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RESEARCH ARTICLE

Psychometric properties of attitudes towards research scale in Peruvian university students

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ABSTRACT

Attitudes towards research play an important role in the development of critical thinking and in the research training of students. Therefore, the psychometric properties of attitudes towards research scale were evaluated. An instrumental design was used, with the participation of 2448 students from five public and private universities in Peru, selected through intentional non-probabilistic sampling. For the analysis, the sample was randomly divided into two subgroups, applying exploratory factor analysis (EFA) in the first, and confirmatory factor analysis (CFA) in the second. The original three-factor model did not show an adequate fit to the data, and a new structure composed of four factors emerged: valuation and disposition towards research, interest and participation in research, demotivation towards research and devaluation of research. The revised model presented an adequate fit ($\chi 2(269) = 1526.77$; CFI = .954; TLI = .949; RMSEA = .044; SRMR = .037). Likewise, the scale presented an Omega of .80 (95% CI: .79 - .81) demonstrating good reliability. Therefore, the new factor organization evidence adequate structural validity and reliability, supporting its usefulness to measure attitudes towards research in university environments. Its use in future research with different populations and academic contexts is suggested.

Keywords: Attitudes towards research; factor analysis; structural validity; reliability; university students

1. Introduction

Research training is a fundamental axis in higher education, especially in contexts where it seeks to strengthen the scientific production and analytical capacity of future professionals. In this sense, the development of attitudes towards research influences academic performance, as well as the student's willingness to be actively involved in research processes during and after their university education[1].

The attitude towards research includes affective, cognitive, and behavioral components, which determine the degree of interest, valuation, and disposition that a person has towards research activity[2].

In this sense, the tripartite model of attitude[3], is composed of three dimensions: cognitive (ideas and beliefs), affective (emotions or feelings), and behavioral (action tendencies), this model allows us to

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comprehensively understand how students evaluate, feel and act in the face of research; Likewise, the classical theory of attitude[4], maintains that attitudes are learned dispositions that guide favorable or unfavorable responses to research, therefore, these attitudes are formed from the knowledge acquired, the emotions it generates, and the predisposition to participate in scientific activities.

Likewise, from the theoretical perspective of social psychology, attitudes towards research in university students can be understood from the theory of social identity[5], explains that identification with academic groups that value research fosters favorable attitudes and reduces its devaluation, since the sense of belonging strengthens commitment, aspects that allow theoretically sustaining the dimensions focused on valuation and disposition towards the research, as well as the devaluation for research.

On the other hand, the theory of planned behavior[6] proposes that the intention to perform a behavior is determined by three factors: attitudes towards behavior, subjective norms (perceived social influence) and perceived control (degree of control that the individual believes he or she has over some action). In the research context, the intention to investigate depends on positive attitudes, perceived social support and confidence in one's own ability. Substantiating the dimensions of interest and participation in research, as well as demotivation towards research.

Together, these theories show that attitudes towards research are the result of personal beliefs, perceptions of competence and group dynamics, which underpin the proposed structure with four dimensions that aim to measure attitudes towards research.

Therefore, some studies have shown that positive attitudes towards research are associated with greater academic engagement, better scientific skills, and a greater likelihood of continuing graduate studies[7,8].

However, it has also been documented that several university students have negative attitudes towards research, which may be influenced by factors such as lack of motivation, poor methodological training, and unsatisfactory previous experiences in research-related courses[9].

In addition, attitudes towards research in university students are also largely shaped by cultural, family and social environment influences, from the sociocultural perspective, the value assigned to research in the cultural environment determines the way in which students perceive and engage in scientific topics[10]. At the family level, factors such as the educational level of the parents and the stimulus towards intellectual activities have a direct impact on interest in research[11].

Similarly, the peer group exerts a significant influence. When peers value research, students tend to adopt similar attitudes, motivated by social learning and a sense of belonging[12,13], together, these factors contribute to strengthening or weakening academic and research engagement in university contexts.

Faced with this reality, it is essential to have valid and reliable instruments that allow us to accurately measure research attitudes in specific educational contexts; one of the most widely used scales for this purpose is the scale attitudes towards research, developed by Aldana, Caraballo and Babativa[2], which presents a three-dimensional structure that measures the affective, cognitive and behavioral dimensions, evidencing adequate reliability and validity indices in Colombian university populations.

However, the use of instruments with psychometric properties in contexts other than those in which they were originally developed requires rigorous contextual validation, which ensures that the instrument's properties are maintained in populations with different cultural, educational, and social characteristics.

In the case of Peru, there are previous studies that have addressed attitudes towards research from descriptive or correlational approaches[14,15], but there is little research that has focused on validating specific scales such as scale in the Peruvian university population.

In this regard, we found some studies that adapted and validated reduced or modified versions of this scale, such as the scale (revised version) in Peruvian and Latin American contexts[16,1]. However, the evaluation of its complete psychometric properties in large and diverse samples of the country has not been widely reported. Likewise, the relevance of the study lies in the sample size, allowing for more robust statistical analyses with confirmatory factor analysis, as well as the external validity of the results[17], allowing a better generalization of the findings to the university context. Likewise, the sensitive nature of an instrument could be affected by the social context in which the research is carried out[18].

Therefore, it is pertinent and necessary to submit the original scale to a validation process in Peruvian university students, which includes the analysis of its factor structure, internal consistency, and cultural adequacy.

In this sense, the main objective of this study is to evaluate the psychometric properties of the scale in a sample of Peruvian university students from different regions and types of university (public and private). With the purpose of providing a solid tool that allows researchers, professors and academic authorities to diagnose and promote positive attitudes towards research in the field of Peruvian higher education.

2. Method

2.1. Type of study

An instrumental design was used through confirmatory factor analysis for the validity of the scale[19]. The information was collected during the last half of 2024.

In addition, the COSMIN (Consensus-based Standard for the selection of health Measurement Instruments) reporting guide was used, its usefulness in the present study allows to rigorously evaluate the methodological quality of the psychometric validation, ensuring that the scale meets international standards of validity and reliability.

2.2. Participants

2,448 university students from five Peruvian universities participated, both public and private, participated in the study. The sample was distributed as follows: University A (n = 521), University B (n = 663), University C (n = 480), University D (n = 660) and University E (n = 124). Participants were selected through intentional or convenience non-probability sampling, which allowed the inclusion of students who met specific inclusion criteria, such as being enrolled in undergraduate programs and having a voluntary willingness to participate in the research.

2.3. Instrument

The Scale of Attitudes towards Research, developed by Aldana et al.[2], was used for data collection. The instrument consists of 34 items organized into three dimensions: affective, cognitive, and behavioral, which are answered through a 4-point Likert-type scale (0 strongly disagree and 4 strongly agree). The scale presented content validity, as well as construct validity (exploratory factor analysis) confirming the three-dimensional structure; for internal consistency, they used Cronbach's alpha coefficient ($\alpha = 0.854$). Likewise, the instrument included social and academic variables of the students such as age, sex, origin, year and area of studies; finally, the data of the informed consent were recorded.

2.4. Procedure

The corresponding ethical procedures were followed for the application of the instrument. Both universities and students were informed about the objectives of the study and expressed their agreement with

the data collection, by signing the informed consent. The questionnaire was administered individually, to guarantee the confidentiality of the participants and ensure the quality and sincerity of the answers.

2.5. Data analysis

The data were imported into the statistical software R and its integrated development environment RStudio. The data was cleaned, and then psychometric analyses began. First, the descriptive statistics of the items are presented, considering the number of valid cases, the mean, the standard deviation, the asymmetry and the kurtosis. The polychoric correlations between the items are then analyzed. This type of correlation is used due to the ordinal nature of the variables. A Confirmatory Factor Analysis was applied with the WLSMV (Robust Weighted Least Squares) estimation method[20], analyzing the original structure of the scale (three factors). For the evaluation of the adjustment indices, the following criteria were taken into account: values ≥ .90 and ≥ .95 in the CFI and TLI as adequate fit and good fit respectively, values ≤ .08 and ≤ .05 in the RMSEA as adequate fit and good fit respectively and for the SRMR, the values ≤ .08 and ≤ .06 were considered as good fit and ideal respectively[21].

As the model did not have a good fit, it was decided to randomly divide the sample, so that in the first half an exploratory factor analysis with oblique rotation (oblimin) and ULS (unweighted least squares) estimation method was applied. And subsequently, a CFA is applied to the second half. The reliability assessment was calculated using the internal consistency method with the Omega coefficient and its 95% confidence intervals.

2.6. Ethical considerations

The study was carried out in accordance with the ethical guidelines established in Ministerial Resolution No. 233-2020-MINSA of the Ministry of Health of Peru and the principles of the Declaration of Helsinki. Respect for the rights of the participants was guaranteed, ensuring their informed consent by obtaining the corresponding signature that guarantees their participation, as well as safeguarding the confidentiality of the data always provided and the well-being.

3. Results

The descriptive analysis of the socio-academic variables was carried out, finding the following information, 21.3% study at a public university, and 78.7% at a private university; By area of studies, 36.6% were from sciences and engineering, 41.6% from social sciences and 21.9% from health sciences; in relation to sex, 46.4% were men and 53.6% women; in addition, students indicated that they are only engaged in studying (95.2%) and 4.8% study and work; The mean age was 20.57 years with a standard deviation of 2.66 years in a range of 16 to 35 years.

Table 1 Presents a description of the items of the instrument. It is observed that the means ranged from 2.12 to 3, and the Standard Deviation varied from 0.96 to 1.2. The values of asymmetry and kurtosis were within range 2, which indicates that they apparently follow normal distributions.

Table 1. Descriptive statistics of the items

Item	*n*	*M*	*OF*	*g1*	*g2*	Item	*n*	*M*	*OF*	*g1*	*g2*
1	2448	3	1.19	-1.11	0.3	18	2448	2.28	0.98	-0.25	-0.34
2	2448	2.29	1.02	-0.31	-0.37	19	2447	2.33	1.14	-0.2	-0.72
3	2448	2.22	1.03	-0.2	-0.45	20	2448	2.68	1.07	-0.58	-0.29
4	2448	2.55	1.16	-0.43	-0.66	21	2448	2.44	0.96	-0.31	-0.27

Item	*n*	*M*	*OF*	*g1*	*g2*	Item	*n*	*M*	*OF*	*g1*	*g2*
5	2448	2.8	1.18	-0.68	-0.55	22	2448	2.63	1.01	-0.5	-0.24
6	2448	2.44	1.04	-0.36	-0.43	23	2447	2.15	1.12	-0.12	-0.72
7	2447	2.93	1.1	-0.84	-0.09	24	2447	2.12	1.03	-0.11	-0.44
8	2448	2.59	1.03	-0.57	-0.17	25	2447	2.3	1	-0.24	-0.35
9	2446	2.12	1.04	-0.05	-0.48	26	2445	2.55	1.03	-0.51	-0.25
10	2448	2.55	0.98	-0.46	-0.15	27	2448	2.3	1.15	-0.22	-0.77
11	2447	2.52	1	-0.4	-0.24	28	2448	2.12	1.18	0.01	-0.9
12	2448	2.84	1.07	-0.67	-0.3	29	2448	2.62	1.2	-0.51	-0.7
13	2445	2.33	1.03	-0.18	-0.44	30	2448	2.16	1.12	-0.13	-0.64
14	2448	2.28	1.13	-0.18	-0.73	31	2447	2.65	1.06	-0.53	-0.38
15	2448	2.78	1.06	-0.63	-0.24	32	2447	2.45	1.11	-0.34	-0.55
16	2448	2.3	1.01	-0.21	-0.34	33	2447	2.58	1.03	-0.46	-0.34
17	2448	2.42	1.01	-0.25	-0.39	34	2448	2.38	1.08	-0.25	-0.58

Table 1. (*Continued*)

Figure 1 shows the matrix of polychoric correlations between the items. The correlations ranged from -.08 to .54. According to the correlations found, apparently the correlations would not be supporting the original structure.

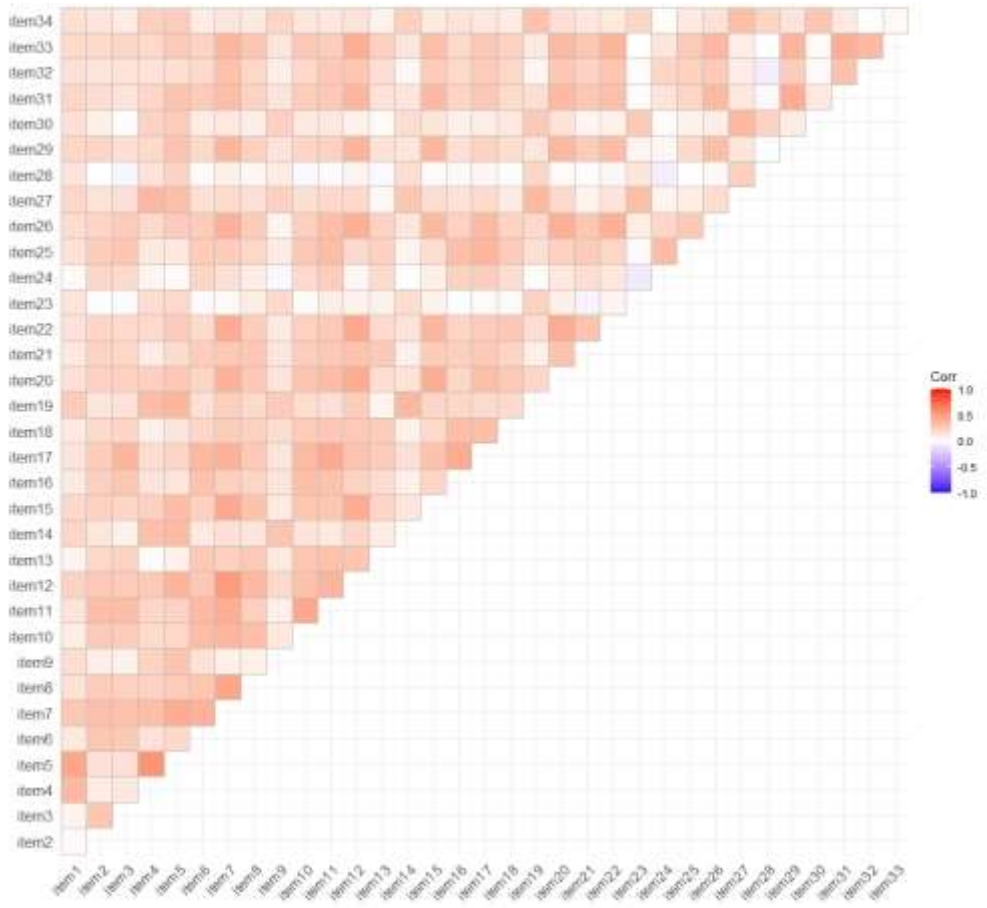

Figure 1. Polychoric correlation matrix

A Confirmatory factor analysis was applied for the structure of three dimensions: Affective, Cognitive and Behavioral. The results show that the fit was inadequate ($\chi 2(524) = 8570.41$; CFI = .789; TLI = .774; RMSEA = .079; SRMR = .073) and the factor loads of the model ranged from .113 to .731 (Affective Dimension: .351 - .639, Cognitive Dimension: .113 - .731, Behavioral Dimension: .172 - .586). The model modification indices are analyzed and the re-specification of the model is tested to improve the fit indices, however, the models presented problems of multicollinearity and not relevant improvement of the fit indices in the re-specified models.

Based on the inadequacy of the fit indices, the low factor loads and with great dispersion in the dimensions of the original structure, the values of the polychoric correlation matrix that suggest a different structure from the original, it is decided to propose a new structure for the instrument. To establish this new structure, it is decided to work in two stages. First, participants are randomized into two balanced groups, and then a new structure is evaluated by exploratory factor analysis for the first half (n = 1.224) and then confirmatory factor analysis is applied to validate the proposed model in the second half (n = 1.224).

Exploratory Factor Analysis

An exploratory factor analysis was applied with oblique rotation (oblimin) and with ULS estimation method. The KMO coefficient was applied, finding an overall value of .92 and the values of the items were greater than .76. In addition, in Bartlet's sphericity test $\chi^2(561) = 11{,}731.27$, $p < .001$, suggest that the items are sufficiently correlated for the application of the EFA. **Table 2** presents the factor loads and the structure found. It's observed that the factor loads were greater than .40 and the communalities ranged between .22 and .64. Item 7 presented a complexity value of 2.9 and comparing it with the items of the dimension, it was decided to remove it from the model.

Table 2. EFA factor loads

No	Item	F1	F2	F3	F4	H2	u2	with
29	In my opinion, without research, science would not advance.	.67				.38	.62	1.1
22	I believe that research helps to detect errors in science.	.65				.4	.6	1
33	I recognize that research helps correct common sense errors.	.6				.41	.59	1.1
20	Working with others in research helps us achieve better results.	.6				.41	.59	1.1
31	In my opinion, research contributes to solving social problems.	.59				.37	.63	1
12	I believe that persistence contributes to achieving goals.	.54				.48	.52	1.2
15	Research is possible if we are interested in doing so.	.5				.38	.62	1.2
26	For me, in research it is important to strengthen the ability to listen.	.48				.37	.63	1.3
17	Research is one of the things that interests me.		.61			.44	.56	1
16	I often find myself consulting information in scientific articles.		.58			.33	.67	1.1
11	I like to train myself to acquire research skills.		.58			.43	.57	1.1
25	I like to speed up research-related work.		.55			.32	.68	1.1
3	One of the things I like the most is scientific conversations.		.55			.29	.71	1
6	I believe that I have the necessary patience to investigate.		.54			.32	.68	1.1
24	I take every opportunity to publicize my research work.		.54			.22	.78	1.2
10	I seek to inform myself of current affairs.		.51			.35	.65	1.1
2	At research events (conferences, meetings) I interact with people.		.44			.24	.76	1
30	My research activities are a mess.			.55		.3	.7	1

No	Item	F1	F2	F3	F4	H2	u2	with
27	The thought of starting to investigate makes me discouraged.			.54		.41	.59	1.3
34	I am the last to know about current affairs.			.5		.28	.72	1
23	To be honest, what I really do the least I do is write.			.46		.22	.78	1.1
19	I find scientific conversations boring.			.43		.38	.62	1.7
5	I think that consulting scientific information is a waste of time.				.69	.64	.36	1.1
4	That thing of taking refresher courses is not for me.				.62	.47	.53	1.1
1	In my opinion, research should not be taught at university.				.46	.27	.73	1.1
7	All professionals should learn to investigate.				.43	.56	.44	2.9

Table 2. (*Continued*)

A four-factor structure was found. Depending on the content of the items, it is decided to name them as follows: Factor 1 – Assessment and disposition towards research. This factor includes items related to the development of knowledge (items 29, 22 and 33), it also refers to a collaborative and social function of research (items 20, 31 and 26), it also includes items related to a good disposition towards research, implying personal interest and perseverance (items 12 and 15); F2 – Interest and participation in research, this factor includes items on an interest and liking for research, characterized by recognizing research as a source of personal pleasure and motivation (items 17, 3, 25 and 11), there are also items referring to participation in research work (items 16, 10, 24, 2 and 6). These items have in common a proactive behavior towards specific research activities, such as: search for information, dissemination of works and participation in scientific academic spaces; F3 – Demotivation towards research, this factor refers to disorganization and low productivity in research processes (items 30 and 23), they also refer to an emotional rejection or displeasure towards what research represents (items 27 and 19) and a disconnection with the scientific and social environment, which reflects disinterest in research (item 34); and F4 – Devaluation of scientific training, which addresses issues such as the rejection of the search for scientific information (item 5), disinterest in continuous learning and professional development (item 4) and an explicit rejection of scientific training at the university (item 1).

Likewise, items 24 ("I take advantage of any opportunity to publicize my research work"), 23 ("To be honest, what I really do least is write"), 2 ("At research events (conferences, meetings) I interact with people."), 1 ("In my opinion the university should not teach research"), 34 ("I am the last to know about current affairs") and 3 ("One of the things I like the most are scientific conversations") they had factor loads above the established threshold (.40) but with low values in their communalities (<.30). However, it is decided to keep them in the model because the content of the aforementioned items is aligned with the rest of the items and their respective factors, and as will be seen later, in the internal consistency analysis, they do not affect the model.

Confirmatory Factor Analysis

A CFA with the four-factor structure is applied using WLSMV as the estimation method. The results indicate a good fit ($\chi^2(269) = 1526.77$; CFI = .954; TLI = .949; RMSEA = .044; SRMR = .037). **Figure 2** presents the factor loads of the model. These ranged from .354 (item 24) to .827 (item 5).

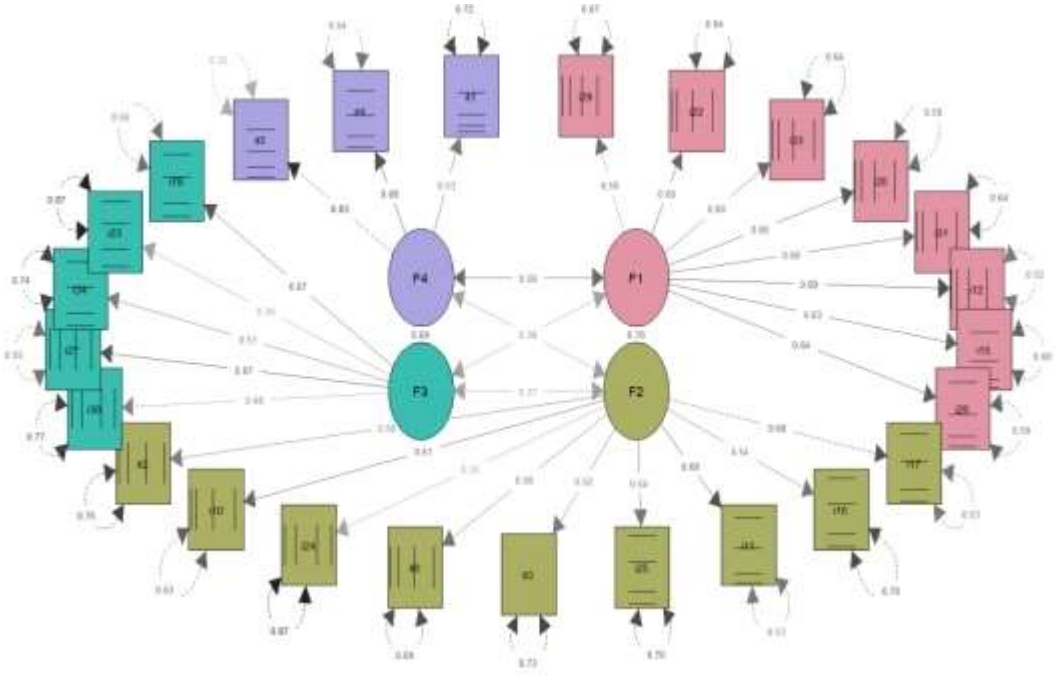

Figure 2. Factor loads of the CFA model

Finally, the internal consistency of each factor of the instrument was evaluated using McDonald's Omega coefficient, calculated on the matrix of polychoric correlations. Factor 1 had a value of .80 (95% CI: .79 - .81), Factor 2 obtained a value of .78 (95% CI: .76 - .79), while Factors 3 and 4 showed values of .65 (95% CI: .63 - .68 and .62 - .67, respectively). These findings suggest good internal consistency in F1 and F2, and moderate consistency in F3 and F4. However, the confidence intervals suggest values close to the usual threshold (.70).

Likewise, internal consistency was tested by removing the items with low communalities (<.30), it was found that omega values were reduced in the dimensions with these items (F2: .74, F3: .57, F4: .64), which shows that these items, although statistically weaker, contribute conceptually to the representation of the construct and, therefore, it is considered pertinent to maintain them in the proposed model.

4. Discussion

The evidence of validity found in the internal structure through factor analyses demonstrates adequate validity in the four-factor structure that differs from the original model[2], in that sense, the fit indices coincide with the international standards suggested by Hu and Bentler[22], demonstrating a good fit in the structure of the model.

Therefore, to improve the fit of the model, it was decided to perform confirmatory factor analysis for the three-dimensional structure of the scale, however, the fit indices were not adequate, and the proposed modifications generated problems such as multicollinearity and specification errors. Therefore, it was decided to divide the sample into two balanced groups: with the first half, a new structure was explored through EFA, and with the second half, the structure was validated with CFA, following good practices to strengthen the validity of the instrument[23].

The results of the exploratory factor analysis, using the method of estimation by unweighted least squares and oblique rotation, assumed the existence of correlations between the factors, something common in psychological constructs[24]; the adequacy of the analysis was supported by the KMO index indicating high sample consistency, and by the Bartlett sphericity test being significant, confirming the relevance of the

analysis. The results allow us to affirm that the factorial structure of the instrument can be identified with statistical validity.

Likewise, the EFA revealed a structure composed of four factors that more accurately represent attitudes towards research in university students. The naming of each factor was based on the analysis of the content of the items, and their factor loads, considering conceptual and statistical criteria valid in psychometric studies[24].

The first factor, valuation and willingness to research, requires statements that reflect favorable attitudes, recognition of the value of research and predisposition to participate in it; This component is associated with the affective dimension within the tripartite model of attitude[3].

The second factor, interest and participation in research, indicates personal commitment to research activities, associating emotional and behavioral aspects within the attitudinal construct[25]. In addition, from the theory of planned behavior, this factor shows how positive attitudes, together with the perception of control and social support, strengthen the intention and real commitment to research.

The third factor, demotivation towards research, groups items that reveal lack of interest, insecurity or apathy towards scientific activity, which can influence a perception of low self-efficacy[26]. According to Bandura's socio cognitive theory, these attitudes occur when students doubt their abilities to research or perceive insurmountable barriers, reducing motivation considerably distancing them from scientific activities.

And the fourth factor, devaluation of research, refers to beliefs that minimize the importance of research, expressing a negative view from the cognitive component. This pattern may be due to institutional beliefs or previous academic experiences that have affected the perception of the value of research[27]. The theory of planned behavior explains that these beliefs constitute unfavorable attitudes that decrease the intention to participate in research activities, in addition, the theory of social identity maintains that when reference groups, faculties and academic programs do not value research, students strengthen these beliefs, reducing their appreciation for this activity.

Therefore, this factorial configuration offers a more differentiated view of the construct, by clearly identifying the positive and negative dimensions of attitudes towards research, allowing for the design of more focused pedagogical strategies.

When the confirmatory factor analysis was performed again with the new model explored, good adjustments of the structure to the empirical data were found, finding ranges recommended by the specialized literature to consider an adequate factor structure[28]. Therefore, the results show that the four-factor structure coherently represents the relationships between the items of the scale.

Likewise, the factor loads of the items in the confirmed model ranged between .354 and .827, although some loads close to the minimum acceptable threshold (.30 -.40) can be considered weak[29], most exceed this value, confirming the significant contribution of the items to their respective latent factors. This behavior is expected on attitudinal scales that address complex and multidimensional components of human thought and behavior[30].

Indeed, these findings support the psychometric properties of the scale with a four-dimensional organization, in addition, the adequacy of the model not only improves the explanation of the construct but also offers a solid psychometric basis for its application in university contexts.

For this reason, the original model of the scale of attitudes towards research, structured in three factors, did not present an adequate fit to the empirical data, despite being based on a classical conceptual organization; the results obtained indicated a poor fit, with TLI and CFI indices below the minimum

recommended value .90, evidencing that the original structure does not adequately represent the relationships observed between the items[31].

Likewise, attempts to improve the model through error correlation failed to solve the fit problems and generated indicators of multicollinearity between factors, suggesting conceptual redundancy or an incorrect specification of the theoretical structure. These results are consistent with studies that warn of the need to revise traditional theoretical models when cultural or educational contexts change[28].

The methodological decision to randomly divide the sample and apply EFA and CFA separately allowed for a more robust restructuring of the instrument; As a result, a new four-dimensional factor organization was identified, with better fit and theoretical coherence, reinforcing the idea that the attitudinal structure towards research in university students may be more complex than the original model proposed.

In addition, the results of the instrument's validation identified four factors, reflecting not only individual components, but also sociocultural influences. Positive attitudes may be related to family and educational contexts that value research, while negative attitudes may be related to environments where academic identity is not promoted and there are no real opportunities for research[11].

The different theories can help to understand a weak membership in groups that prioritize research, the low perception of control or the lack of support to reduce the intention to participate in research activities, therefore, the results highlight the need to consider social and cultural factors when designing strategies to promote favorable attitudes towards research in the university environment[5,6,10].

Precisely, recent studies in Peruvian contexts evidenced the significant relationship between attitudes towards research and their actual research behaviors, it was found that the attitudes and competencies acquired motivate research[30]. Similarly, it was shown that having a positive scientific attitude increases the chances of developing research skills[32].

However, many university students have not developed the behaviors and knowledge to carry out research processes[33]. Situations that may be influenced by factors such as lack of motivation, poor methodological training, and unsatisfactory previous experiences in research-related courses[9].

Regarding socio cognitive factors, for Bandura[34], these research attitudes in university students are influenced by personal factors such as self-efficacy and outcome expectations; Research self-efficacy explains the perception of competence to perform tasks related to research, favoring a positive disposition towards this activity. In turn, when students consider that research generates personal or professional benefits, their attitudes become more favorable, therefore, these socio cognitive factors promote motivation and commitment to research practice, highlighting the importance of strengthening trust and the perception of usefulness among students to generate more favorable attitudes towards research.

With respect to the reliability analysis of the scale, the Omega coefficient found adequate values in F1 - F2, and moderate in F3 - F4, although the reliability of factors 3 and 4 was lower, their confidence intervals are close to the acceptable threshold[35], authors such as Loewenthal and Lewis[36], point out that in brief scales, attitudinal measures or multidimensional constructs, values between .60 and .70 can be considered acceptable, especially when the items reflect complementary aspects of the same domain.

In addition, Clark and Watson[37] highlight that high internal consistency may indicate content redundancy, while moderate levels indicate adequate coverage of different facets of the construct, therefore, in this study, the values are acceptable given the complexity of attitudes towards research and the conceptual relevance of each item.

Likewise, items with low commonalities were eliminated, further reducing reliability, evidencing that, despite their lower statistical weight, these items are conceptually relevant to comprehensively represent attitudes towards research. Therefore, it was decided to keep them in the final model, prioritizing conceptual representativeness over the strict optimization of psychometric indicators, as recommended by comprehensive validation approaches in psychological and educational measurement[38].

In conclusion, these results not only question the structural validity of the original model but also highlight the importance of contextual and empirical validations before applying psychometric instruments, especially in large and diverse samples such as those in the present study.

Despite the contributions of the present study, some limitations should be considered, the sampling was intentional, limiting the generalization of the results to the entire university population of Peru. Although the sample was large and diverse (n=2448), national representativeness is not guaranteed.

Likewise, the data were collected in a single period (cross-sectional), preventing the evaluation of the temporal stability of the instrument. Likewise, the factorial invariance between groups by gender, academic area or region was not examined, which would be necessary to validate its comparative use. In addition, although a random division was performed for independent tests, the same dataset was used, recommending future validations with external samples. Finally, as it is a self-report instrument, there is a risk of bias or social desirability or ambiguous understanding of some items.

Therefore, these limitations open the possibility of future research that reinforces the psychometric evidence of the instrument and its applicability in different educational and cultural contexts.

Conflict of interest

The authors declare no conflict of interest.

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