

THE INFLUENCE OF SCHOOLING ON COGNITIVE DEVELOPMENT: A REVIEW OF RESEARCH IN INDIA

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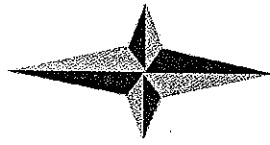
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Cross-cultural studies have quite often reported schooling as an important factor in determining the level of performance on cognitive tasks. Rogoff (1981) has presented a detailed review of these studies. Mishra (1997, 2001) has examined selected studies carried out not only with schooled and unschooled subjects, but also with children attending schools of different quality and types.

Comparison of the performance of schooled and unschooled subjects on various cognitive tasks indicates qualitative as well as quantitative differences. The effect of schooling and/or literacy has been interpreted in different ways (Dasen, 2000; Segall, Dasen, Berry, & Poortinga, 1999; Trommsdorff & Dasen, 2001):

1. Schooling produces new cognitive processes.
2. Schooling impacts on universal cognitive processes:
 - a) through promoting the *generalization* of existing processes to a large array of contexts, including new and unfamiliar ones;
 - b) through fostering different *cognitive styles*.
3. The effects of schooling are mainly *artifacts*:
 - a) Schooling produces only *school-specific skills* that are therefore likely to show up only in school-like experimental studies;
 - b) Schooling produces only *superficial effects* that result from positive test taking attitudes and ease in test situations. (Often referred to as "test sophistication effect" or "test acculturation effect").

ONGOING THEMES IN PSYCHOLOGY AND CULTURE



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- To this typology, we should add the following methodological issues:
4. Schooling is not a unitary process, but much depends on the amount, type and quality of schooling.
 5. Comparative cross-cultural research offers quasi-experimental designs to disentangle, or unconfound the two variables of chronological age and schooling.
- We will now review research carried out in India, and will then attempt to assess which of these interpretations and methodological issues receive most support.

Review of Research in India

With respect to the effects of schooling on cognitive performance, studies carried out in India have either attempted a comparison of the cognitive performance of unschooled children and those attending schools, or they have examined the effects of different quality of schools (e.g., good vs. poor, high facility vs. low facility schools). In India, the schools run by the state governments, both in urban and rural areas differ in many respects from the private English-medium schools that draw children from economically prosperous families. Thus, the Indian setting today is characterized by the existence of good schools and ordinary schools, which may be distinguished on the basis of a number of indicators, including teaching methods, physical facilities, and policies of administration. Good schools impart education through well-trained teachers, using new teaching methods supported by technology; they are equipped with fairly good libraries, reading rooms and adequate reading material; they have enough space for accommodating students and members of the teaching staff; they generally provide children with transport and the facilities for games, sports and other recreational activities. Ordinary or poor schools are generally less or not equipped with these facilities (Mishra & Gupta, 1978; Shukla, 1993; Sinha, 1977).

Another contrast in schooling in the Indian setting is created by the existence of traditional and modern schools. Traditional schools generally refer to the traditional institutions of teaching and learning for the Hindu and Muslim communities (Kumar, 2000). Since the ancient Hindu knowledge is stored primarily in the Sanskrit language, traditional Hindu school-

ing had placed great emphasis on the knowledge of this language, which also was used as the medium of instruction. Hence, these schools are commonly referred to as Sanskrit schools or *Sanskrit pathshala* (a place of Sanskrit teaching) (Mishra & Vajpayee, in press). In the present days, these schools teach Vedic literature, philosophy, astrology, religion and traditional rituals following the ancient Indian tradition of *guru-shishya* (teacher-taught) relationship. The teaching method involves primarily rote learning. The teacher often recites a lesson orally, which the students repeat, or the teacher writes it on the blackboard and the children copy it. Great emphasis is placed on the memorization of the verses of Vedas and grammatical formulae, but also on argumentation and other curricular content.

Quranic schools, often known as *maqtab*, have served as the traditional institutions of teaching and learning for the Muslim community. Quranic schooling in the present days refers to elementary or intermediate levels of traditional education, which provide the learner with the basic skills of reading and writing in Arabic, elementary notion of grammar and knowledge of Islamic law. It also requires children to memorize part or all of the Quran. Great emphasis is placed on rote learning (Mishra & Agrawal, 2001).

Modern schools refer to those schools that are modeled on the western system of education. This system was introduced during the British rule in India, and was stepped up after 1947 with the general policy of education for the masses. The history of these schools is not very old, but their impact on the society is widespread. These schools teach languages, arithmetic, history, geography and science that seem to expand a child's knowledge of the external world and promote abilities of analytical reasoning and logical thinking. Religious topics are taught only as lessons of moral education. Considerable variation exists in the educational facilities available in these schools. Their curricula do not put as much emphasis on rote memorization as those of the traditional schools, and effort is made towards the understanding of logical connections and rules. It is in terms of these emphases that modern schools present a contrast to traditional schools.

In studies on the effects of schooling on cognitive development, the performance of children who attend a school, either in the city or in the village, has been compared with that of the children who do not attend a school. In these studies, no effort is usually made to control for the effect

of social background factors that might create differences in performance of children besides school attendance. For example, most of the children who do not attend school come from a low socio-economic background, which seems to be significantly linked with low cognitive performances available to children, malnutrition, and similar other factors. In remote areas, such a confounding generally does not take place, but they are often so physically inaccessible and challenging that researchers usually do not venture to work there.

Studies investigating the effect of different quality and forms of schooling tend to focus on how the demands of various schools, as well as experiences and learning opportunities available to children in them, can alter the pattern of performance on cognitive tasks. Parental needs, aspirations, attitudes and values play a great role in determining the children's enrollment and continuity in schools. The extent to which these factors may be linked with cognitive development of children needs to be seriously examined. These factors have often been considered in comparisons of the educational achievement of children, but not much attention has been paid to them in studies of cognitive development.

In the following sections, we have attempted to briefly review relevant research in order to exemplify why studies with children from different quality and types of school background are necessary in the assessment of cognitive development. These studies broadly relate to pictorial perception, psychological differentiation, as well as learning and memory processes.

Pictorial Perception

Studies of pictorial perception have addressed two broad questions: (a) Are all people equally competent in perceiving and interpreting pictorial materials? (b) If not, are there some factors (related to pictures themselves or the perceiver), which can reliably account for differences in the perception and interpretation of pictures?

Mishra (1996) compared the perception and interpretation of pictures offered to schooled and unschooled adults, aged 20-40 years. The participants were selected from high caste groups and from groups placed at a lower level in the social hierarchy (called scheduled castes after being put

under a specific Schedule of the Indian Constitution for their overall development through a variety of schemes, including reservation in government jobs). Socio-economic level was controlled. High caste groups, even if unschooled and of low socio-economic level, have more pictures in the home, particularly of a religious nature, and interact with other more schooled members of the same caste. The participants also differed in terms of their contact with urban centers. Using culturally familiar pictorial stimuli, the participants were asked to interpret certain pictures that involved the depth cue of interposition in one of the tasks. In a second task, the participants had to arrange a series of four picture cards in their proper sequence in order to make a small story.

Findings revealed that schooled subjects in general offered a more relevant and logical interpretation of pictures as compared to non-schooled subjects. The overall performance of scheduled caste subjects was significantly lower than that of the members of the nonscheduled castes, and urban contact also had a significant impact. Schooling exercised a "leveling" influence in the sense that it tended to eliminate the performance difference between the scheduled and nonscheduled castes.

However, this leveling effect of schooling was not found in a study by Sinha and Mishra (1982) on the perception and interpretation of pictorial symbols by low and high caste, rural and urbanized subjects. The main effects of all three sociocultural variables were statistically significant, but were found to operate independently (none of the interactions was significant). Pictures were shown containing conventional symbols representing "hospital", "school", "railway-line", "family planning", and so on; half of these were familiar and half unfamiliar. Schooled, high caste, urban respondents were more likely to know the conventional meanings of these pictures, and familiarity had an influence on their performance while it made little difference for the disadvantaged groups. It was argued that interpretation of the meaning of symbols requires a person not only to go beyond the information available in the stimuli, but also to make full use of knowledge that has been culturally transmitted. In the absence of this knowledge, the interpretation of symbols is likely to be figure-based (Mishra, 1987). As a cultural institution, schooling tends to promote connotative knowledge by providing an organized set of experiences with a variety of pictures, including symbolic ones.

Mishra and Gupta (1978) examined the effect of quality of schooling on the perception and interpretation of sequences of pictures by comparing children drawn from nursery (good) and municipality (ordinary) schools. The children were given four series of pictures, each with a set of four cards, to arrange in a logical sequence so that a meaningful story emerged out of it. Children of the nursery school were found more skillful than those of the ordinary schools, not only in terms of arranging pictures in their logical sequence but also in terms of coherence and organized description of events in pictures. Similar results were obtained from nursery and municipality school children in another study in which the perception and interpretation of dual scene pictures were compared (Mishra & Gupta, 1983).

In a developmental study, Shukla (1993) analyzed the responses of children aged 4-12 years on five pictorial tasks. Children of high facility (good) schools generally performed better on tests than their low facility (ordinary) school counterparts. Factor analysis revealed that the perception of pictures was characterized by three sets of factors, namely "perceptual segregation," "cognitive operations," and "logical representation," all of which were significantly promoted by high facility school attendance. Combining pictorial and linguistic measures, Mohanty and Mohanty (1985) investigated the effect of preschool experience on the linguistic and cognitive skills of 3.5 to 5 year old children; 30 children were enrolled in a preschool program and 30 children had received no formal school training. Draw-a-design and draw-a-child tasks were used, and children's comprehension and production of Oriya locative sentences were interpreted as measures of linguistic development. Results showed that the preschool children performed significantly better than the unschooled children on all measures.

Perceptual Differentiation (Cognitive Style)

Studies of perceptual differentiation have generally been carried out using the "eco-cultural framework" developed by Berry (1976), and in some studies, schooling has been used as a variable characterizing children's acculturation. In one such study G. Sinha (1988) examined the effect of the experiences of formal schooling, industrialization and urbanization on the performance of Santhal Tribal children on the Story-Pictorial Em-

bedded Figures Test (SPEFT, Sinha, 1984). While industrialization had the strongest influence on the performance of children, the impact was further strengthened when it was combined with exposure to formal schooling. Schooled samples were found to be more differentiated (i.e. more field-independent) than the unschooled in all settings.

Mishra and Agrawal (2001) examined the development of abilities of spatial analysis and perceptual disembedding (using the Block Designs Test and the SPEFT as measures) among Hindu and Muslim children attending traditional (Sanskrit or Quranic) or modern (Western-type government) schools. It was hypothesized that cultural practices associated with traditional schooling would encourage a lower level of differentiation among children. Results showed that children attending modern schools were psychologically more differentiated than children attending traditional schools. A comparison of non-schooled children with traditional school children in terms of their level of differentiation has apparently not been made, and this may be an interesting topic of research in this area.

Memory, Learning, Problem Solving and Piagetian Tasks

Some studies have been carried out with a focus on learning and memory of schooled and unschooled children and also of children attending different quality and forms of schools.

U. Dash (1988) tested schooled (aged 6-8 and 10-12 years) and unschooled (aged 4-6, 6-8, and 10-12 years) boys for their ability to remember the location of pictures in a serial short-term recall task as a means of examining the influence of age and schooling on the development of structural features and control processes in memory. Short-term store, a structural aspect of memory as reflected in recency recall, remained invariant to either age or schooling, thus implying universality of structural memory. Age but not schooling contributed toward the development of control processes in memory (e.g. primacy effect) indicating that formal educational experience imparted through rural primary schools may not train children to employ active mnemonic strategies.

A.S. Dash and Rath (1985) found that the rate of learning could be improved by preschooling. Small samples of schooled nondisadvantaged (SND) and non-schooled disadvantaged (NSD) 4-5 year old children were given training on a battery of cognitive tasks for eight weeks. The children were trained in sequential thinking, figure-ground perception, shape dis-

crimination, visual recall, and visual discrimination. Four cognitive tests were administered twice, before training and after training, including the Visual Reception and the Visual Association subtests of the Illinois Test of Psycholinguistic Abilities and Draw-A-Design and Draw-A-Child Tests from the McCarthy Scales of Children's Abilities. All children showed significant improvement on cognitive tasks following training, but the rate of improvement was greater for NSD compared to SND children, which is in favour of the levelling effect of schooling.

Mishra, Shukla and A. Mishra (1999) examined learning and memory in schooled and unschooled children, aged 7-12 years, controlling for the effect of socio-economic background. Using verbal learning tasks in a free recall procedure with unrelated, conceptually related, and phonetically related words, the authors demonstrated that the effects of schooling were age and task-specific. The overall recall and clustering scores of schooled children were higher than those of the unschooled, particularly on the conceptual task. However, these differences were less evident on the phonetic task.

Focusing on quality of schools, Agrawal and Mishra (1983; see also Mishra & Agrawal, 1982) examined the development of category clustering among children (aged 5-13 years) attending good (high quality) and ordinary schools. Analysis of free recall protocols revealed that children from ordinary schools showed lesser clustering than those of the good schools.

The role of task characteristics in learning and memory has been demonstrated by A. Mishra (1992) with children in ordinary and better schools. The children were presented with a categorical list of items for free recall, and the same items were also embedded in a culturally salient story. The findings revealed that differences in recall and clustering were related to schooling only when the items were presented in a "list context." When these items appeared in a culturally appropriate "story context," there were no differences associated with schooling.

Mishra (1988) compared the organizational strategies of children of Sanskrit (traditional) and modern (western-type) schools in learning and recall of list items. As far as recall performance was concerned, there was no significant difference between the scores of the two groups, but it was found that children in both types of schools tended to organize items according to what was most important for them. The Sanskrit school children based the clustering of items on the symbolic meaning of the objects

in Hindu ritual practices, whereas the children attending modern schools organized the recall around a series of events.

Rath (1990) examined the differential performance characteristics of 50 schooled (Grade 2) vs. 50 nonschooled tribal Santal children in problem-solving tasks involving differential processing strategies (rather than ability) when the mediational role of linguistic competence was at a minimum level. Children were administered tests of reflection-impulsivity, simultaneous, and successive processing. Schooled children outperformed their nonschooled counterparts in reflective and simultaneous processing. No significant difference was found in successive processing. More schooled children were reflective processors compared to their nonschooled counterparts, who were primarily impulsive processors. Even the most minimal form of schooling accelerated the growth of reflective and simultaneous cognitive information processing in tribal children independently of IQ.

Dash and Das (1987) administered a 14-item, 7-category syllogistic reasoning test to 60 schooled and 90 nonschooled children (aged 4-12 years). Results indicated a significant developmental trend in reasoning, but failed to demonstrate any significant influence of schooling for the total number of syllogisms solved. An analysis of group differences for different types of syllogisms revealed significant schooling effects for the conjunctive type in favour of the schooled group and for the contrary-to-experience type in favour of the nonschooled group. Results suggested that logical truths could be grasped by nonschooled children as competently as by their schooled counterparts, and both samples seemed to do poorly when empirical and contingent truths interfered with logical inferences. The absence of effect of schooling could be attributed either to the poor quality of schooling, relying only on rote memorisation, or to the rich oral tradition of reciting religious and mythological poetry (to which both unschooled and schooled children are exposed in Orissa), and the syllogistic reasoning embedded in the latter.

Another study contradicting the effects of schooling has been reported by C. Mishra and Padhee (1987). They studied the effects of parents' formal schooling and socioeconomic status (SES) on the conservation of volume of three groups of 7-11 year old children representing unschooled low SES, schooled low SES, and schooled high SES. Results showed that the development of conservation of volume was age-dependent, but that, in contrast to previous findings, both schooling and SES had no significant effect.

Dash and Das (1984) examined the influence of schooling and age on the development of concrete operational thought and information processing. Four to six year old preschoolers and schooled children of 6-8 and 10-12 years, drawn from a relatively homogeneous socio-demographic background of rural India were given four tests of information-coding processes. Half of the children in each group were also given four Piagetian concrete operational tasks. As predicted, performance on Piagetian tasks increased as a function of age only, whereas the effects of schooling, age, and their interaction were clearly observed for coding processes. It was concluded that information-processing modes were more sensitive to cognitive consequences of schooling than concrete operational skills.

Language and Metacognition

Dash, Kantha, and Singh (1995) examined the influence of schooling on sensitivity to the formal properties of language by comparing small samples of schooled and unschooled children, aged 10-12 years, on five metalinguistic awareness tasks. They completed rhyme recognition, arbitrariness of language, symbol substitution, word creation and linguistic ambiguity tasks. Results revealed that schooled children performed markedly better on all tasks except rhyme recognition suggesting that schooling strengthens metalinguistic awareness.

Mohanty and Das (1987) studied the impact of bilingualism on cognitive and metalinguistic abilities and the relationship between the two abilities among tribal Kond children. Twenty unilinguals and 20 bilinguals in each group, one composed of 7-year-olds and the other of 9-year-olds, were administered metalinguistic tasks, Piagetian conservation tasks, and the Raven's Coloured Progressive Matrices. Analysis of variance showed significant effects of bilingualism and age on Raven scores, but not on conservation scores. The effect of bilingualism on metalinguistic ability was not significant. Findings support the claim that metalinguistic ability is school-related and that bilingualism alone does not promote it.

While many studies show that bilinguals outperform unilinguals on a number of cognitive, linguistic, and metalinguistic tasks, even when differences in intelligence are controlled, a study by Mohanty (1992) with unschooled bilingual and unilingual children showed no significant difference in metalinguistic skills. The metalinguistic hypothesis of bilinguals

superiority in cognition needs to be re-examined in the context of the effect of schooling on metalinguistic processes.

Kurtz (1990) reported a study on memory performance and metamemory in 120 schooled and unschooled six and eight years old children in Nagpur, Maharashtra. The two groups were matched on socioeconomic status and IQ. No difference was found on metamemory tasks, but on a serial rehearsal task. The schooled children rehearsed more, which is consistent with the emphasis the Indian teachers were found to place on rote memorization (Kurtz, Borkowski, & Deshmukh, 1988). When trained to cluster and to rehearse, schooled children improved more on clustering, rehearsal, and recall measures than did nonschooled children. Among schooled children, number of years of schooling predicted performance on two of the memory tasks in regression equations with age controlled. The negative result regarding metamemory was attributed to the fact that even the schooled children had received little schooling, or alternatively to a lack of sensitivity of the metamemory test.

Conclusion

These studies suggest that the effect of schooling is linked to a number of factors, among others familiarity with cognitive operations, local environmental demands, long-term adaptations to particular situations, children's motivation and other non-test factors. It is necessary to examine these factors before making specific predictions about the effects of schooling in general or of various quality and forms of schooling in particular.

As to the typology presented at the beginning of the review, all the interpretations except the first one receive some support. Indeed, there are no cognitive processes found in schooled children that seem to be completely absent in non-schooled children, i.e., the effects of schooling, if any, are quantitative rather than structural. They are also qualitative insofar as schooling fosters certain cognitive styles (interpretation 2b) such as connotative, conventional knowledge vs. figure-based knowledge (Sinha & Mishra, 1982), and psychological differentiation. The classic link between a "theoretic" vs. "empiric" style and literacy, described by Scribner (1979), was not confirmed in a study by Dash and Das (1987), and possibly needs further investigation. This could be due to the fact that Scribner's Liberian informants were illiterate adults, able to resist the contrary-to-

reality premises, while in Orissa, unschooled children accepted the experimenters' statements, while the schooled children introduced school knowledge to counter them.

Most of the studies use a testing format that comes close to school activities, which may explain the higher performance of schooled children (interpretation 3a or b). However, the effects of schooling are quite systematic (except on Piagetian concept development) and are found even on culturally appropriate tasks, suggesting that the effect is just not an artifact. In some cases, schooling acts as a cultural amplifier (Berland, 1982), strengthening the impact of other factors such as urbanization, or allowing the children to take better advantage of learning opportunities. In other cases, schooling produces a leveling effect, i.e., it serves to erase the differences that otherwise exist in terms of more or less stimulating environments.

The studies dealing with the quality or form of schooling emphasize the fact that schooling is a packaged variable that needs to be broken down into procedural components, and also that schooling is far from homogeneous, as it is embedded in socially complex situations, with many interacting variables. This is no doubt what limits the quasi-experimental possibility of unconfounding variables such as age and schooling, and may explain why this research strategy is not used more often. However, when it was used, age was found to be more influential than schooling (e.g. Dash & Das, 1987), and in Mohanty's studies, it allowed to qualify the impact of bilingualism on metalinguistic skills.

In summary, concentrating on research carried out in India, we have to conclude that the situation is more complex than previously thought. Both age and schooling are "packaged variables" that need themselves to be broken down into processes. Schooling, for example, is not a unitary process, but much depends on the amount, type and quality of schooling. Learning outside of school also has to be taken into account.

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THE INFLUENCE OF SCHOOLING ON COGNITIVE DEVELOPMENT: SPATIAL LANGUAGE, ENCODING AND CONCEPT DEVELOPMENT IN INDIA AND NEPAL

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Most developmental psychological research takes place in contexts where all children go through the process of schooling at much the same age; hence, two variables, chronological age (representing maturation, or more generally ontogenetic development) and schooling (representing one major aspect of social learning) are confounded. Comparative cross-cultural research offers the quasi-experimental paradigm to disentangle, or unconfound these two variables.

Mishra and Dasen (this volume) have reviewed research carried out in India on the influence of schooling on cognitive development. In this paper, we present some empirical results on the same topic, comparing schooled and non-schooled children in a study of language development, spatial encoding and spatial concept development in India and Nepal. Moderate support is found for an impact of schooling on spatial concept development, and to some extent on the use of spatial language, but not on the choice of the frame of reference (egocentric or geocentric) for encoding spatial arrays. In the relationships between spatial language and concept development, both schooling and age were found to be independently influential.