Influence of Acculturation on Cognitive Development

JASMIN E. ACUÑA
Science Education Center
University of the Philippines

Attempts to match the curriculum with the intended learners' capacities are not new. Researches have shown that students' capacities vary as a function of their sociocultural environment. However, most of the research on the subject has categorized the sociocultural environment in a global manner, which is not particularly useful for the curriculum planner. This study is an attempt to specify some aspects of the sociocultural environment related to children's cognitive development. Cultural differences are seen as a result of the tendency of each cultural group to develop the skills and concepts that it needs most. It is in this vein that this research is conducted.

An example of the global classification of the sociocultural environment is the usual rural-urban comparison found in the literature. Conflicting results have accumulated, relating the development of the concept of conservation in children with urban or rural conditions. Greenfield, Madiano, and Maccoby (in Bruner et al., 1966) have reported differences in conservation scores between rural and urban children, while other studies have found no differences (Price-Williams, 1961). In the same study Greenfield et al. showed that rural subjects conserved earlier than urban subjects, while Lloyd (1971) found the opposite to be true for his subjects. But there is no way of integrating these findings, since community variables across research sites are not known. An acculturation scale was, therefore, devised to describe how communities differ significantly from each other and to determine whether these differences are related to aspects of children's cognitive development.

In 1976, working with fourth year high school students (10th grade, ages 16–18) as subjects (see Acuña, 1977), opportunity structure in the community was seen to have affected the adolescent's ability to develop concrete to formal operational thinking on a nonverbal task adapted from Fieldman and Stone (1978). Children from communities with varied structures of opportunity—as found in entrepreneurial communities—tended to be more field independent, to have more individual initiative, and to participate more in decision-making regarding their careers. On the other hand, children from communities with very limited structure of opportunity tended to be more field dependent, to be generally more submissive and accepting of authority figures in the home, and hardly ever to participate in decision-making. These were children from tenant agricultural families, where dependency is usually accepted as a way of life.

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In the present study, opportunity structure was operationalized through a composite scale which was labeled acculturation continuum. The scale is composed of various quantifiable aspects of the community which enable comparisons among communities. The next sections will describe how this scale was arrived at and how it relates with different aspects of cognitive development.

Cognitive development is measured through the use of scales developed from tasks, interview questions, and tests chosen on the basis of their relevance to science. Conservation concepts are assumed to be necessary for science-learning. Children whose thinking is dominated by perceptions as opposed to those whose thinking is dominated by logical operations are not able to discover relationships in the real world. Five conservation and sorting tasks were combined into a cognitive scale to test the hypothesis.

The structure of children's thinking about aspects of causality is assumed to be relevant to scientific thought, so a set of questions regarding aspects of causation in the life cycle and about natural phenomena was developed. These questions were combined into three scales on life processes of plants and of animals and one on natural phenomena. And, finally, the ability to infer emotional states of significant persons in the environment was assumed to have survival value for the child living in the complex social network of a rural community. A model was developed for expressing qualitative changes in children's inferences, and one scale was constructed for inferring emotional states and another scale for inferring internal states without external references, such as headache and pain.

METHOD

Procedure

The community-level variables for this research were obtained through interviewing parents of the children involved in the study. The data obtained from the interviews were validated through observation and through interviews with selected informants, usually the officers of the smallest political unit in the country, called the *barangay*. All interviews were conducted in the vernacular. These were taped and then transcribed by the research team before the final coding and collating of the information obtained.

The children were given a battery of tests individually and clinical interviews were conducted in a semiprivate room. These interviews were taped, transcribed, categorized, and coded.

Subjects

The subjects for this study were 980 children in grades 1, 3 and 5 (ages 7–12) in 12 research sites. It was assumed that alternate grades would be sufficient to reveal significant changes in children's thinking. Since there is universal compulsory education in the Philippines, age and grade are confounded—a correlation of .91. Maturation and schooling cannot be teased out of the analysis.

Research Sites

Communities were chosen according to their predominant occupations. Six rural communities were included in the study: three farming, one fishing, one twine making, and one abaca processing. For comparison, two urban communities and four semi-urban communities were also included.

Instruments

To describe the children's cognitive functioning, we used a cognitive scale, cognitive tests, inferential reasoning scales, and questions about natural phenomena and biological processes—a total of ten cognitive scales and tests. The first is a *cognitive* scale which is the combined score of six Piagetian type tasks. These were conservation of mass, volume, number, liquid and internal volume, plus one on sorting. The *next four* were cognitive tests, which included a test of cognitive style (Children's Embedded Figures, CEFT, by Oltman et al., 1971) and three aptitude subtests from the Wechsler Intelligence Scale for Children (WISC)—Digit Span, Block Design, and Picture Arrangement. And, finally, we developed *five scales* from our interview questions. Two scales were on understanding life processes—one on plants and the other on animals. The third scale was on understanding natural phenomena. The two remaining scales were on inferential reasoning in order to measure the child's ability to infer the emotional and internal states of other people.

Acculturation as a Composite Index

Our independent variable, the scale on acculturation, was theoretically a composite of three clusters—parental education, level of income, and urbanization.

Formal education of parents was assumed to directly affect the child's learning environment. The first two indices were levels of formal education of the mother and the father. Income was assumed to be related to prestige in the community and to a sense of efficacy, an attitude which shapes the individual's interaction with his community. The next two indices were thus on regularity of employment of the mother and father. Although this research was focused on low income families whose children are in free public schools, relative discrepancies in income may still be relevant to one's sense of competence and efficacy. Economic opportunity structure was assumed to be an aspect of social structure, which is related to cognition. The other two indices were on the median of reported income and expenditure. Rural homogenous communities are generally poor, but variations in community income and expenditures contributed to the ranking of communities along an acculturation index in the present study.

And finally, there were four indices of urbanization: type of toilet, fuel supply, water supply, and exposure to outside information through radio, television, and movies. Presumably, a more urbanized community would offer more varied opportunities for employment, more alternatives for adult roles, more achievement-oriented positions, and more reward for individual initiative. This cluster on urbanization was previously identified as a superordinate variable labeled opportunity structure in the community (Acuña, 1977). These aspects of the community may in fact provide for more varied opportunities for growth and development.

Refinement of the Acculturation Continuum

The association of the ten indices with the composite ranking on the acculturation continuum was tested using the Kendall-Rank correlation coefficient. We wanted to establish that the theoretical components of acculturation empirically contribute to our composite. The highest associations among the ten indices with the composite score are the community's median for reported income at .79, and reported expenditures at .75. Also highly associated with the acculturation continuum are the following aspects of urbanization: type of toilet, exposure to television, and type of fuel supply, with correlations of .70, .64, and .60, respectively. Moderately associated with acculturation is the cluster on parental education, with a correlation of .52. A revision of the components of the acculturation continuum was based on the above results. The other indices, which proved to be significant but low, were eliminated and recomputed for the composite score reported in Table 1.

Table 1 summarizes the ranking of communities on the revised acculturation continuum. The table shows a clustering of the rural communities toward the lower end of the continuum, from R1 to R6, and a clustering of the comparison communities—semi-urban (S1 to S4) and urban (U1 and U2)—toward the upper end of the continuum. However, one urban community, Looc, Dumaguete (U1), is less acculturated than the two semi-urban communities in Iloilo (S4) and Pangasinan (S3). This supports our contention that global classifications into urban, semi-urban, and rural are inadequate unless these classifications are based on quantifiable aspects across communities.

Table 1: Revised Acculturation Continuum

	Research Site	Composite Scale	Final Rank
R2	Farming (Dolores, Quezon)	15.5	1
R3	Twine Making (Malilipot, Albay)	23.5	2
R1	Farming (Odiongan, Romblon)	27.0	3
R4	Fishing (San Salvador, Iloilo)	35.5	4
R6	Farming/Fishing (Basey, Samar)	40.0	5
R5	Processing Abaca Fibers (Mauraro, Albay)	45.0	6
S2	Farming (San Miguel, Laguna)	58.0	7
S1	Duck Raising/Farming (Cabuyao, Laguna)	60.5	8
U1	Looc, Dumaguete City	72.0	9
S4	Fishing/Farming (Banate, Iloilo)	72.5	10
S3	Fishing/Farming (Lingayen, Pangasinan)	75.5	11
U2	Taytay, Rizal	86.0	12

RESULTS

The Effect of Acculturation

A two-way ANOVA was used to provide a test of significance for the two main effects in this study. On all the ten cognitive scales, acculturation and grade level were both

found to have significant effects on cognitive development (see Table 2). In other words, the child's sociocultural environment and schooling both have a consistently strong association with children's performance on all ten dependent measures of cognitive development. However, when the relative contribution of both acculturation and grade level was graphed, five scales were found to have significant grade effect, while the other five scales had a weaker grade level effect. A significant grade effect, while the other five scales had a weaker grade level effect. A distinction is, therefore, being made between the group of skills and concepts reflected in the scales that are emphasized in school—the formal reasoning type—and those that can be learned outside of school from observations, traditional cultural explanations, and social interactions.

Table 2: Two Way Analysis of Variance: Summary of F Tests

		*Main Effects**	
		Grade	Acculturation
A.	Cognitive Scales	28.23	34.76
B.	Cognitive/Perceptual Style	93.80	78.97
C.	Picture Arrangement	45.47	75.75
D.	Digit Span	56.47	22.88
E.	Block Design	50.75	55.50
F.	Life Processes in Plants	9.12	24.48
G.	Life Processes in Animals	4.93	26.49
H.	Natural Phenomena	23.02	32.21
I.	Emotional Inference	2.31[a]	39.97
J.	Inferences on Internal States	3.04[b]	55.45

*All values significant at $p < .001$ except a and b
[a]significant at $p < .05$
[b]significant at $p < .01$

A. Skills/concepts with a clear grade effect

The five scales with a clear grade effect are block design, picture arrangement, digit span, cognitive style, and cognitive scale. Among these five scales, block design, picture arrangement, and digit span are aptitude subscales from the Wechsler performance part. Block design measures the ability to transform a two-dimensional design into three-dimensional blocks. Picture arrangement measures the ability to sequence events chronologically. Digit span measures the ability to repeat a sequence of numbers forward or backward. On these three tests the mean score of the children from the less acculturated communities tended to be lower than the mean score of children from the more acculturated communities. The correlation between acculturation and the scores on the aptitude subscales ranges from .62 to .38, which is from high to moderate. The correlation with grade varies from .33 to .41, which is also significant and moderate (see Figures 1, 2, 3).

These results were interpreted to mean that, by comparison to grade level, acculturation is a better single predictor of children's performance on the two tests—picture arrangement

Figure 1. Block Design, Acculturation and Grade Level

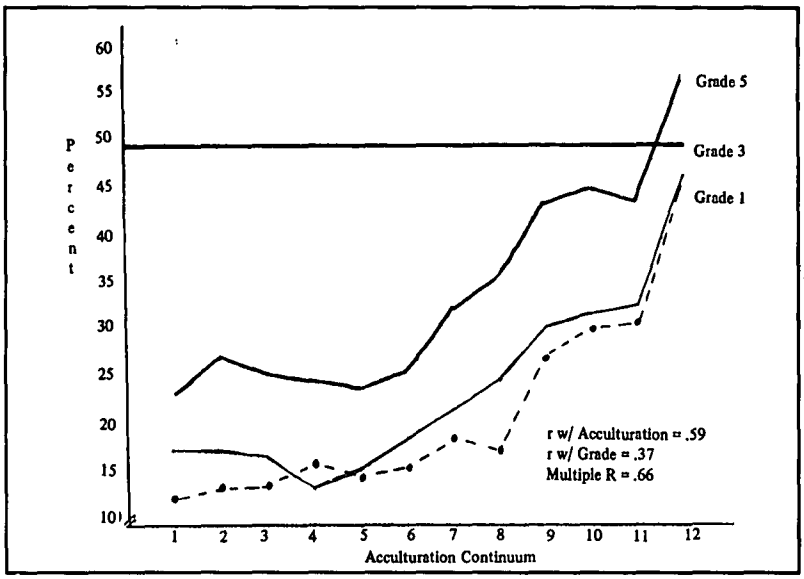
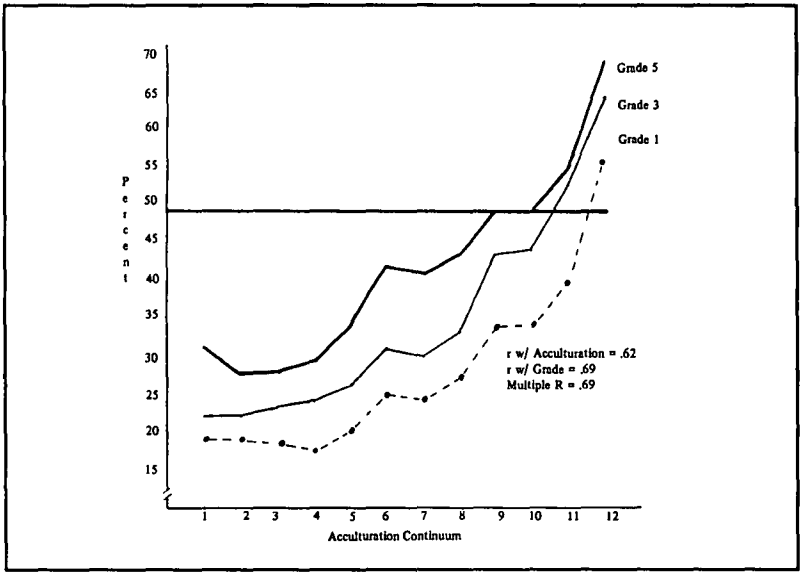
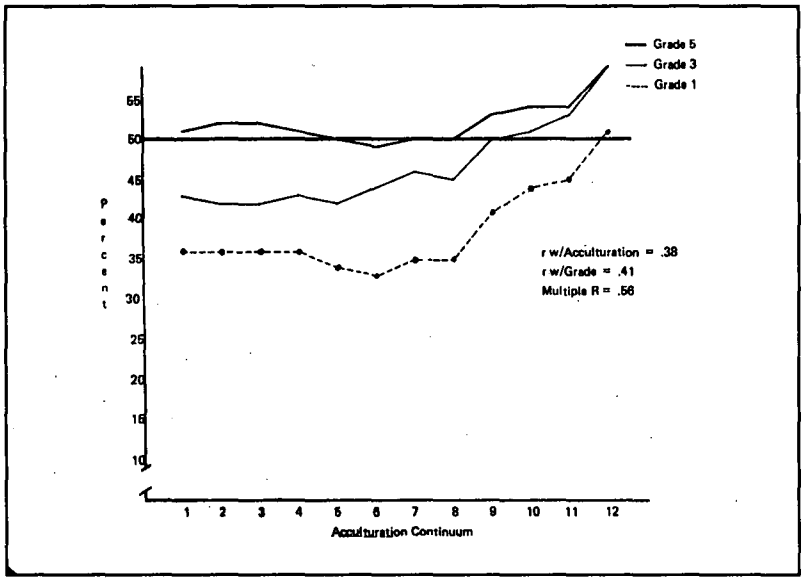


Figure 2: Picture Arrangement, Acculturation and Grade Level



and block design. For digit span, grade level is a better single predictor than acculturation. However, the two independent variables, acculturation and grade level, contributed significantly to children's performance.

Figure 3: Digit Span, Acculturation and Grade Level



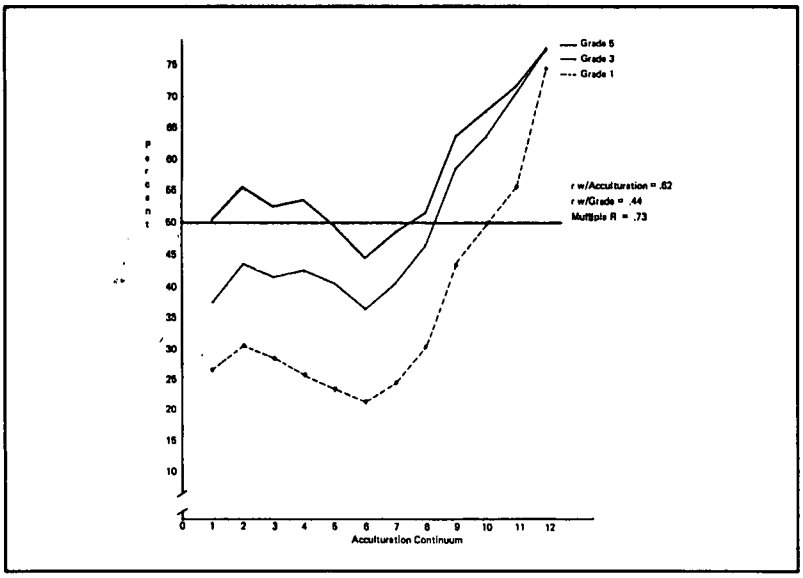
For block design the majority of the children sampled were below fifty percent of the theoretical maximum. We used 50 percent as a cutoff criterion to be able to say that children have acquired the skill. Therefore, the children we sampled have not acquired the ability to transform two-dimensional designs into three-dimensional blocks even in grade 5, except for those at the most acculturated research site.

For picture arrangement the results were a little better. Children in grade 5 from the four most acculturated research sites had mean scores of 50 percent or above. But in grade 3, only the two most acculturated research sites obtained mean scores of 50 percent or above. And in grade 1 only the most acculturated research site had a mean score of above 50 percent. These seven subgroups can be said to have had the ability to sequence events chronologically.

For digit span, all mean scores of grade 5 students across our acculturation continuum were at least 50 least percent. And children in grade 3 from four of our most acculturated communities in the sample had mean scores of 50 percent or above. For grade 1 only children from the most acculturated research site obtained a mean score of 50 percent. In other words, the ability to recall a sequence of numbers forward or backward is generally acquired by fifth grade pupils no matter what the acculturation level of their community. Schooling and maturation may explain the strong effect of grade level on this test.

The other two scales, cognitive style and cognitive scale, are also well explained by the joint effects of acculturation and grade. The multiple correlation of acculturation and grade in explaining children's cognitive style is .73, the highest among our dependent measures (see Figure 4).

Figure 4: Cognitive Style, Acculturation and Grade Level (Children's Embedded Figures Test)



Cognitive style is the ability to use internal versus external frames of reference. CEFT is a task requiring children to locate a simple form within a complex configuration. Although there are no negative ends in this continuum the ability to be flexible is generally demanded by most school-related tasks.

This study shows that children from less acculturated environments tended to be more field sensitive or less field independent. More acculturated environments tended to foster more field independence, especially among younger children (grade 1). There was an overall increase in the tendency to be more field independent with increased schooling and maturation.

For science achievement, the ability to use internal frames of reference is important. Most science classes are big, and the personalistic approach to instruction, appropriate for children with field sensitive learning style, will not always be practical nor possible. Most science teachers would find it necessary to utilize a task-oriented, less directive classroom management, especially at higher levels of education. By grade 5, the majority of the students would have acquired some ability of responding in a field independent way. And, it is this flexibility in responding that is required for good performance in most science classes. In the present study, children in more acculturated communities acquired this ability much earlier than children in less acculturated communities. Grade 1 children from the most acculturated communities—research sites 10, 11, and 12—already possessed this ability and were therefore at an advantage by comparison to the other grade 1 students from less acculturated communities.

On the other hand, the cognitive scale combines five conservation tasks and sorting. The scale is seen to be a measure of the ability to perceive equivalence in the face of

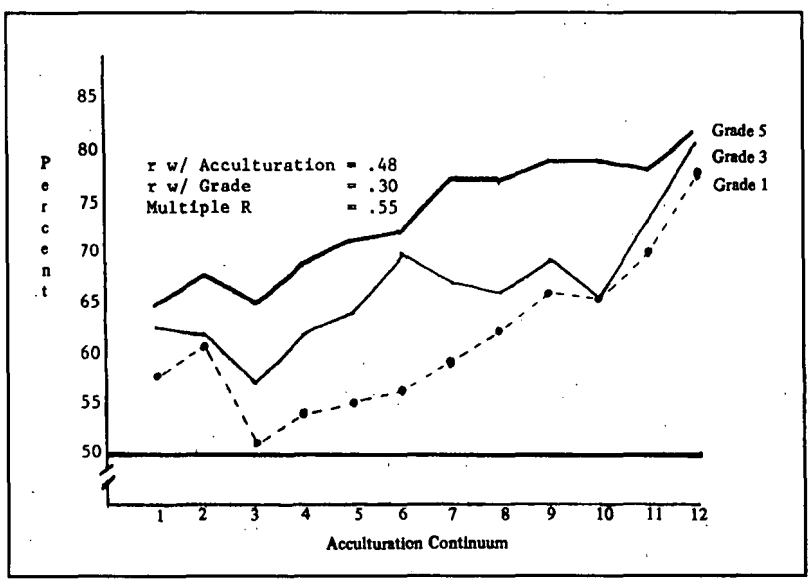
perceptual transformations. This ability is a prerequisite to logical and scientific reasoning. From the graphs, acculturation can be taken as an important explanatory variable. However, it was observed that the relation is not necessarily linear, the least acculturated subgroup was not performing at the lowest level. In the scales to be discussed later this trend will be even more pronounced, but already the least acculturated subgroup was seen as not necessarily at the lowest level of cognitive development. The correlation of acculturation with the cognitive scale is .48. The correlation of grade with cognitive scale is .30. Together, acculturation and grade explain children's performance on the cognitive scale, with a multiple correlation of .55.

All grade 1 pupils across all communities sampled in this study were able to conserve mass and do multiple sorting. But more of the grade 1 pupils from the more acculturated research sites had achieved the transitional level for volume and liquid conservation. By grade 3 almost all children were in the transitional stage for number , volume, and internal volume conservation tasks. By grade 5 the majority of the students had acquired conservation of number and internal volume. These children were of the lower social class, and it would be reasonable to assume that part of their daily experience was to work with objects and liquids. To this end the graph reflected that all the subgroup means were above the 50 percent criterion of attainment. One can conclude that these children had at least some of the prerequisite concepts for logical reasoning.

B. Skills/Concepts with a low correlation with grade

The next five scales that will be discussed have a significant but low correlation with grade. These scales are: life processes in plants and in animals, natural phenomena,

Figure 5: Cognitive Scale Scores, Acculturation and Grade Level



emotional inferential reasoning, and inferential reasoning about internal states. In general, these scales are strongly associated with acculturation. However, this association is curvilinear in nature rather than linear. Both ends of the continuum seem to have positively affected the children's performance. The concepts in these scales could have been acquired by children outside the classroom through actual life experiences, through traditional cultural explanations, or through social interactions.

For example, understanding life processes in plants is a scale based on responses to questions on plant origin, growth, disease, plant life, and death. The graph in Figure 6 shows two peaks for grade 1, occurring near both ends of the acculturation continuum. This means that children from the least acculturated (the most rural) communities and children from the most acculturated (the most urban in this study) communities had a greater understanding of life processes in plants, possibly for different reasons. Children from the least acculturated communities probably gained information about plant life through vicarious experiences and greater exposure to mass media and information sources. Hence some grade 1 children from the least and the most acculturated communities did better than their counterparts in grades 3 and 5.

The graphs in Figure 7 also show two peaks for understanding animal life processes, toward both ends of the acculturation continuum. Understanding life processes in animals is based on questions regarding animal life, origin, growth, disease, and death. This was interpreted to mean that children come to school with greater understanding about animal life processes when they come from the least and the most acculturated communities. This seems to have something to do with children's exposure to either actual or vicarious experiences with animal life. The children from the least acculturated

Figure 6: Life Processes/Plants Scale, Acculturation and Grade Level

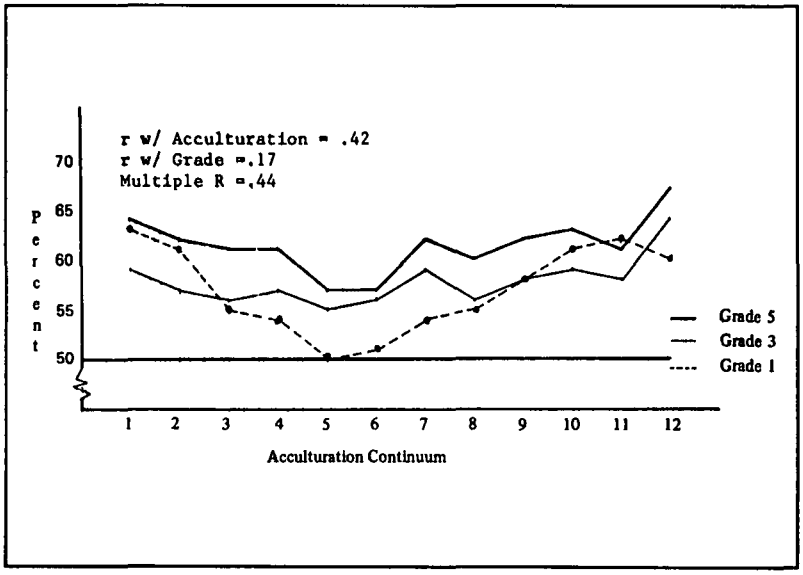
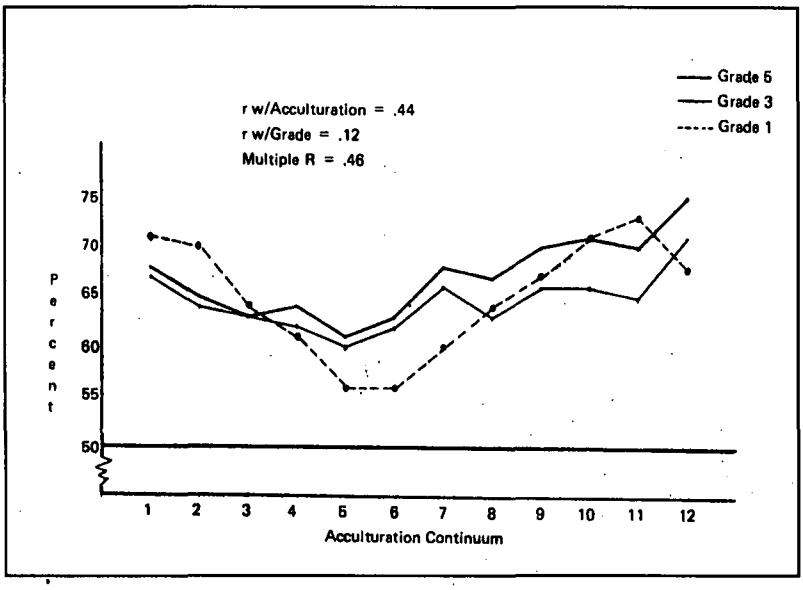


Figure 7: Life Processes/Animals Scale, Acculturation and Grade Level

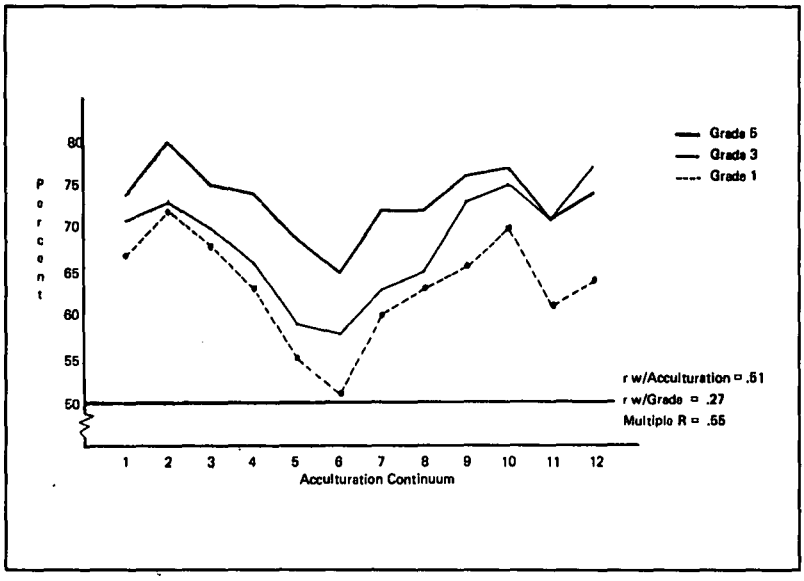


communities, may have had more understanding from actual experiences with animal life. Children from the most acculturated communities may have learned vicariously through exposure to information and mass media.

The effect of grade level appears to be very low; the correlation is .12. From the graph, we observe that grade 1 students did better than both grade 3 and grade 5 students in some research sites—numbers 1, 2, 3, and 11 along the acculturation continuum. In some research sites—numbers 8,9, and 10 along the acculturation continuum—grade 1 students did better than grade 3 but not better than grade 5 students. Elementary schooling, in particular the first five years, may not necessarily have improved the structure of understanding animal life processes for these sample pupils.

A similar curvilinear trend is found in Figure 8 for children's understanding of natural phenomena. The scale on understanding natural phenomena was based on answers to questions about rain, night and day, movement of clouds, and typhoons. Although insights into understanding natural occurrences are observed to be directly affected by schooling (as reflected by the non-intersecting lines in the graph), the curvilinear effect of acculturation is very evident. Referring to the graph in Figure 8, grade 5 children generally did better than grade 3 and grade 1 children except at research site numbers 11 and 12. And grade 3 students in general did better than grade 1 students. But the high scores for the children occur towards both ends of the continuum. The association of grade and understanding natural phenomena is .27, which is significant but low. The correlation of acculturation with children's understanding of natural phenomena, .55, is high and significant. In short, children at both ends of our acculturation continuum were doing better than students in the middle.

Figure 8: Natural Phenomena Scale, Acculturation and Grade Level



Finally, the ability to infer emotional and internal states in other persons is assumed to have survival value for the less acculturated communities. Schooling was found to have a very low effect on these two scales: .11. The level of acculturation of communities was also found to significantly affect insights into emotional inference and inference about internal states. The correlation coefficients are .53 and .59, respectively. The graphs are observed to be curvilinear, with tendencies for both ends of the continuum to do better than the middle parts. These trends point to a strength of the traditional, rural (the least acculturated) communities in providing for their children a sensitivity to the social environment. This is an aspect of inferential reasoning that is generally neglected and usually unaddressed in modern-slay schooling. We want to point out that this skill may be a relevant starting point for effective functioning in our society. Our most and least acculturated communities developed this skill in their children. But those who have neither the advantage of a traditional culture nor the advantage of urbanization seem to have failed to develop this inferential reasoning skill in their children.

In conclusion, some formal reasoning skills were found to be developed only in acculturated communities with strong schooling effects. These were the abilities to represent two-dimensional designs into three-dimensional blocks, to recall numbers forward and backward, and to sequence events chronologically. Some concepts were also found to be well developed toward both ends of our acculturation continuum. These were concepts associated with life processed, insights about natural phenomena, and inferential reasoning skills. Children from the most acculturated and least acculturated research sites performed almost as well as each other. In some cases, higher grade level did not necessarily mean better performance. This was interpreted to mean that schools

Figure 9: Emotional Inferential Reasoning, Acculturation and Grade Level

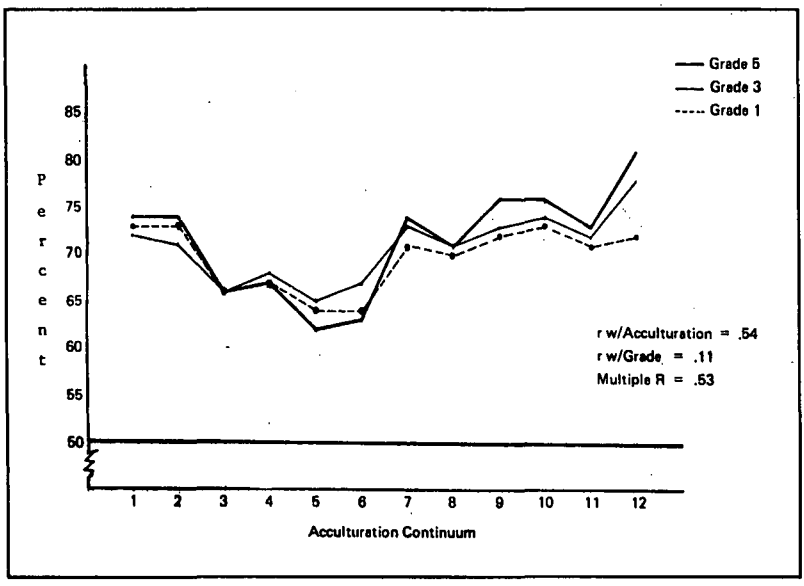
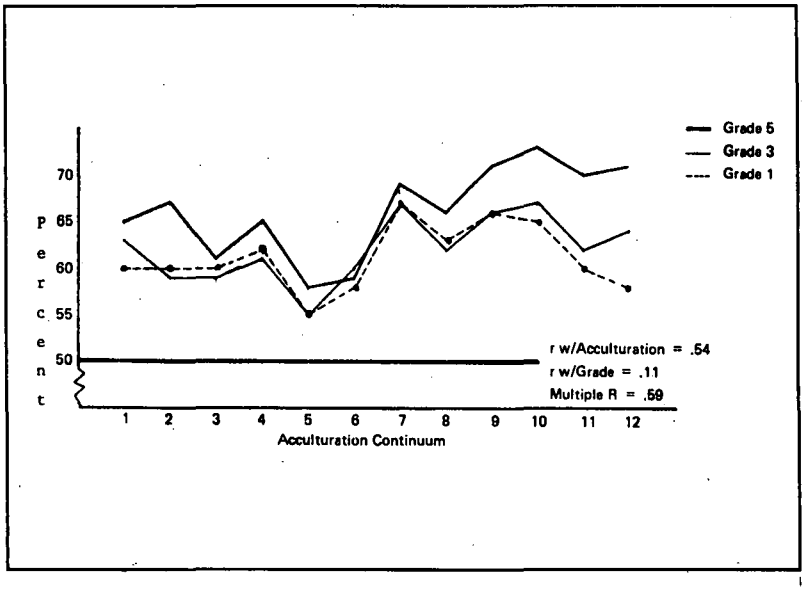


Figure 10: Inferential Reasoning/Internal States, Acculturation and Grade Level



may not have been successful in taking full advantage of the children's initial learning may even be perceived as ineffective in the development of certain biological concepts, certain insights into explanations for natural occurrences, and inferential reasoning skills.

It is therefore recommended that science activities at the elementary level be developed to address biological concepts in a way that is relevant for the children living in our rural areas.* These children already have the benefits of exposure to many of these life experiences, and teachers can take fuller advantage of the information they already possess to bring them to think scientifically about these processes.

It is also worthwhile to inquire into teaching strategies that match with younger children's learning style. Field-sensitive children are likely to benefit from a personalistic, warm learning climate. Cooperative group work as well as ways of developing flexibility in learning styles among children may need to be more emphasized in the elementary curriculum.

The thesis is that the rural child has certain advantages which have not been fully utilized in present educational curriculum development and planning. This contention seems supported by the data. There is also a need to reorient our usual perceptions of deprivation in the rural setting. On occasion, it seems that deprivation occurs in the middle portions of our continuum—those who miss out both on the traditional, cultural explanations and on the exposure to media and other source of information.

NOTE

*This idea has been partly pursued, and some instructional materials have been developed by Dr. Rosalina Villavicencio. She presented in a workshop session at the recent International Council of Associations in Science Education (June 3–7, 1981) materials addressing life processes in plants for elementary children.

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