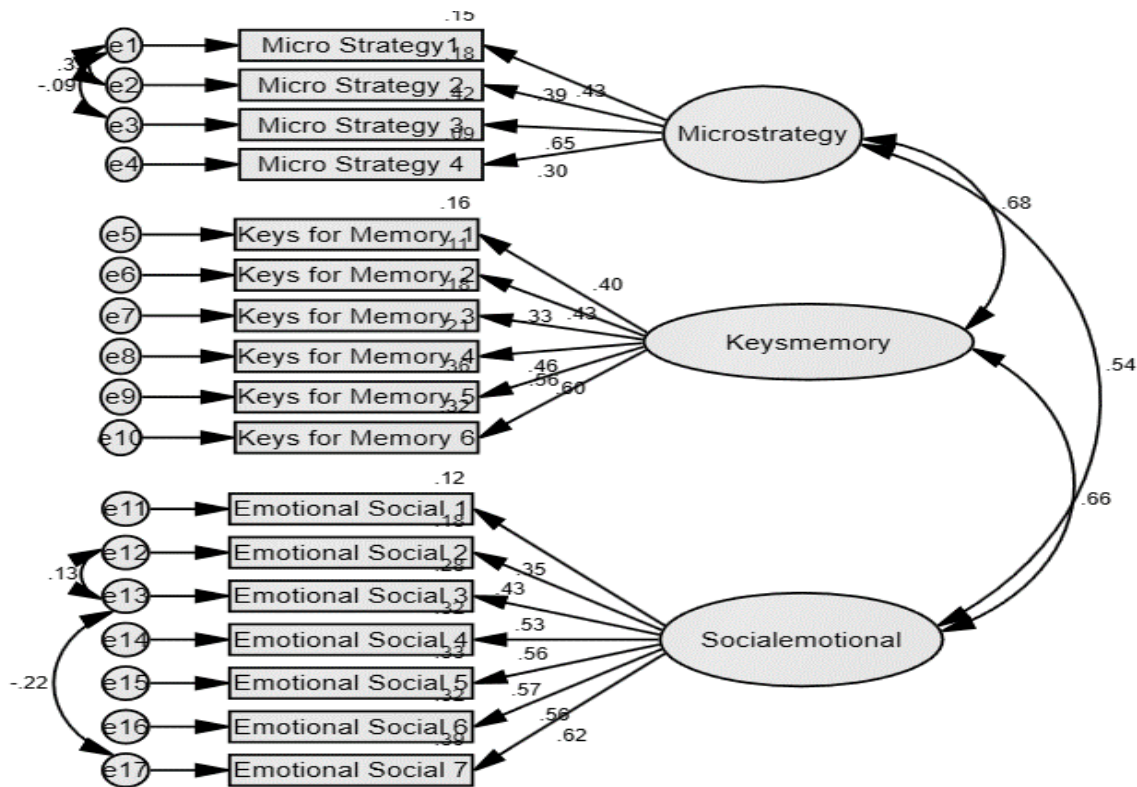


Figure 2. ACRA Brief Measurement Model.

The descriptive indicators and internal consistencies were then calculated for the composite data, whose values are presented in **Table 4**.

Table 4. Descriptive statistics and Alpha reliability coefficients of the ACRA Brief subscales (N = 950).

Subscales	No. of items	A	M	SD	Range		S	K
					Actual	Potential		
Micro-strategies	4	.69	12.35	2.66	4-16	4-16	-.635	.066
KMM	6	.79	19.56	3.38	6-24	6-24	-.881	1.108
ESS	7	.74	23.76	3.53	7-28	7-28	-.876	.726

Note. S = Skewness; K= Kurtosis; KMM = Keys to Memory and Metacognition; ESS = Emotional and Social Support

It is evident from **Table 4** that the internal consistency value of the first subscale, micro-strategies, is below 0.070, while the rest of the subscale possess higher values. Indicators of normality suggest that the data are normally distributed. It can be seen from the negative skewness values of all subscales that most of the participants show high scores.

Table 5. Correlation between the ACRA brief subscales and the variable of interest (N = 951).

	1	2	3	4
1. Micro-Strategies	-	.589**	.354**	.038
2. Keys to metacognition and memory	-	-	.474**	.07*
3. Emotional and Social Support	-	-	-	.026
4. Students GPA	-	-	-	-

* $p < .05$. ** $p < .01$.

The correlations between the ACRA factors and the variable of interest, GPA, were calculated with the help of Pearson's product moment (see **Table 5**). Positive associations between the three factors of the ACRA brief provide evidence of its validity. There is also a weakly significant association between GPA and key factors of metacognition and memory, which could mean that the use of this strategy is positively associated with an increase in GPA.

To fulfill the last objective of the study, a gender-based comparison of scores was made in the ACRA brief using an independent samples t-test. The findings are tabulated in **Table 6**.

Table 6. Gender Differences in the ACRA Brief Subscales (N = 950).

Scales	Men(n =533)		Women (n =417)		t (948)	p	95% CI		Cohen's d
	M	SD	M	SD			LL	UL	
MS	12.29	2.78	12.42	2.49	-.79	.43	-.48	.20	
KMM	19.35	3.59	19.81	3.07	-2.08	.04	-.89	-.02	.13
ESS	23.82	3.62	23.69	3.42	.53	.59	-.32	.57	

Note. S = Skewness; K= Kurtosis; MS = Micro-strategies; KMM = Keys of Memory and Metacognition; ESS = Emotional and Social Support

It is clear from **Table 6** that mean differences are significant only for the Memory Metacognition Keys, suggesting that female students rely more on this strategy than male students. However, the effect size of this difference is small, as per ^[67] conventions.

4. Discussion

Learning strategies help students concentrate, process, internalize, and memorize new and difficult academic information ^[68]; therefore, they are essential for academic success. To encourage university students' academic, personal, and professional development, knowing which learning strategies they use and promoting them is essential ^[69]. Knowing what strategies university students use in the context of Pakistan is especially important because students here do not combat the challenges of the modern era effectively ^[69]. However, such an endeavor can proceed only with a valid and reliable instrument applicable to Pakistan's culture.

The present study made an effort to validate the ACRA brief scale ^[49] for use within Pakistani universities. Our exploration of the ACRA brief retained its three-factor structure, which contains microstrategies, keys to memory and metacognition, and emotional and social support. The only difference observed was that item 5, “I memorize summaries, diagrams, conceptual maps, etc.,” originally belonged to the factor; micro-strategies were shifted to the second factor, keys of memory and metacognition. Conceptually, item 5 fits into the second factor because it refers to the memory encoding process. This change has also been supported by satisfactory loading of this item on factor 2 in an independent sample in a CFA.

The internal consistency estimate for the factor micro strategies was below .70. However, this finding is still an improvement over the estimates obtained by Reyes et al. ^[56] because their internal consistency estimates were much lower for the ACRA brief. They explain the reason behind these findings: Jimenez et al. ^[49] relied solely on internal qualities such as reliability estimates and factor loadings to form their factors. Subjective judgment was ignored, which could be why the items had lower reliability in an independent sample. The same reasoning may be applied to the present study.

Therefore, current findings provide additional support to the three-factorial structure of ACRA, which has previously found considerable support ^[49,56,58,59,70]. Further evidence of the validity of the construct was

evidenced by the significant positive correlation among the three factors that represent the three types of learning strategies.

According to Jimenez et al. ^[49], the first factor, micro-strategies, aims to assess specific strategies students use to aid their learning. The second factor, the keys to metacognition and memory, aims to assess the ability to self-regulate the learning process and control the organization and elaboration of information. The last factor, emotional and social support, is a critical part of strategic learning behavior and emphasizes the social nature of learning.

The validity of the criterion of the ACRA brief has also been assessed. Our study has shown that GPA and one component of ACRA, keys to memory and metacognition, are positively associated. This finding is consistent with consistent evidence showing a significant association between high ACRA scores and academic performance ^[55,59,71,72]. It should be noted that the factor keys for memory and metacognition were extracted by Jimenez et al. ^[49] from the factor cognitive strategies and learning control proposed by De la Fuente and Justicia ^[58]. Factors, cognitive strategies, and learning control have previously been shown to predict academic achievement ^[73].

As part of the third objective, the study also discovered a significant difference in keys for memory and metacognition between men and women, the finding being that women are more likely to use keys for metacognition and memory than men. Previous studies support this result, as female students have been shown to engage in more diverse learning strategies than male students ^[58,59]. However, the effect size of this difference is small, so a conclusive judgment cannot be made. Previous studies, for example ^[56,74], could not find gender differences in learning strategies.

5. Limitations, suggestions, and implications

As mentioned above, the internal consistency of ACRA is brief and ranges from low to moderate. The translation of this instrument may help to address these psychometric shortcomings. An even better alternative is to design an indigenous instrument that considers culturally unique strategies. In this endeavor, this instrument can aid in establishing the validity of the convergence. Another limitation was the weak correlation between the second subscale, keys of memory and metacognition, and student GPA. The student's GPA is likely not a satisfactory measure of student achievement. Perhaps more conclusive results could have been found if a more psychometrically sound measure of student achievement had been utilized.

When it comes to the implications of the ACRA brief, the evidence for the existence of the emotional and social support factor emphasizes the fact that strategies can be modified through explicit training ^[75] so that it is possible to create learning environments where effective learning strategies can be imparted, tailored to the personal needs of each university student, and designed according to the surrounding academic context. Pedagogy is becoming more learning-centered with time ^[23], so focusing on interventions that aim to strengthen students' cognitive, metacognitive, affective, and social skills is necessary. For many students, especially those just starting university, developing learning strategies independently can be challenging because such strategies require effort ^[76]. However, directly teaching students about the techniques and benefits of learning strategies can help them overcome their hesitation.

6. Conclusions

Learning strategies have been widely examined on several scales, among which the ACRA brief scale for university students is the most popular, especially in Spain. In Pakistan, validation of the ACRA scale is important so that indigenous national researchers can use it according to their beliefs and culture. Exploratory

and confirmatory analyzes have been combined to validate the brief version of ACRA for use with Pakistani university students. This scale incorporates three strategies: micro-strategies, the key to memory and metacognition, and emotional and social support. All of these scales show satisfactory psychometric properties. It is hoped that this validated version will be useful in evaluating the frequently used learning strategies by Pakistani students and that this effort will help design interventions in academic contexts to improve the quality of education in higher education institutes.

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Declaration of conflict

No conflict of interest.

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Annexure A. Items in the ACRA brief scale validated for use in Pakistani universities

Factor I: Micro-strategies

1. I make summaries after underlining.
2. I make summaries at the end of each topic.
3. I summarize after each topic lesson or write down the most important things.
4. Diagrams of underlined material and summaries.

Factor II: Keys to memory and metacognition

5. I memorize summaries, diagrams, conceptual maps, etc.
6. I use signs and drawings to highlight important information.
7. I am aware of the importance of using elaboration strategies.
8. I recognize the role of learning strategies for memorizing.
9. It helps me if I remember events or anecdotes to remember.
10. I recall drawings, images, and metaphors to elaborate information.

Factor III: Emotional and social support

11. I study hard to be proud of myself.
12. I avoid distractions when studying.
13. I sort out family problems to concentrate on studying.
14. I solve conflicts with fellow students, lecturers, or family.
15. I talk to fellow students, lecturers, or family to clarify study doubts.
16. It gives me satisfaction when others value my work positively.
17. I encourage and help my fellow students to be academically successful.