

THE DRAW-A-MAN TEST AND RAVEN PROGRESSIVE MATRICES PERFORMANCE OF GUATEMALAN BOYS AND LADINO CHILDREN¹

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A comparative psychology of mental development requires the careful examination of children of various ages, and of adults, from a variety of different cultures. We are in the position at the present time of knowing something about intelligence testing and the influence of certain environmental factors. But we are still unable to explain why persons who identify with a particular culture differ in their testing performance from persons who identify with a different culture.

To be able to explain such cultural variations we require two general kinds of information about how individuals in various cultures respond to our standardized tests. First, we must document the full range of variation in human intellectual development under all possible cultural conditions. Second, we must examine the way the testing situation is understood by the subjects themselves, in order to evaluate the significance of the testing performance for the behavior of the individual.

The crucial nature of the latter requirement was recognized as early as 1913 by Rouma working with the Quechua and Aymara Indians of South America (cited by Goodenough and Harris, 1950). He reported, for example, that his instructions involving the term 'up' were misconstrued by his subjects to mean toward the sky, rather than toward the top of the page. In the present study assumptions concerning such matters as privacy, task orientation, and relation to the investigator had to be carefully reexamined in order to adequately understand the obtained results.

Research Objectives. The purpose of the present research were threefold: 1) to assess the intellectual status of two ethnic groups among Guatemalan

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children, utilizing standard measuring instruments, thus allowing both comparison with results from other cultures and comparison with results from other tests with the same Guatemalan children; 2) to advance a comparative psychology of mental development, including exploration of universal, or constant factors, and locally variable factors, along the lines visualized by Werner (1948), Dennis (1957), and others; 3) to explore testing methods in non-Western cultures.

Subjects. The subjects of the present study were children enrolled in a public school located in the department of Totonicapán in the Central Highlands of Guatemala. The school was situated in a town of approximately 14,000 inhabitants and was accessible by bus from two large cities.

The town served as a *cabecera*, or local government center, in a densely populated area. It boasted a beautiful and important church to which delegations of Indians from the surrounding villages came on holy days. There was available in the town a potable water service, electricity, and radio-telegraph communication with the national and international world.

In spite of these advantages, the town was predominantly rural. With the exception of a few Ladino business families, the citizens of the town were commuting farmers, agricultural workers, or part-time farmers who supplemented their incomes with weaving, carpentering, butchering and other skills. Modern health services consisted of monthly or bi-monthly visits by one medical doctor. Sewer service was unavailable.

The significance of the distinction between the Indian and Ladino ethnic groups was borne out in all measures of social and economic variables. Indians had lower incomes, were less well-educated, less well-fed, and received little or no medical care. (Whetten, 1961). The ethnic affiliations of the public school students, as indicated by their teachers, followed the definition based on style of life as developed by Adams (1957).

Ladinos appeared with greater frequency in our subject group than in the general population. In the department of Totonicapán 3.2 per cent of the inhabitants were reported as Ladino in the 1950 census. In our school population approximately 35 percent of the students were identified by their teachers as Ladino. We surmise that our 40 Ladino boys were from lower income families who were pressed by economic circumstances to seek an education at an inferior local school. Ladino girls, by contrast, were apt to be kept near home to go to school regardless of the family resources, since education for them was clearly frosting on the cake and not a serious undertaking. In the case of the 112 Indian boys, it is likely that we encountered some of the most capable youngsters, since Indians have scant opportunities to send their children to a better school in the city. The 52 Indian girls, like their 52 Ladina counterparts, apparently were not seriously prepared for any life outside of the traditional Indian way.

The department of Totonacapan reported 90 percent illiteracy in rural areas in 1950. In the research town this rate was undoubtedly lower because of the presence of the school. Nevertheless, the illiteracy rate, high daily absenteeism, and the presence of a Catholic school in the town, probably functioned to bias our sample toward the medium income Indian group and the lower income Ladino children.

Our subjects ranged in age from six to sixteen years and constituted about three-fourths of the total student load in the six grades of public school. In all, 152 boys and 104 girls were tested.

PROCEDURE

Instruments selected for this portion of the research were the Draw-A-Man Test (DAMT), the Raven Progressive Matrices (RPM), and teacher ratings of pupil intelligence. The DAMT and RPM were chosen because of the largely non-verbal nature of the required responses. The RPM test appeared, superficially at least, to resemble the complex designs of the native fabrics of the research town. Since the children of weaving families helped with the work from a very young age, we were interested in exploring the nature of the cognitive problems presented by such a situation through a standard test which seemed to present a similar task.

The DAMT had the advantage of a large cross-cultural literature against which to compare results. Since two excellent reviews are readily available (Goodenough and Harris, 1950, Harris, 1963) we shall direct attention here to some of the trends which have emerged from cross-cultural applications of this test.

Research previous to 1940 generally reported mean IQs below 100 for American Indians, Mexican-Americans and other North American minority groups. However, during and after the 1940s research with Indian populations began quite consistently to report IQs above 100. Other minority groups continued to score below the usual IQ level.

The relatively high American Indian scores have been explained on the basis of a cultural emphasis placed on the graphic arts by Indians (Russell, 1943; Dennis, 1942). Conversely, the low scores obtained by children in the Near East have been partially explained as a function of the sanctions against human figure drawing by the Moslem religion (Dennis, 1957). A summary of selected cross-cultural DAMT studies is presented in Table 1.

In the present study the DAMT was administered to a total of 256 children in one public school of the research town in carefully monitored groups of from ten to fifteen children. All drawings were made on $8\frac{1}{2} \times 11$ white paper with number two pencils. The drawings were scored according to Harris

TABLE 1
Results of Selected DAMT Studies From 1926 to 1962

Investigator	Year	Ethnic Group	Number of Subjects	Mean IQ
Goodenough	1926	Hoopa	79	85.6
		Anglo-Amer.	396	100 to 107
Manuel and Hughes	1932	Mexican-Amer.	440	90 to 94
Telford	1932	Sioux	225	88.6
Eels	1933	Chippewa		
		Eskimo	364	89.6
		Aleut	105	93.6
		Indian	58	91.6
Dennis	1942	Hopi	152	108.3
Russell	1943	Zuni	41	105.7
Havighurst	1946	Hopi (Oraibi)	46	110.5
Gunther		Hopi (1st Mesa)	32	117.1
Pratt		Zuni	42	111.7
		Zia	32	109.6
		Navajo	47	109.7
		Papago (I)	49	108.5
		Papago (II)	25	103.6
		Sioux (Pine Ridge)	23	102.0
		Sioux (Kyle)	30	113.6
Midwest (Anglo)	66	101.2		
Carney and Trowbridge	1962	Fox	36	114.9

(1963) by scorers who had been especially trained for a large scale study of DAMT scoring reliability.²

The RPM was administered individually to 34 children either in the school principal's office or in our temporary laboratory. The book form of the test was used throughout. Testing conditions were adequate according to North American standards. Instructions for both the RPM and the DAMT were translated into Spanish and revised for local idiomatic acceptability with the advice of two teachers from the school staff.

Teacher ratings of pupil intelligence were added to the test battery in order to supply a ranking of the students in the context of their fellow students by one who was familiar with their daily capabilities. The ratings were obtained by a specific and concrete method. The name of each pupil was written on a slip of paper and each teacher was individually asked to arrange the slips into five

² The scorers were Molly Denny, Peggy Claffin, and Carolyn Ramirez.

TABLE 2

Sex and Ethnic Group Differences in Draw-A-Man Test IQ's

	N	Mean	S.D.	t	p
All Subjects	256	85.08	13.88		
Total Boys	152	89.94	12.97	9.13	<.001
Total Girls	104	77.98	11.95		
Total Indian	164	85.12	14.40	Not Significant	
Total Ladino	92	85.02	12.87		
Boys					
Indian	112	90.29	12.81	Not Significant	
Ladino	40	88.95	13.37		
Girls					
Indian	52	73.96	10.85	3.61	<.001
Ladino	52	82.00	11.59		
Indian					
Boys	112	90.25	12.81	7.89	<.001
Girls	52	73.96	10.85		
Ladino					
Boys	40	88.95	13.37	2.63	<.01
Girls	52	82.00	11.59		

piles, according to the relative "brightness" of their pupils, with pile one containing the names of very dull students (*menos listo*) and pile five containing the names of the very bright students (*mas listo*).

RESULTS

As may be seen by referring to Table 2, the DAMT responses, considered as a whole, obtained a mean IQ of 85.08. Scores ranged from 56 to 146. Sex differences were striking. Boys obtained a mean IQ of 89.94, but the girls' scores reached a mean of only 77.98. Differences between boys and girls mean IQs reached significance at the .001 level.

Ethnic differences considered for the group as a whole were not significant. However, when the groups were separated by sex, it can be seen in Table 2 that this was largely due to the more or less equal performances of Indian and Ladino boys. Ethnic differences were especially severe for the girls. Ladino girls obtained a mean IQ of 82.00 as against a mean IQ of only 73.96 for Indian girls.

Many recent studies of intelligence involving "culturally disadvantaged" children have noted lower IQs for older children. The possibility that this might be true of the population in the present study was checked. The DAMT results analyzed by age appear in Table 3. In order to make a clear distinction between

TABLE 3
Draw-A-Man Test IQ's by Age, Sex and Ethnic Group

Age	Boys				Girls			
	N	Mean	N	Mean	N	Mean	N	Mean
	Indian		Ladino		Indian		Ladino	
6	1	146.0	-----		1	107.0	-----	
7	7	92.9	3	97.7	-----		3	88.0
8	12	94.3	4	85.5	5	73.4	12	85.3
9	22	92.7	8	99.0	7	74.4	11	84.6
10	16	88.3	2	87.0	17	78.4	7	73.1
11	17	88.7	6	86.7	8	71.5	7	80.1
12	9	87.0	7	83.7	10	67.1	3	85.7
13	13	90.7	3	91.3	4	68.8	4	71.0
14	4	78.5	5	85.2	-----		2	62.0
15-16	9	86.9	2	77.0	-----		1	76.0

	Ages 6-10		Ages 11-16		t-test	P
	N	Mean	N	Mean		
Boys						
Indian	58	92.72	52	87.79	2.03	<.05
Ladino	17	94.17	23	85.22	2.71	<.05
Girls						
Indian	30	77.60	22	69.00		Not Significant
Ladino	37	84.57	17	76.59	2.36	<.05

younger and older children a cut-off point was arbitrarily set at age ten. Younger children were those between six and ten years of age inclusive. Older children were designated as those eleven years of age and older. Age differences significant at the five percent level were revealed by this procedure. Older Indian boys scored lower on the DAMT than younger Indian boys. The same age difference was evident for older and younger Ladino boys and older and younger Ladino girls. Indian girls, however, scored uniformly low in both older and younger age groups.

Correlations of the teacher ratings with the DAMT scores presented a varied picture (see Table 4). Correlations of .71, .04, and .50 were obtained with Third, Fifth, and Sixth grade teacher ratings respectively. The mean of the

TABLE 4

*Intercorrelations of Draw-A-Man Test, Raven's Progressive Matrices
and Teacher Ratings*

Draw-A-Man Test Scores vs. Raven Progressive Matrices Raw Score	N = 34	r = .59
Draw-A-Man Test IQ vs. Teacher Ratings		
Third Grade	N = 17	r = .71
Fifth Grade	N = 20	r = .04
Sixth Grade	N = 34	r = .50
Raven Progressive Matrices Percentile vs. Teacher Ratings (Sixth Grade)	N = 31	r = .49
Raven Progressive Matrices Raw Score vs. Teacher Ratings (Sixth Grade)	N = 31	r = .53

three correlations was .41. This is approximately the expected relationship between this type of test and teacher ratings of pupil intelligence.

Considering now the RPM responses as a group, we can observe that they indicate uniformly low intellectual capacity. The median percentile achieved by the Guatemalan children was the 5th, with a range of from below the fifth percentile to the thirtieth percentile according to Raven's British norms (1956). An item analysis (see Table 5) was prepared using the boys' results in an attempt to explain these unusually low scores.

Each of the RPM problems requires the child to imagine which of six choices would complete the large design. For the first item of each set the choice is as nearly as possible self evident. Subsequent choices require finer and finer discrimination of differences. For sets C and D the identification of the correct choice requires both complex distinctions and analogical recombinations of the design elements.

In general, sets A and B are thought to tap the intellectual capacity of the young child under eight years of age, and the problems are consonant with a limited vocabulary and largely practical forms of education. For children over eight years of age the first two sets function primarily as training experience.

It can be noted in Table 5 that Guatemalan responses to all four sets exhibit a similar pattern. The first problem of each set elicited a high proportion of correct responses, indicating that the boys were relating appropriately to the materials and the investigator. The attitude of the children was one of interest and delighted cooperation throughout. Following their initial success, however, the proportion of correct responses fell precipitously until only two or three

TABLE 5
*Item Analysis of Raven Progressive Matrices Responses
 For 27 Sixth Grade Boys*

Set A			Set B		
Correct Responses			Correct Responses		
Item	Number	Percent	Item	Number	Percent
1	27	100	1	26	96.3
2	27	100	2	20	74.1
3	27	100	3	19	70.4
4	26	96.3	4	19	70.4
5	26	96.3	5	13	48.1
6	27	100	6	10	37.0
7	12	44.4	7	10	37.0
8	24	88.9	8	3	11.1
9	19	70.4	9	1	3.7
10	18	66.7	10	8	29.6
11	9	33.3	11	2	7.4
12	9	33.3	12	1	3.7

Set C			Set D		
Correct Responses			Correct Responses		
Item	Number	Percent	Item	Number	Percent
1	21	77.8	1	19	70.4
2	18	66.7	8	8	29.6
3	13	48.1	3	9	33.3
4	9	33.3	4	7	25.9
5	7	25.9	5	10	37.0
6	12	44.4	6	5	18.5
7	6	22.2	7	4	14.8
8	4	14.8	8	6	22.2
9	7	25.9	9	4	14.8
10	7	25.9	10	1	3.7
11	1	3.7	11	1	3.7
12	1	3.7	12	1	3.7

sixth grade boys could respond correctly to the final problems of sets B, C, and D.

Prior to the final problems of each set, low points were recorded on Problem 7 Set A, Set B, 8 Set C, and 7 in Set D. Let us examine the nature of the tasks presented to the Sixth grade boys by these problems.

In Set A problem 7 the requirement is to supply the missing cross section where two out of four lines intersect. The commonest error was that of choosing a block which repeated the entire design instead of the one which would complete the design when inserted into the cut-out space. In order to avert misunderstanding, the instructions were repeated again at this point. Problem 9 Set B required the boy to distinguish and recombine both shape and color in a four-part pattern. Problem C9 was of the same type but with nine elements instead of four. Problem D7 required the same kind of analogic reasoning with nine elements, but the lines of the design ran diagonally instead of horizontally and vertically as had been the case previously. Although some recovery in number to correct responses was indicated after the low point of each set, it is evident that, with a few exceptions, the group as a whole was not able to understand the logic of the matrices test design.

DISCUSSION

1. *Intellectual Status*

The results indicated a remarkably low intellectual performance for the subject group as a whole. On the DAMT the mean IQ was 85.08 compared with a mean of 102 to 117 for the North American Indian children. The RPM scores which rated at only the 5th percentile were even lower than the DAMT scores.

An explanation of these low scores calls for an analysis of relevant factors in the subjects' developmental background. Three explanations offer themselves from the cross-cultural literature on intellectual functioning: a) it is likely that sub-standard conditions of nutrition and health function to depress the general intelligence level; b) it has been suggested for other cultures that the value placed upon graphic arts may affect performance on a test in which the single response is one of drawing a human figure; and c) the formal educational experience of the subjects may have prepared them for the testing experience in a manner which varied from that expected by North American investigators. Each of these explanations will be reviewed in turn.

a) Research evidence advanced by Pasamanick and Knobloch (1966) and Knobloch and Pasamanick (1966) has demonstrated a link between sociological, physiological, and psychological variables. On the very lowest socio-economic levels, prenatal and maternal care is poor and nutrition is inadequate. This leads directly to high indices of prematurity and complications of pregnancy, and these in turn are associated with high proportions of infant brain-

damage. One outcome of this sequence of events is lowered intelligence. Other results are cerebral palsy, epilepsy, and learning disorders.

In 1950 an INCAP survey in the department of Totonicapan reported that 84 percent of all children examined had intestinal parasites. Endemic goiter was present in 46 percent of all cases examined. Probably the most important finding of the nutritional survey in regard to intellectual functioning was the evidence of a widespread deficiency of Vitamin A. Clinical observations of this deficient condition have repeatedly pointed out sluggish mental activity (Whetten 1961). Such information indicates that explanation (a) deserves serious consideration in explaining the unusually low test results.

One difficulty in accepting the Pasamanick-Knobloch line of explanation, as sufficient in itself, however, arises from the DAMT literature on North American Indian children. These North American youngsters have grown up under comparably poor economic, nutritional, and medical conditions, but obtain higher DAMT IQs than our Guatemalan subjects. One other discrepancy is the significant sex difference in our Guatemalan results. Prenatal nutritional deficiencies would be expected to affect both boys and girls with equal seriousness, yet the girls in our sample scored significantly lower than the boys.

An alternative explanation in view of this cross-cultural evidence is, (b) that the positive evaluation placed on graphic arts by North American Indians was reflected in a general drawing ability on this particular task, which would be absent or mitigated in the case of our Guatemalan subjects. Unfortunately, the DAMT literature does not provide estimates of intellectual functioning utilizing variously valued tasks in order to assess the weight which should be accorded this explanation.

However, in the case of our Guatemalan subjects, we can say that the moderately high correlations between the DAMT, which depended upon drawing ability, and the RPM which did not, as well as the primitive correlation with the ratings by classroom teachers who were familiar with students' daily performance, suggest that in this case at least, the difficulty did not lie in a general cultural devaluation of artistic expression. At the very least we can state that this argument is inadequate to explain the present results.

We observed the weaving procedure in order to evaluate the similarity between the cognitive problems presented by the native task and those presented by our imported foreign task.

The intricately patterned fabrics of the research town are produced by the following method. The purchased yarn is tied or wrapped by one or more women in a series of knots which is repeated over and over until the end of the skein is reached. Different types of sequences of knots have individual names. Once the skein has been dipped in a purchased dye, dried and rolled into a ball, the ball receives the name of the knot sequence. Even very little children are

taught to recognize and name on sight the type of knot sequence for each ball.

For the weaver the cognitive task is to memorize the names of individual balls in the order in which they occur in a band of the traditional pattern. Whereas a certain amount of innovation was evident in the use of materials, i.e. silk as well as cotton and wool thread, for the individual weaver the task is one of rote memorization. In a series of observations in different parts of the town, not a single incident of problem solving as required by the matrices appeared in the weaving sequence.

It thus appears that while the complex weaving designs seemed to be similar in construction to the Progressive Matrices designs, the complexity in the case of the weaving was located in the social organization, particularly in the intercorrelation of specialized skills which contributed to the fineness of the finished product. The matrices on the other hand required a single individual, working alone and without advice, to distinguish and utilize the logic of the unfamiliar matrix presented to him.

A third possible explanation (c) of the low test scores may be found in the contrast between the formal educational experience of the children and the task presented by our foreign tests. During the DAMT administration, attempts to trace from the backs of school books were fairly frequent, especially among the girls. These children were demonstrating the fact that they were never asked for an original solution to a problem. Ordinarily, classroom questions came supplied with ready-made answers. The children, especially the girls, expected to be told what the answers was, and then to memorize it. Children were not expected to take any initiative in the ongoing educational enterprise. Every question already had its answer, based on authority and tradition.

In the case of the Indian girls passive learning was so much the order of the day that a Ladino girl would occasionally burst into the testing room, take the pencil from the Indian girl's hand, and attempt to make her drawing or to answer questions for her. Indians were more passive learners than Ladinos, and Indian girls were the most passive of the four groups.

One final observation of the formal educational situation needs to be cited. It is that the primary grade classrooms were overwhelmed by sheer numbers of children. There were more than 100 children enrolled in the first grade alone, in a school where the total enrollment was but 400. Furthermore, attendance was most irregular. Passive learning, overcrowding and high absenteeism no doubt contributed to the inhibition of intellectual development.

2. *Sex Differences*

According to Harris (1963) North American girls usually obtain higher DAMT scores than boys. Our finding that Guatemalan boys scored significantly higher than girls suggests an important difference between North American

and Guatemalan cultures. Girls in highland Guatemala live relatively sheltered lives; they are expected to defer to others, to be passive, and to avoid the appearance of intellectual ambitions. It is possible that where appropriate sex role behavior is narrowly defined, the kind of problems posed by the psychological tests and testing situation could be construed as more appropriate for boys than for girls, thus prejudicing the results in favor of the boys.

3. *Age Differences*

Our results showing older children to have lower DAMT IQs than younger children, were consistent with other studies of educationally disadvantaged children which indicate that IQs go down as children grow older if they do not live in an intellectually challenging environment (Wheeler, 1942). While it is possible that this is a valid interpretation of the present results, there are reasons for caution. The most troubling problem is that of sample representativeness. Many students drop out of school after a few years. We do not know whether the able or the inept students drop out more often. The second difficulty has to do with a peculiarity of the DAMT. Its value as a test of intellectual functioning declines during adolescence because normally there is very little improvement in drawings from age 13 and on (Harris, 1963). In fact, the adolescent's self-consciousness regarding such things as artistic productions often inhibits his drawing performance and lowers the scores obtained.

4. *Cross-cultural Testing*

One objective of this research was to explore the suitability of various cognitive tasks for cross-cultural research. The wider range of functioning elicited by the DAMT as compared with the RPM suggested that the DAMT provided a superior measure of intellectual level. Although the RPM results correlated favorably with the teacher ratings, the range of scores elicited was extremely narrow since few of the children were able to make the required shift from simple to complex problem-solving. The teacher ratings provided a check for the results of the foreign tasks against the observations of students' daily performance. Ideally, however, an accurate survey of intellectual functioning should indicate the language abilities of the subject population as well as a realistic appraisal along the entire continuum of cognition which exists in the subject population.

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SUMMARY

The Draw-A-Man Test and Raven's Progressive Matrices were administered to a group of highland Guatemalan public school children. The DAMT, administered to 256 children, showed an overall mean IQ of 85. Boys scored significantly higher than girls. There were no important differences between the scores of Indians and Ladinos. The Raven Progressive Matrices test, given to 34 children, also yielded low intelligence scores. Significant correlations between teacher ratings of intelligence and the above tests suggest that these measures have a certain validity in the Guatemalan setting.

In spite of the non-verbal nature of the test problems, it seemed likely

that formal and informal cultural differences in educational goals functioned to depress the test scores. In addition, low health levels have been associated with the low test performance in other areas and were present in the subject population in the present instance.

We suggest that important untapped human resources remain undeveloped in the highlands of Guatemala, and that sensitive and planned social improvement could readily change the present picture.

RESUMEN

El test de Goodenough y el de Matrices Progresivas de Raven fueron aplicados a un grupo de niños en una escuela pública de las montañas de Guatemala. Al aplicar el test de Goodenough a 256 niños se obtuvo como resultado un cociente medio de inteligencia de 85. Los puntajes de los niños fueron significativamente más altos que los de las niñas. No se encontraron diferencias importantes entre los niños indios y los ladinos (mezcla de indio y guatemalteco). El test de Matrices Progresivas de Raven también dió puntajes de inteligencia bajos al ser aplicado a 34 niños. Las correlaciones significativas entre la evaluación de la inteligencia hecha por los profesores y los resultados de los tests anteriormente mencionados sugiere que éstos instrumentos tienen cierta validez en la muestra guatemalteca.

A pesar de que éstos tests no requieren habilidad verbal, parece probable que las diferencias culturales formales e informales con respecto a los objetivos educacionales actuaron para bajar los puntajes. Además los índices bajos de salud, que han sido asociados con una actuación pobre en los tests en otras áreas, parece estar presente en la muestra aquí estudiada.

Sugerimos que hay potenciales humanos que están por desarrollarse en la montaña guatemalteca, y que un mejoramiento social planificado podría cambiar rápidamente este estado de cosas.

RESUMO

Os testes de Goodenough e o de Matrices Progressivas de Raven, foram aplicados a um grupo de crianças de uma escola pública da região montanhosa da Guatemala. A aplicação do teste de Goodenough, em 256 crianças, apresentou como resultado um quociente médio de inteligência de 85. Os meninos obtiveram quocientes mais altos que as meninas. Não se verificou diferenças significantes entre os resultados apresentados por crianças índias e os apresentados por ladinas (mestiças de índios e guatemaltecos). O teste de Matrices Progressivas de Raven também apresentou resultados baixos quando aplicado em 34 crianças. Correlações significantes entre a avaliação da inteligência feita

por professores e os resultados nos testes acima mencionados sugerem que estas medidas têm uma certa validade na Guatemala.

Apesar dos problemas apresentados nos testes serem de natureza não verbal parece que as diferenças culturais, formais e informais, com referência a objetivos educacionais, concorreram para abaixar os escores nos testes. Além disso, índices baixos de saúde, associados a pobre desempenho no teste em outras áreas também estavam presentes na população estudada.

Sugerimos que existem ainda importantes recursos humanos que permanecem subdesenvolvidos na região montanhosa de Guatemala e por meio de um plano de melhoramento social poder-se-ia modificar rapidamente a presente situação.