Visual Selector Functional Aptitude and Achievement Levels in Communication and Mathematics in Peruvian First Grade Primary School Children

Alex Grajeda-Montalvo[1], Beder Bocanegra-Vilcamango[2], Juan Danielli-Roca[3], María Fernández-Celis[4], Alberto Quintana-Peña[5], Ynes Solano-Guillen[6], Raquel Tello-Flores[7], Shirley Ore-Sandoval[8], Juan Pérez-Bautista[9]

[1]Professor at the Faculty of Psychology of the Universidad Nacional Mayor de San Marcos. Corresponding author agrajedam@unmsm.edu.pe. https://orcid.org/0000-0001-5972-2639
[2]Professor at the Faculty of Historical-Social Sciences and Education of the Universidad Nacional Pedro Ruíz Gallo. bbocanegra@unpprg.edu. pe https://orcid.org/0000-0002-4157-265X
[3]Professor at the Faculty of Psychology of the Universidad Nacional Mayor de San Marcos. jdaniellir@unmsm.edu.pe, https://orcid.org/0000-0001-5453-1956
[4]Professor at the Faculty of Historical-Social Sciences and Education of the Universidad Nacional Pedro Ruíz Gallo. mfernandezc@unprg.edu.pe, https://orcid.org/0000-0002-0248-5852
[5]Professor at the Faculty of Psychology of the Universidad Nacional Mayor de San Marcos. aquintanap@unmsm.edu.pe, https://orcid.org/0000-0003-4305-137X
[6]Professor at the Faculty of Psychology of the Universidad Nacional Mayor de San Marcos. https://orcid.org/0000-0001-5599-3271. ysolanog@unmsm.edu.pe
[7]Professor at the Faculty of Historical-Social Sciences and Education of the Universidad Nacional Pedro Ruíz Gallo. rtellof@unprg.edu.pe, https://orcid.org/0000-0001-8060-2017
[8]Professor at the Professional School of Psychology of the Universidad César Vallejo. sore@ucvvirtual.edu.pe , https://orcid.org/0000-0002-9026-3052.
[9]Professor at the Professional School of Psychology of the Universidad César Vallejo. X199003489@ucvvirtual.edu.pe, https://orcid.org/0000-0001-7106-8991,

The relationship between visual selector functional aptitude [VSFA] and achievement levels in communication and mathematics in Peruvian children in first grade of primary school has been investigated. For this, 139 students were selected probabilistically by proportional allocation, whose ages fluctuated between 5 and 7 years, to whom the Visual Selective Functional Aptitude Test was applied, which was correlated with the learning achievements in mathematics and language provided. by teachers and directors of the only two state schools in the Jesús María district that have first grade of primary school. The results show that men and women maintain the same levels of school achievement and also the average rank in the VSFA does not show significant differences. On the other hand, the relationships between the dimensions of the VSFA and learning achievements in language and mathematics are direct and significant. Finally, direct and significant correlations with a medium effect size have been found between the VSFA and the levels of learning achievements in language and mathematics.

Keywords: Visual selector functional aptitude, level of learning achievement, state school, correlation, significant differences.

1. Introduction

Formal primary education assumes learning in language and mathematics as an element of utmost importance, generating from the stages prior to the primary level the preparation that must strengthen necessary skills for future learning. In Peru, 6 years is the average age of entry to first grade and the beginning of greater demands for learning, observing problems in the teaching-learning processes with a greater incidence in children with poor initial education, disabilities or different abilities. Timely intervention is necessary or there is the possibility of developing disorders that affect writing and calculation. These so-called specific learning disorders [SLD] are considered neurodevelopmental disorders, which affect 5% of students in the USA, and between 2 and 10% in other countries, and it is also reported that around 40% of children with these problems drop out of school (American Psychiatric Association [APA] 2014). In the same sense, Bosch et al. (2022) report that SLD are present in between 5 and 17% of the Spanish school population. Grajeda (2018) maintains that at the base of SLD there are different psychological dispositions also called prerequisite behaviors for reading and writing, such as attention, memory, fine motor coordination, perception, auditory discrimination, visual selector functional aptitude (VSFA), among others. others.

The VSFA is found within one of the five levels of interbehavior, which is called selector interbehavior. For Ribes and López (1985), it is a functional level that allows us to respond based on sequential changes in contingency relationships, due to the presence of new characteristics that are added to previously learned elements.

The observer's responses are a function of the relational characteristics between the stimulus objects. These would be operant responses that are executed based on some fixed or invariant relationship between two or more stimuli. It would then be an interbehavioral level in which people solve with relative ease problems in which it is necessary to identify, point out or choose stimuli from the environment based on similarity or difference. The behaviors involved here would have to do with both mediation and the operation in which elements that have common or different characteristics must be pointed out, identified, chosen, grouped, etc. (Grajeda, 2019, p. 4).

As has been seen above, the theoretical basis of the present study is interbehaviorism, which is proposed as a meta-theory located in the behavioral approach, which considers as the object of study the behavioral segment or psychological event, which is the product of the complex interaction of various factors. The behavioral segment construct is the descriptive unit of psychological events and refers to many factors. The elements that constitute it are: "a) the response function, b) the stimulus function, and c) the interbehavioral medium. The most peripheral: d) the interbehavioral contexts and the interbehavioral history, which includes: e) the reactional biography, and f) the evolution of the stimulus function" (Kantor, 1967, p. 72. In that sense, the visual selector interbehaviors, linguistics and mathematical operations would have to be analyzed and understood interbehaviorally assuming that their changes are observed thanks to this complex interaction of multiple factors.

In Peruvian schools, the learning of reading, writing and calculation is evaluated through written tests and performance during practical tasks according to the expected achievements at each level and school grade. The qualifiers placed at each level are: AD for outstanding achievement; A for achievement achieved; B when the achievement has not yet been achieved and is in process; and C when it is just starting (Ministry of Education [MINEDU], 2018 in Grajeda and Cangahuala, 2019). Likewise, MINEDU (2023), when nationally evaluating learning achievements through the National Survey of Learning Achievements [NSLA], proposes the following qualifiers: satisfactory, in process, at the beginning and prior to the beginning. The results of the NSLA show that in second grade of primary school, women show better achievement than men in language. On the contrary, men show better achievement in mathematics.

With respect to the relationship between the VSFA and the levels of achievement in communication and mathematics, national and international research has been traced and only that of López (2021) has been found, who, working with 52 first-grade primary school students from a Lima school, did not found a significant correlation between the VSFA and performance in comprehensive communication, with Rho = -.128 even being negative with a small effect size that reaches at least 1.6% of the participants. Likewise, they show that there is no significant difference according to sex and that the effect size [ES] falls within the small effect range, being favorable to women (Cohen, 1981).

On the other hand, Ore (2021) investigates the levels of VSFA in first grade children from schools in Ayacucho, a department in the Peruvian mountains. The author uses a computerized version of the Grajeda Visual Selective Aptitude Test, 2018. The sample consisted of 130 schoolchildren, from two Ayacucho schools, of which 75 were women and 55 men. In this study, no significant differences were found according to sex. The ES was not calculated, however if we perform the calculation it would be equal to .22, falling in the range of a small effect favorable to women.

The absence of research on these variables allows us to consider it necessary to fill this gap by investigating: What are the relationships between the VSFA and the levels of achievement in communication and mathematics in first grade primary school children?

Objetives

To achieve this problem, the general objective is: to determine the relationships between the

VSFA and the levels of achievement in language and mathematics in first grade primary school children and as specific objectives: 1. determine if there are significant differences in the VSFA according to the sex. 2. determine if there are significant differences in the levels of communication and mathematics achievement according to sex. 3. Describe the correlations between the dimensions of the VSFA and achievement levels in communication and mathematics.

2. Méthod

The present research is conceived of a basic and correlational type since it will provide new knowledge about the relationship between VSFA and learning achievements (Sánchez and Reyes, 2015). Taking into account Ato et al. (2013, p 1047 - 1049) is an empirical investigation, under a comparative associative strategy, with a transversal approach and natural group design. Furthermore, taking into account Kerlinger and Lee (1992, p. 420), it is a non-experimental study with a cross-sectional design since the variables will not be manipulated and the data are collected at the same time.

Population and study simple

The students enrolled in the first grade of primary school in Jesús María have been 153, distributed in two schools, one with only women (89) and the other school composed of 46 boys and 18 girls (MINEDU, 2018). Whose ages fluctuated between 5 and 7 years. From here, a sample of 139 was obtained under the formula for finite populations of Abad and Servin (1981) with a margin of error of .3 and confidence level of .97. The sampling used has been probabilistic by proportional allocation, respecting the population proportions of each school. The mean age was 5.9 and the standard deviation was .60.

Study tolos

The Visual Selective Aptitude Test [VSAT] was used (Grajeda, 2018). The general objective of which is to determine the level of visual selection aptitude. It can be applied individually to first grade primary school children aged between 5 and 7 years. The test is composed of 12 items in two dimensions: intramodal transfer (first 7 items) and extramodal transfer (last 5 items). The validity obtained by expert judgment is very high, reaching .99. Likewise, the construct validity by corrected test dimension correlation has been .69 and .79. Regarding reliability, this was obtained through the split half method, being equal to .72, being considered high according to Pallela and Martins (2012, p 169).

On the other hand, with respect to the levels of achievement, these were obtained from the grade records that were provided by the teachers and directors of the sampled educational institutions. These qualifiers are: AD for outstanding achievement; A for achievement achieved; B when the achievement has not yet been achieved and is in process; and C when it is just starting up.

Data Analysis

The results of the application of the VSAT and the learning achievement qualifiers were placed in a spreadsheet and subsequently processed in SPSS 25. Non-parametric tests were used since the Kolmogorov-Smirnov score distribution test and Shapiro-Wilk analysis (table 1) showed

significance levels less than .05, which indicates that they are abnormally distributed. Therefore, to study mean differences, the Mann Whitney U was used and Spearman's Rho was used in correlations.

Table 1. Normality tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Estadístico	gl	Sig.	Estadístico	gl	Sig.
VSFA	,119	139	,000	,972	139	,005
Language	,310	139	,000	,744	139	,000
Mathematics	,291	139	,000	,763	139	,000
Intramodal	,199	139	,000	,905	139	,000
Extramodal	,201	139	,000	,858	139	,000

3. Results and Discussion

Table 2. Significant differences in VSFA according to sex

	Sex	n	Average range
	Men	42	65,67
	Whomen	97	71,88
U de Mann-Whitney		1855,000	
W de Wilcoxon		2758,000	
Z		-,841	
Sig. asintót. (bilateral)		,400	
d		0.142	

Table 2 shows that there are no significant differences in the VSFA in boys and girls. Likewise, when calculating the effect size [ES], the calculated Cohen's d falls in the range of no effect. The result therefore indicates that boys and girls have similar average ranges. A similar result is shown by López (2021) and Ore (2021). Both authors do not find significant differences, however, the TE calculation states that it is small and favorable to women. The three investigations agree that there are no significant differences according to sex, which would indicate to a certain extent that both variables are distributed similarly in men and women and that they also act independently (Newbold, et al., 2008).

Table 3. Significant differences in language and mathematics according to sex

	Sex	n	Average range
Language	Men	42	54,79
	Whomen	97	76,59
Mathematics	Men	42	55,54
	Whomen	97	76,26
	Language	Mathematics	
U de Mann-Whitney	1398,000	1429,500	
W de Wilcoxon	2301,000	2332,500	
Z	-3,279	-3,083	
Sig. asintót. (bilateral)	,001	,002	
d	.513	.486	

Table 3 shows us that there are significant differences in the levels of learning achievement, being greater in women. Likewise, the calculated ES falls in the intermediate range for both cases. This would indicate that in at least 51% and 49% of cases, women have better achievement in learning language and mathematics compared to men. No recent studies have

been reported in first grade to make the respective comparisons, however, MINEDU (2023) has reported from the results of its national survey to evaluate learning achievements that, with respect to second grade of primary school, which is the closest to first grade, it is the women who excel in language and the men in mathematics. The difference with said research may be due both to the size of the sample, since the national survey covers all of Perú, and, on the other hand, to the age group and school grade, since in the present research they are smaller than in those of the NSLA.

Table 4. Correlations between the dimensions of the VSFA and achievement levels in language and mathematics

		Language	Mathematics
Intramodal	Rho	,358**	,293**
	r^2	,13	,09
	Sig. (bilateral)	,000	,000
	n	139	139
Extramodal	Rho	,282**	,183*
	r^2	,08	,03
	Sig. (bilateral)	,001	,031
	n	139	139

As observed in Table 4, positive and significant correlations have been found between the dimensions of the VSFA and learning achievements in language and mathematics, with the relationships of the intramodal dimension being greater and with a medium effect size with language and mathematics. On the other hand, the extramodal dimension presents small effect sizes with both learning achievements in the subjects (Cohen, 1981). No previous studies have been found to make comparisons. However, the findings would show us that at least in 13% of those evaluated there is a covariation between the intramodal dimension and language and in 9% with mathematics. These percentages are lower between the extramodal dimension and language and mathematics, only demonstrating that the covariation would reach 8% and 3% respectively.

Table 5. Relationships between VSFA and achievement levels with language and mathematics

		Language	Mathematics
Visual Selector Functional Aptitude	Rho	,407**	,321**
	r^2	,17	,10
	Sig. (bilateral)	,000	,000
	n	139	139

Finally, table 5 shows positive and significant correlations between the VSFA and learning achievements in language and mathematics, considering a medium ES for both cases (Cohen, 1981). No previous studies have been found to make comparisons. However, the findings would show us that at least in 17% of those evaluated there is a covariation between the VSFA with language and in 10% with mathematics. This data indicates the importance that should be given to the development of the VSFA in relation to the learning of mathematics and language, therefore planning activities that promote its development from the stages prior to the beginning of the primary level of studies.

Taking into account interbehavioral psychology (Kantor, 1967), it is necessary to analyze the multifactorial interaction in psychological events which the function of the response is not

explained only by the function of the stimulus but also by the contingency interaction in the interbehavioral environment, the various contexts of interbehavior, the interbehavioral historical development that is made up of the subject's reaction biography and how the function of the stimulus has progressed throughout the experiences of the subject and their environment. In summary, the VSFA would constitute one of the dispositional factors, it is part of the interbehavioral history necessary for the learning of language and mathematics.

4. Conclusions

No significant differences have been found according to sex in the VSFA in first grade primary school children from state schools in the Jesús María district.

No significant differences have been found according to sex in the levels of achievement in language and mathematics in first grade primary school children from state schools in the Jesús María district.

There is a direct, significant correlation with a medium ES between the intramodal dimension of the VSFA and the levels of achievement in language and mathematics.

There is a direct, significant correlation with a small ES between the extramodal dimension of the VSFA and the levels of achievement in language and mathematics.

There is a direct and significant correlation with a medium ES between the VSFA and achievement levels in language and mathematics.

References
1. Abad, A. y Servin, L. (1981). La Técnica del Muestreo. Limusa.
2. Asociación Americana de Psiquiatría (2014). Manual diagnóstico y estadístico de los desórdenes mentales V. Asociación Americana de Psiquiatría.
3. Ato, M., López, J. J., & Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. Anales de Psicología, 29(3), 1038-1059.
4. Bosch, R., Pagerols, M., Rivas, C., Sixto, L., Bricollé, L., Español-Martín, G., … Casas, M. (2022). Neurodevelopmental disorders among Spanish school-age children: prevalence and sociodemographic correlates. Psychological Medicine, 52(14), 3062–3072. doi:10.1017/S0033291720005115
5. Cohen, J. (1988). Statistical power analysis for the behavioral sciences [El poder del análisis estadístico para las ciencias del comportamiento] (2ª ed.). Erlbaum.
6. Grajeda Montalvo, A., & Cangahuala Matos, S. (2019). Percepción de la motivación académica docente y rendimiento académico en estudiantes de sexto de primaria de un distrito limeño. Revista De Investigación En Psicología, 22(1), 79-94. https://doi.org/10.15381/rinvp.v22i1.16583
7. Grajeda, A. (2018). Construcción y validación de un test de aptitud funcional selectora visual en estudiantes de escuelas estatales del primer grado de primaria del distrito de Jesús María, 2018. [Tesis para obtener el grado de Doctor en Psicología, Universidad César Vallejo]. https://repositorio.ucv.edu.pe/handle/20.500.12692/21249
8. Grajeda, A. (2019). La aptitud funcional selectora visual en el marco de la Psicología Interconductual. PsiqueMag, 8(1), 1–7. Recuperado a partir de https://revistas.ucv.edu.pe/index.php/psiquemag/article/view/183

9.   Kantor, J. R. (1967). Psicología interconductual. The Principia Press.
10. Kerlinger, F. & Lee, H. (1992). Investigación del comportamiento. Mc. Graw Hill.
11. López, Z. (2021). Aptitud funcional selectora visual, conducta agresiva y rendimiento en comunicación integral en niños de primer grado de primaria de una I.E.P. en Santa Anita, 2021. [Tesis para obtener el título profesional de Licenciada en Psicología, Universidad César Vallejo]. https://repositorio.ucv.edu.pe/bitstream/handle/20.500.12692/73697/Lopez_ZJA-SD.pdf?sequence=1&isAllowed=y
12. Ministerio de educación del Perú (2018). Estadística de la calidad educativa. https://escale.minedu.gob.pe/
13. Ministerio de educación del Perú (2023). Evaluación nacional de logros de aprendizaje. MINEDU. http://umc.minedu.gob.pe/resultadosenla2023/
14. Ore, S. (2021). Aptitud funcional selectora visual en estudiantes del primer grado de primaria en instituciones educativas del departamento de Ayacucho, 2021. [Tesis para obtener el grado de Magister en Psicología, Universidad César Vallejo]. https://repositorio.ucv.edu.pe/bitstream/handle/20.500.12692/76953/Ore_SSR-SD.pdf?sequence=1&isAllowed=y
15. Newbold, W., Carlson, L & Thorne, B. (2008). Estadística para Administración y Economía. Pearson Educación, S.A.
16. Palella, S. y Martins, F. (2012). Metodología de la investigación cuantitativa. Fedupel.
17. Ribes, E. y López, F. (1985). Teoría de la conducta: Un análisis de campo y paramétrico. Trillas
18. Sánchez, H. y Reyes, C. (2015). Metodología y diseños en la investigación científica. Business Support Aneth.