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The mental aptitudes test in the 5th and 6th levels of secondary school

Validación de la prueba de aptitudes mentales en los niveles 5to y 6to de secundaria

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ABSTRACT

The present study examines the degree of validity of the Primary Mental Aptitudes (PMA) test in the educational units of the intermediate city of Achacachi, in fifth and sixth grades at productive community secondary schools. The study population is made up of 421 students. The approach is quantitative; the design is non-experimental, descriptive and explanatory. The technique used was the survey and experimentation and the instrument used was the Thurstone Primary Mental Aptitude Test. The results demonstrated good validity indices with the Aiken V of 0.93 and a reliability of 0.909 Cronbach's alpha, therefore, the instrument is useful for evaluating intelligence. A significant difference was also observed between local and foreign scores, it suggests the need to use local norms for the application of this test in order to ensure correct inferences and interpretations about it.

Keywords: Primary mental abilities; Intelligence; Validity; Scale; Educational units; Bolivia.

RESUMEN

El presente estudio examina el grado de validez de la Prueba de Aptitudes Mentales Primarias (PMA) en las unidades educativas de la ciudad intermedia de Achacachi, en los grados quinto y sexto de secundaria comunitaria productiva. La población de estudio está compuesta por 421 estudiantes. El enfoque es cuantitativo, el diseño no experimental, descriptivo y explicativo. La técnica empleada fue la encuesta y la experimentación y el instrumento utilizado fue la Prueba de Aptitudes Mentales Primarias de Thurstone. Los resultados demostraron buenos índices de validez con la obtención de la V Aiken de 0,93 y una fiabilidad de 0,909 alfa de Cronbach, por lo tanto, el instrumento es útil para evaluar la inteligencia. También se observó una diferencia significativa entre las puntuaciones locales y extranjeras que sugiere la necesidad de utilizar normas locales para la aplicación de esta prueba, a fin de asegurar inferencias e interpretaciones correctas sobre la misma.

Palabras clave: Aptitudes mentales primarias; Inteligencia; Validez; Baremo: Unidades educativas; Bolivia.

INTRODUCTION

The PMA test is one of the most widely used intelligence tests by psychologists, educational psychologists and pedagogues to assess different areas of intelligence, such as verbal (V), spatial (E), reasoning (R), numerical (N) and verbal fluency (F) in order to facilitate psychodiagnosis and also the process of school or professional guidance and selection. This instrument allows the measurement of cognitive abilities such as intelligence or it can be used for vocational guidance. In this way, the most outstanding abilities of individuals can be identified and they can be guided towards a corresponding area.

The PMA test can be applied collectively and individually, in a practical, simple, fast and economical way. Therefore, it can be said that the test constitutes an effective alternative for the initial evaluation of intellectual capacity in large groups, and can be used together with other tests to make a more exhaustive diagnosis.

However, in Bolivia there are no specific criteria for applying the test and due to this insufficient; criteria from countries with similar cultures are used, such as the Lima and Spanish standards. However, a study carried out with the test at a local level indicates that there is a highly significant difference for a reliable diagnosis. The differences achieved by the local population are not comparable to those of the Lima scale. For example, according to factor E, it is observed that 55.86% of students are in the deficient category when using the Lima standards, while only 32.43% are in this category when using the local standard, with a variation of approximately 20 percentage points between the two, which indicates a significant variation between the standards.

Therefore, the use of the Lima scales is not very reliable, since it presents high variations in the scores of some factors and this limits its use in the local population, since a diagnosis must be reliable because it allows us to understand any situation, its importance, how to act and the possible consequences. For this reason, it is necessary to describe the degree of validity of the PMA test for a local reality. In this sense, there are previous investigations that have compared the scores and percentile values of the test with normative values of Peru (Lima), finding significant differences. This is one of the reasons why this research is carried out; the objective is to establish local normative values that adjust to the social environment.

Therefore, the general objective is to describe the validity of the PMA test for 5th and 6th grades at productive community secondary education in the intermediate city of Achacachi, La Paz department, in 2023. This by means of which, the local normative values for the population will be obtained taking into account the sociocultural context. Regarding the specific objectives, they are the following:

Determine the content validity of the PMA test.
Determine the construct validity of the PMA test.
Identify differences between international scales and the local scale.
Determine the normative values of the PMA test.

It should be added that the PMA is an instrument that allows identifying the strengths and weaknesses of an individual in terms of their cognitive abilities. Here are some relevant references at the national and international levels that allowed the implementation of this test and now constitute the background for this research.

Among the international investigations, the study by Recarte (2016) from the School of Psychological Sciences in Honduras stands out. He developed scales for this test for Honduran university students. This research is quantitative, descriptive, cross-sectional and non-experimental of correlational type. The study population consisted of 2,588 students, distributed by sex in 63.3% women and 36.7% men. The results obtained, according to the calculated statistics, revealed differences by sex, secondary education modality, regional center and age of the participants. The scores were compared through the Student T test and analysis of variance. To compare the scores of the percentiles of the Spanish scale and the one constructed in this study, a subsample of 1,987 subjects of both sexes was taken and the Pearson correlation coefficient was calculated, obtaining statistically significant differences in the five PMA subtests.

On the other hand, Wu (2015) from the University of Lima investigated the psychometric properties of the PMA test in first to fifth grade students from two mixed schools, one public and one private. The sample included 457 students, 177 from a state school and 280 from a private school. The results showed statistically significant differences according to management, grade and gender in the scores of the test. In addition, an increase in the scores of the spatial factors, reasoning and verbal fluency was found in an evolutionary analysis.

No further research was found on the validation of the scales of the test; however, studies related to the instrument were found, which are detailed below.

Astonitas (2016), from the Señor de Sipán University in Peru, carried out research to analyze the relationship between mental aptitudes and behavioral problems. The study population consisted of 4th, 5th and 6th grade students from the I. E. N. Mariano Melgar Valdivieso in Chiclayo, totaling 306 students. This correlational research sought to understand the relationship between two variables: mental aptitudes and behavioral problems. The instruments applied were Thurstone's PMA test and the ACE (Behavior Change). The results revealed that there is no relationship between mental aptitudes and behavioral problems, that is, the variables must be intervened independently, since students can share tasks or

activities, but not necessarily knowledge and their behaviors are not related to their mental aptitudes.

Another valuable contribution is from Cruz (2015) who carried out a correlational cross-sectional study to examine the relationship between learning styles and primary mental aptitudes in fourth grade students of secondary education from an educational institution in Chiclayo, Peru. The sample included 30 students from the Academic Recovery Program. The David Kolb Learning Styles Inventory and the Thurstone PMA test were applied. The results indicated a significant relationship between learning style and primary mental abilities (verbal comprehension, spatial comprehension, reasoning, numerical calculation and verbal fluency) in the students of the program.

Now, to better understand this problem, it is relevant to address the concepts that encompass the purpose of the research, which will allow the study to be approached from a theoretical basis.

First approaches to intelligence

History shows that the issue related to intelligence, in ancient times and in the Middle Ages, was not well determined and delimited, which is why experts were always looking for a way to delimit intelligence. Among the first attempts to measure it is Binet, who is known as the creator of the test to measure intelligence. Alfred Binet was commissioned by the French government to find a way to select students who had the ability to attend French schools. Binet designed a series of situations and problems that posed a gradual increase in difficulty. In this way, he suggested a sequence that gave rise to the concept of "mental age" as opposed to "chronological age". These tests initially had a practical function and were applied to various educational contexts (Ardila, 2011).

Based on his study, an attempt was made to correlate the results with the students' academic skills in order to observe their academic success. In a short time, his discovery became known as the intelligence test and its measurement as the Intelligence Quotient. Like other Parisian fads, the IQ quickly reached the United States, where it enjoyed modest success until the First World War. Since then, the IQ test has appeared as the greatest success of psychologists, a genuinely useful scientific tool. Thus, the first psychometric psychological tests for measuring intelligence were created by the American psychologist James McKeen Cattel. According to Martin (2007), the psychologist first had the idea about the concept of mental testing, applying it to the measurement of sensory capacities. But it was not until Alfred Binet that he began to develop scales for measuring intellectual capacities. Binet, together with his assistant Theodore Simon, created the first intelligence scale based on functional criteria and also introduced questions about judgment, comprehension and reasoning, this regarding the first version of the scale.

The multifactor theory

Thurstone's multifactor theory is one of the most relevant in the psychology of intelligence. Thurstone was the first researcher to develop a model of independent primary abilities which has had a great influence on the way cognitive abilities are understood and evaluated and has led to the development of tests that evaluate specific abilities instead of a single intelligence score. Thus, the author (Thurstone, 1938; 1947) identified seven primary mental abilities that constitute intelligence, these are the following:

Verbal factor

It is the ability to understand and work with words and meanings. It includes the ability to read and understand texts, as well as understand and use spoken language. Also, it permits to understand news articles, books and speeches. Verbal comprehension is fundamental for learning and effective communication (Carroll, 1993).

Verbal fluency factor

This is the ability to produce words quickly and easily. It involves generating words under certain constraints, such as finding words that begin with a specific letter, games such as Scrabble, or tasks such as naming as many animals as possible in one minute. Verbal fluency is associated with creative writing and oral communication skills (Thurstone, 1938).

Numerical factor

It is the ability to handle and understand numbers and basic mathematical operations. It includes the ability to perform calculations quickly and accurately, such as addition, subtraction, multiplication, and division. Numerical ability is crucial for success in disciplines related to mathematics and science (Thurstone, 1947).

Spatial factor

It is the ability to visualize and manipulate objects in space. Includes the ability to understand and remember spatial relationships between objects, such as solving three-dimensional puzzles or interpreting maps and diagrams. Spatial ability is important in fields such as architecture, engineering, and the visual arts (Lohman, 1988).

Associative memory factor

It is the ability to remember pairs of unrelated items. It involves the ability to memorize and remember specific associations, i.e. remembering that the word “dog” is associated with the image of a dog in a list of words and images. Associative memory is essential for learning new vocabulary and concepts (Thurstone, 1938).

Perceptual speed factor

It is the ability to quickly recognize visual patterns and details. It involves speed and accuracy in tasks that require visual discrimination of details, such as finding differences in similar images or quickly identifying letters and numbers. Perceptual speed is essential for tasks that require rapid processing of visual information (Carroll, 1993).

Inductive reasoning factor

It is the ability to identify patterns and logical relationships in information. It includes the ability to form generalizations from specific data, such as solving problems involving numerical series or finding the rule that governs a sequence of geometric figures. Inductive reasoning is crucial for scientific thinking and solving complex problems (Thurstone, 1947).

Primary mental abilities test

The Primary Abilities Theory, suggested by Thurstone, provides an alternative multifactorial model of cognitive abilities that can be measured by the Primary Mental Abilities Test (Thurstone L., 1967).

Characteristics of the test

The battery consists of five tests that detect five factors in isolation that the author called Primary Mental Abilities and that he identified with the following names:

Factor V: Verbal comprehension

This is the ability to understand ideas expressed in words. It is needed in activities in which problems must be understood through the written or spoken word. It is a very convenient ability for learning languages, shorthand, history, science and, in general, for being a good student. The verbal comprehension factor is associated with knowledge related to language in all its manifestations; vocabulary, semantics, syntax or pragmatics. This skill is essential for all types of activities in which information is obtained through reading or hearing spoken language, allowing for the establishment of excellent interpersonal relationships. (Thurstone, 1941, p. 23) The test consists of 50 elements or multiple choice problems; the subject must find the synonyms of the proposed words.

Factor E: Spatial

This is the ability to visualize objects in two or three dimensions by forming a mental model of the world. People with this ability have the ability to make a good artistic appreciation or build puzzles. It is related to the functioning of the right hemisphere and the tendency to give creative responses (Thurstone & Thurstone, 1941, p. 23). The test consists of 20 elements, each of which presents a flat geometric model and six similar figures; the subject must determine which of the latter, presented in different positions, match the model, even if they have been rotated on the same plane.

Factor R: Logical reasoning

This is the ability to solve logical problems, foresee and plan. Various investigations show that reasoning involves two different capacities: one, inductive, the ability to infer the general rule from particular cases, and another, deductive, the ability to extract the logical conclusion from the premises. The test is an exploration of both aptitudes; it consists of 30 elements where the subject must determine which letter continues in a series of them, once the logical connection that links them has been found out.

Factor N: Numerical understanding

It is the ability to handle numbers, to quickly and correctly solve simply quantitative problems. The ability to calculate is useful for academic success in arithmetic, statistics and all kinds of disciplines in which mathematical calculation is a main component. The test consists of 70 elements or problems where the subject must determine whether the sum of four two-digit numbers is correct or incorrect. The main activities they carry out are the handling of numbers applied to quickly and easily solve simple quantitative problems, as well as their grouping and classification (Thurstone, 1941, p. 24).

Factor F: Verbal fluency

It is the ability to speak and write easily. People who have words that come to mind quickly and fluently have the F factor in a high degree. To explore this factor, the test asks subjects to write words that begin with a certain letter. This aptitude can be defined as a person's ability to express coherent and structured verbal sequences quickly and naturally. It is the ability to speak easily in front of a group of people through expository techniques, group debates, etc. These people are also characterized by having the ability to write books or draft any type of document. Some of the people who possess this ability are writers, poets, among others (Thurstone, 1941, p. 27).

General application rules

The test is made up of five evaluations, each of which consists of two parts: understanding of the exercises and execution. The first part includes instructions that must be understood correctly, while the second part is the test itself. The examiner must read aloud each of the introductory parts of each evaluation, making sure that the participants pay attention in complete silence. After reading, additional examples are provided to facilitate better understanding before the test is administered. During its administration, different set times are implemented for each assessment, covering both the instructions and the execution of the test.

Initial instructions for PMA administration

Standardized administration

The PMA test should be administered in a standardized manner for all examinees, strictly following the instructions in the manual. This includes the time allotted for each section and the conditions under which the tasks are to be performed. “Standardization in test administration is crucial to the comparability of results among different individuals and groups” (Thurstone & Thurstone, 1941, p. 30).

Clarity

Instructions should be clear and complete. It is crucial that examinees understand how to answer the questions and what is expected of them.

Pre-Test questions

Before beginning, participants should be allowed to ask questions to clarify any questions about the testing process.

Timing

Each section of the PMA test has a specific time limit. The administrator should use a stopwatch to ensure that all participants have the same amount of time to complete each section. Time warnings should be given, for example, when there are 5 and 1 minute(s) left, so that examinees can manage their time effectively.

Supervision

The administrator must be present at all times to supervise the test, answer questions, and ensure that instructions are followed correctly. A controlled, cheat-free environment must be maintained. Participants must be supervised to prevent any attempt at cheating.

Now, once the theoretical foundations that were taken into account for the development of this study have been described, it is relevant to appreciate the method that was used for the collection and analysis of the data, which are shown below in the method.

The research was carried out from a quantitative approach, with a statistical analysis of the data obtained. The design is non-experimental, which implies that the data obtained were not altered and the type of research is descriptive. The population of this research is made up of fifth and sixth grade high school students from the educational units of the city of Achacachi: U.E. Simón Bolívar, U.E. José Antonio Plancarte, U.E. Don Bosco de Villa Lealtad, U.E. Omasuyos (secondary), U.E. Mariscal Andrés de Santa Cruz, U.E. Las Américas and U.E. Bautista Saavedra. In total, 377 students were registered, of which 186 are male and 191 are female, with ages ranging from 15 to 18 years. This specific population allows a detailed evaluation of the degree of validity of the PMA test in a diverse educational context.

The techniques used for data collection in the research include surveys and experiments. The instrument used was the PMA test, which was applied to seven educational units in the municipality of Achacachi with the objective of describing the degree of validity and thus subsequently making comparisons regarding the scores obtained locally with international scores.

For data collection, a study was conducted to evaluate an instrument for measuring primary mental aptitudes in fifth and sixth grade high school students, and the test was validated through an expert evaluation. Then, permission was requested from the district authorities to apply the test in different educational institutions. Once authorization was obtained, the date and time of the application were coordinated with each school. The test was administered collectively to the students, following the instrument instructions. The data obtained were processed in the SPSS software to perform validity, reliability, and descriptive analyses.

Cronbach's alpha coefficient was calculated to determine the internal instrument consistency. Finally, the results were reviewed. The most representative ones are described below.

RESULTS

Table 1 presents the content validation carried out by experts, aimed at obtaining a degree of validity for each item that makes up the test.

Table 1. Content validation by judges

Factor	Item	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Total
	6	1	1	0	1	0	0,60
	7	1	1	0	1	0	0,60
Factor v	9	1	1	0	1	1	0,80
	12	1	1	0	1	1	0,80
	13	1	0	1	1	1	0,80
	16	1	1	0	1	1	0,80
	27	1	1	0	1	1	0,80
	28	1	1	0	1	1	0,80
	29	1	1	0	1	1	0,80
	40	1	0	0	1	1	0,60
	6	1	0	1	1	1	0,80
Factor E Factor R Factor N	6	1	0	1	1	1	0,80
	2	1	1	0	1	1	0,80
	3	1	1	0	1	1	0,80
	4	1	1	0	1	1	0,80
	8	1	1	0	1	1	0,80
	10	1	1	0	1	1	0,80
	12	1	1	0	1	1	0,80
	14	1	1	0	1	1	0,80
	17	1	1	0	1	1	0,80
	18	1	1	0	1	1	0,80
	19	1	1	0	1	1	0,80

V aiken 0,93

Table 1 highlights the items with low scores for each factor, where each judge rated them on a scale of 0 to 1, where 0 indicates that the item is bad and 1 indicates that it is good. In this case, the primary mental aptitude test was evaluated.

The average Aiken V coefficient obtained is 0.93, which indicates that the test has excellent validity.

For the validation of the instrument's construct, the Cronbach alpha coefficient shown below was used.

Table 2. *Cronbach's alpha of the total score*

Score	Number of elements
0,909	117

Note: Own elaboration

In this regard, Table 2 shows the result of the score obtained from Cronbach's alpha, where the 117 elements were taken into account. To obtain the result, the SPSS program was used. As can be seen, the value of Cronbach's alpha is 0.909.

Regarding the differences between the international scales and the local scale, the table below presents, according to the school grade and test factors, the comparisons of the scores obtained according to the percentiles established taking into account the Spanish scale, the Lima scale and the local scale.

Table 3. Differences between the scales

Categoría	f	%	f	%	f	%
Muy bajo (1-2)	403	96%	10	2%	9	2%
bajo (3-14)	17	4%	70	17%	39	9%
Normal bajo (15-34)	1	0%	125	30%	87	21%
Promedio (35-69)	0	0%	139	33%	151	36%
Normal alto (70-89)	0	0%	67	16%	87	21%
Alto (90-97)	0	0%	8	2%	38	9%
Muy alto (98-99)	0	0%	2	0%	10	2%
Total	421	100%	421	100%	421	100%

Note: Own elaboration

As it can be seen in Table 3, the difference between the scales indicates that, according to the Spanish scale, 96% of the students are in the Very Low category and the remaining 4% are in the Low category. However, on the Lima scale, 2% correspond to Very Low, 17% Low, 30% Low-normal, 33% Average, 16% High-normal and 2% High. On the other hand, according to the local scale, 2% are in the Very Low scale, 9% Low, 21% Low-normal, 36% Average, 21% High-normal, 9% High and 2% Very High.

Now, to review the normative values of the PMA test, the percentile values of all the factors are presented, as well as the total, in intervals of five according to the school grade of the population that participated in the research. In addition, a general categorization of the percentile ranges of the test is provided.

Table 4. *Publications by country on pedagogical support in teaching competence*

Rate	Category	Description
1	Very high	If the score is equal to or less than the 2nd percentile.
2	Low	If the score is equal to or greater than the 3rd percentile. If the score is equal to or less than the 14th percentile.
3	Low normal	If the score is equal to or greater than the 15th percentile. If the score is equal to or less than the 34th percentile.
4	Average normal	If the score is equal to or greater than the 35th percentile. If the score is equal to or less than the 69th percentile.
5	High normal	If the score is equal to or greater than the 70th percentile. If the score is equal to or less than the 89th percentile.
6	Alto	If the score is equal to or greater than the 90th percentile. If the score is equal to or less than the 97th percentile.
7	Muy alto	If the score is greater than or equal to the 98th percentile.

Table 4 shows the percentiles and statistical distribution of the fifth grade in secondary school. When interpreting the percentiles, it is established that a total score of 2 or less corresponds to a very low category. Scores between 3 and 14 are categorized as low, while those between 15 and 33 are considered low normal. On the other hand, scores from 35 to 69 belong to the average normal category, from 70 to 89 to high normal, and from 90 to 97 to high. Finally, scores of 98 or more are classified as very high.

Table 5. *Content validation by judges*

Factor	Item	Factor V	Factor E	Factor R	Factor N	Factor F	Total
	1	3	2	1	0	20	52
	2	5	3	1	0	21	54
	3	6	3	1	1	21	55
	4	6	3	2	2	22	56
	5	6	4	2	2	22	58
	10	7	4	3	4	23	61
	15	8	5	3	4	25	66
	20	9	6	3	5	27	68
	25	9	6	3	5	29	71

Factor	Item	Factor V	Factor E	Factor R	Factor N	Factor F	Total
	30	10	7	4	6	30	72
	35	10	7	4	6	31	75
	40	11	9	5	7	32	78
	45	11	10	5	8	32	83
	50	12	11	6	8	34	85
	55	12	12	6	9	35	90
	60	13	14	7	9	36	93
	65	13	15	7	10	38	98
	70	14	17	8	11	39	102
	75	15	19	9	11	41	105
	80	16	21	10	12	44	112
	85	18	22	11	13	46	118
	90	19	25	13	14	52	126
	95	23	30	15	17	56	138
	96	24	32	16	18	58	145
	97	25	35	17	21	61	156
	98	26	41	17	22	64	160
	99	32	41	20	27	73	168

According to table 5, the distribution of the percentiles of the 5th grade of secondary school is observed as follows: in the 1st percentile the total is 52, in the 2nd it is 54, in the 3rd it is 55, in the 4th it is 56, in the 5th it is 58, in the 10th it is 61, in the 15th it is 66, in the 20th it is 68, in the 25th it is 71, in the 30th it is 72, in the 35th it is 75, in the 40th it is 78, in the 45th it is 83, in the 50th it is 85, in the 55th it is 90, in the 60th it is 93, in the 65th it is 98, in the 70th it is 102, in the 75th it is 105, in the 80th it is 108. In the 1980s, the score is 112, in the 1985s it is 118, in the 1990s it is 126, in the 1995s it is 138, in the 1996s it is 145, in the 1997s it is 156, in the 1998s it is 160 and in the 1999s it is 168. This and other aspects are developed in more deeply in the discussion.

DISCUSSION

The experts consulted for the content validation made observations such as: in regard to the instruments, it is necessary to verify the grammar and reformulate the words so that the population understands the instructions. They agree that the instrument is very well structured to measure various types of intelligence, however, sociocultural factors, time factor and mood of the person being evaluated could be considered, since this can cause a certain state of anxiety in trying to respond in the shortest possible time and thus alter the final result of the test. In addition, they recommend clearly specifying the time assigned to solve each factor. These modifications are intended to facilitate the understanding of the terms and ensure that they are not complicated for the participants.

On the other hand, for the validation of the instrument's construct, Cronbach's alpha coefficient was used. Martínez (2020) mentions that Cronbach's alpha is a coefficient that varies between 0 and 1; the closer it is to the number 1, the greater the reliability of the instrument. As it can be seen in Table 2, the value of Cronbach's alpha is .909, so it is in an excellent classification, in this way the instrument turns out to be reliable for the local level.

Regarding the validation of scales, in 5th grade students there is a wide variation in the percentile ranges between the local scale and the Lima scale in comparison with the Spanish scale, evidencing the different standards established by each one. When considering the total score of the test, which groups the scores of the five factors evaluated, a significant discrepancy is highlighted between the direct score of the local population compared to the Spanish scale. In contrast, the comparison with the Lima scale does not reveal such a marked difference in the total score. When analyzing these scores from Thurstone's multifactorial theory (1916), which maintains that intelligence, is not a single entity but a combination of independent mental factors and capacities, it can be observed that the results show the diverse abilities presented by each subject in relation to the five factors evaluated. This is reflected in the variable scores between the different factors, highlighting significant differences in the abilities measured by each one. For 6th grade students, comparisons of the total direct scores of the test between different scales reveal significant differences in the corresponding percentiles.

It is observed that to obtain a fiftieth percentile, there is a difference of four points with the Lima scale and one hundred and fifty-eight points with the Spanish scale. Likewise, to reach a high percentile of ninety-five, a difference of ten points with the Lima scale and one hundred and ninety-three points with the Spanish scale is required. In addition, to reach a minimum percentile of five, one hundred and five additional points are needed to the local score on the Spanish scale and three additional points on the Lima scale.

These differences in percentile scores underline a wide variation in the percentile ranges between the local scale and the Lima scale compared to the Spanish scale, evidencing the different standards of each. Therefore, when reviewing the normative values of the primary mental abilities test, the standard deviation of 31 reveals that most of the scores range between 78 and 140 points, with a variance of 961, which reflects a considerable dispersion according to the mean value obtained. Therefore, when validating the PMA test, significant differences are observed with the scales used in the local context, especially with the Spanish scale that is part of the test manual. Although there is little similarity with the Lima scale, the local scales obtained with the population evaluated present differences. Therefore, new scores will be established for the local scale.

CONCLUSIONS

The conclusions of this research are presented below taking into consideration the specific objectives established above. To determine the validity of the content of the test, experts were accessed who rated the test according to their knowledge and experience. Therefore, to be considered valid, the test was carried out in two ways: through the validity index and the experts' agreement regarding the test items. The experts considered the test statements to be understandable for the target population. Likewise, the validity index is shown using Aiken's V method, obtaining a score of 0.93. Consequently, it is concluded that the degree of content validity of the items that make up the PMA test was achieved.

To determine the construct validity of the test, the Cronbach's alpha procedure was used, obtaining a score of 0.909. This result allows us to conclude that the test has validity in the "excellent" category, since the items that make up this test measure intelligence through different factors. In this way, it is confirmed that the test measures what it was intended to measure. Likewise, the Cronbach alpha of each factor was obtained, which also shows the high validity index of the test for each factor evaluated.

Regarding the objective of comparing percentiles obtained locally with international standards (Lima and Spain) by grades of schooling, the results obtained from this process in the fifth grade of schooling indicate that there is greater similarity with the Lima scale. However, a significant difference is observed in the scores of the spatial and numerical factors, as well as in the total scores of the test. On the other hand, with the Spanish scale, there is a large difference in the direct scores for each percentile, placing them in the low category according to the percentiles obtained for the majority of the population. Likewise, for the sixth grade of secondary school, the scores of the factors evaluated are not very similar to the Lima scale, showing differences of 1 to 5 points according to the statistical data obtained. This allows us to conclude that the diagnosis from this test is being affected by the scale used.

Finally, on the basis of the normative values of the primary mental aptitude test, new scores were established at the local level with the total of the examinees for each factor and by school grade. In this way, the subjects were classified by school grade level for the scores of the primary mental aptitude test for fifth and sixth year of secondary school. According to the distribution of the total scores obtained, it is evident that the extreme scores are distributed from a minimum of 49 to a maximum of 231 in the entire population examined.

REFERENCES

Aiken, L. (2003). Tests psicológicos y evaluación. (11ª ed.). México DF.: Pearson Educación.

Ardila, R. (2011). Inteligencia. ¿Qué sabemos y qué nos falta por investigar?. Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales, 35(134), 97-103.

Astonitas Vásquez, M. M. (2016). Aptitudes mentales y problemas conductuales en niños de una institución educativa de chiclayo, 2016.

Binet, A., & Simon, T. (1905). Novedades en la selección de diagnostico del intelecto. L'Année Psychologique.

Binet, A., & Simon, T. (1908). Le développement de l'intelligence chez les enfants L'Année Psychologique.

Carroll, JB (1993). Habilidades cognitivas humanas: un estudio de estudios analíticos factoriales. Prensa de la Universidad de Cambridge.

Cruz Miranda, J. D. (2015). Estilos de aprendizaje y aptitudes mentales primarias en estudiantes participantes del programa de recuperación académica de una Institución Estatal de Chiclayo, 2015.

Lohman, DF (1988). Habilidades espaciales como rasgos, procesos y conocimientos. Avances en la psicología de la inteligencia humana.

Martín Jorge, M. L. (2007). Análisis histórico y conceptual de las relaciones entre la inteligencia y la razón.

Martínez, J. I.(2020). Análisis de validez de constructo del instrumento: "Enfoque Directivo en la Gestión para Resultados en la Sociedad del Conocimiento". Revista de Ciencias de la Administración y Economía.

Recarte, L. M. M. (2016). Baremos del test de aptitudes mentales primarias para universitarios hondureños. Revista Ciencia y Tecnología, 198-227.

Spearman, C. (1904). "Inteligencia general", objetivamente determinada y medida. Revista Estadounidense de Psicología, 15 (2), 201-292.

Spearman, C. (1927). Las habilidades del hombre. Macmillan.

Thurstone, L. (1921). ItsInteligencia y su medición. Journal of Educational Psychology. Recuperado de https:// www.brocku.ca/MeadProject/Thurstone/ Thurstone_1921.html

Thurstone, L. L. (1938). Primary mental abilities. University of Chicago Press.

Thurstone, LL (1938). Habilidades mentales primarias. Prensa de la Universidad de Chicago.

Thurstone, LL (1947). Análisis multifactorial. Prensa de la Universidad de Chicago.

Wu, V. M. (2015). Propiedades psicométricas de la prueba de aptitudes mentales primarias y comparación de las mismas en estudiantes de secundaria según tipo de gestión, grado y sexo. Lima.