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Exploring Cognitive Skills and Academic Outcomes of Poverty-Affected English Language Learners in Indian Primary Schools

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Swagatika Samantaray [α] & J. P. Das [σ]

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I. Introduction

a) Relevance

We report a study within the framework of a brain-based approach to Intelligence. Specifically we use assessment of Planning, Attention, Simultaneous and Successive(PASS) as a measure of intelligence (Naglieri, J. A., & Otero, T. M. (2018)). PASS provides explanations of cognitive and behavioral expressions of intelligence while its origins remain in physiological levels of brain functions (Das,2018); The brain-based approach does not exclude experience and the cultural environment in which an individual must function We suggest that (1) intelligence should be considered as a conglomeration of cognitive processes for adaptive purpose, that it is not to be defined as IQ, and (2) cognition, unlike IQ, is by nature responsive to learning, be it formal or spontaneously acquired through experience (Das, 2018). Learning links cognitive processes to education because cognitive enhancement can be learned through training (Posner & Rothbart, 2007). Focus on the effect of poverty as a cultural disadvantage delineates changes in the brain due to learning and its dysfunction. Still it is believed that genetics, culture and opportunity are the three major factors that influence intelligence. There is little disagreement at present that gene to culture transmission is a bidirectional process, that it works both ways even at the molecular level. See (Heyes, 2012) Co-evolution "New Thinking: The Evolution of Human Cognition" by Cecilia Heyes. It was published in the journal Philosophical Transactions of the Royal Society B: Biological Sciences. The article discusses the coevolution of human cognition, emphasizing how culture and cognitive processes have evolved together. Heyes argues that many cognitive mechanisms, traditionally thought to be products of biological evolution, are actually shaped significantly by cultural evolution. Key points include: 1. Cultural Inheritance: Cognitive mechanisms are transmitted through social learning, and culture plays a significant role in shaping cognitive development. 2. Cognitive Gadgets: Heyes introduces the concept of "cognitive gadgets," which are mental tools shaped by cultural evolution rather than biological evolution. 3. Interaction of Biology and Culture: The article explores how genetic and cultural evolution interact, proposing that many cognitive traits are a result of this interaction".

Transcription from DNA to RNA is impacted by cultural factors including chronic poverty as a stress response, epigenetic modifications initiated by malnutrition, cultural disadvantage and lack of opportunities for education.

Poverty greatly impacts the resources accessible to students, leading many to fall behind academically compared to children not living in poverty. The influencing key factors which affect student performance include family income, income sources, resources available, home literacy environment etc. Since it is not easy to effect major changes in these conditions widely prevalent among students in poverty, we can provide a school climate that mitigate the impact of poverty by providing teachers as mentors.

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In our study, it was possible to do so as many of the teachers also lived in the same 'slum' area where the school was located. When asked, they said 'if we do not teach our own children, who else would do ?'

This excerpt (Das, J.P.(2018) Brain-Based Approaches to the Study of Intelligence Oxford Research *Encyclopedia of Education Emotion, and Learning*) given below outlines a brain-based approach to understanding intelligence, emphasizing the importance of cognitive processes over traditional IQ measures. The PASS theory (Planning, Attention, Simultaneous, and Successive) is highlighted as a key framework for assessing intelligence. Here are the main points and insights from the text:

b) Key Points

1. Brain-Based Approach to Intelligence
   - Intelligence is viewed as a set of cognitive processes (Planning, Attention, Simultaneous, and Successive) rather than a single IQ score.
   - Cognitive processes are influenced by both physiological brain functions and external factors like experience and cultural environment.
2. Role of Learning and Environment
   - Intelligence is adaptive and can be enhanced through learning and training.
   - Environmental factors, such as poverty, significantly impact cognitive development and academic achievement.
3. Cultural Influence and Coevolution
   - Cultural factors, including chronic poverty, affect gene expression and epigenetic modifications.
   - Heyes (2012) introduces the concept of "cognitive gadgets," mental tools shaped by cultural evolution, suggesting a bidirectional interaction between genetic and cultural evolution.
4. Impact of Poverty
   - Poverty influences student performance through factors like family income, home literacy environment, and access to resources.
   - Schools can mitigate these effects by providing supportive environments, such as teachers from similar backgrounds acting as mentors.

c) Implications for Education

- *Focus on Cognitive Processes:* Education systems should prioritize the development of cognitive processes through targeted interventions and training programs.
- *Supportive School Climate:* Creating a nurturing school environment, especially in impoverished areas, can help bridge the gap in academic achievement.
- *Cultural Sensitivity:* Recognizing the cultural and environmental factors affecting students can lead to more effective educational strategies.
- How to raise the World's IQ –The Economist July 13th—19th 2024

d) The Present Study

We report a study within the framework of a brain-based approach to Intelligence. Specifically we use assessment of Planning, Attention, Simultaneous and Successive (PASS) as a measure of intelligence.

PASS provides explanations of cognitive and behavioral expressions of intelligence while its origins remain in physiological levels of brain functions (Das, Kirby, & Jarman, *1975, 1979;* Das, Naglieri, & Kirby, *1994*). The brain-based approach does not exclude experience and the cultural environment in which an individual must function.

We suggest that (1) intelligence should be considered as a conglomeration of cognitive processes for adaptive purpose, that it is not to be defined as IQ, and (2) cognition, unlike IQ, is by nature responsive to learning, be it formal or spontaneously acquired through experience (Das, 2018). Learning links cognitive processes to education because cognitive enhancement can be learned through training *(Posner & Rothbart, 2007).*

Extensive research has shed light on the cognitive assessment of various functions such as Planning, Attention, Simultaneous, and Successive Processes (PASS measures), particularly in relation to academic achievement, notably in reading and mathematics. However, scant attention has been paid to exploring the influence of poverty on these cognitive processes. Recent scholarly focus has increasingly turned towards understanding the detrimental impact of poverty on education. In our study, we delve into this issue by examining children from a school situated in an urban slum within an Eastern State of India.

i. *Poverty and Culture: The Poverty of Culture Distinguished from Culture of Poverty*

Oscar Lewis (1966) was an American anthropologist known for his concept of the culture of poverty. In his influential work, "The Children of Sanchez: Autobiography of a Mexican Family," (1961) Lewis argued that poverty was not just a result of economic factors but was also perpetuated by a set of values, beliefs, and behaviours that were passed down from generation to generation within impoverished communities.

Lewis suggested that individuals growing up in poverty are likely to develop a particular outlook on life characterized by feelings of helplessness, dependency, and marginalization. This outlook, according to Lewis, becomes ingrained in the culture of the community, reinforcing patterns of poverty across generations.

Lewis has had a significant impact on discussions around poverty and social policy. However, concept of the culture of poverty remains a subject of debate and inquiry in sociology, anthropology, and related fields.

Understanding the culture of poverty allows for a broader perspective on social issues. It reveals that problems traditionally attributed to specific racial or ethnic groups are, in fact, prevalent across various societies. Addressing poverty's cultural aspects requires tailored interventions beyond mere economic assistance. In more developed countries like the U.S., solutions for poverty often involve raising living standards and integrating the impoverished into the middle class.

To mitigate the adverse effects of poverty on academic achievement, schools must create supportive environments. This includes providing basic necessities, offering holistic support services, employing quality teaching methods, integrating social and emotional learning, engaging parents and communities, and advocating for structural change to address inequality. Whether or not these are possible for implementation, remains a topic for discussion.

To address the impact of poverty on academic achievement, it's essential to examine both the school environment and the role of teachers as mentors. In many Indian cities, poverty is synonymous with slums, such as the largest one in Bhubaneswar, the capital of the state of Odisha. Our focus lies on studying children's academic performance within a school located in this slum (who are from low socio-economic status).

The study conducted in a slum where poor families live with limited access to education and health care system and facilities. The children tested for study were considered to be poor on basis of the income of the family. The families are coming under below poverty line (BPL). Below the poverty line refers to individuals or families whose income falls below a certain threshold level, known as the poverty line. This threshold is set by the state Government in Odisha and is typically based on the cost of basic needs such as food, shelter, and clothing. To come under the BPL scheme in Odisha, a family's annual income must be below Rs 40,000 in rural areas and Rs 60,000 in urban areas. All the families living in the slum come under BPL category. Government of Odisha has provided them BPL card examining their income for accessing health facilities, basic education and ration.

The second school outside the slum area is used for comparision. It has students from a wider range of socio-economic background. The course curriculum and the medium of instruction is same as any other Govt. school in Odisha, and the slum school. This school has students from both low and middle socio-economic status.

ii. *The Second Part of the Study Prediction of academic achievement in reading and mathematics associated with PASS processes*

Reading is a complex process and it involves many sub processes (Gough & Tunmer, 1986). The challenges become even more complex for children living in poverty. Prolonged exposure to stress triggers the release of cortisol, a stress hormone that can impair executive functions in children (Blair, Clancy et al.). This impairment often hinders reading acquisition and overall reading development (Evans & Kim, 2007). Numerous studies have established a strong and consistent relationship between poverty and academic achievement (Duncan, Brooks-Gunn, Yeung & Smith, 1998; Guo, 1998; Korenman, Miller & Sjaastad, 1995). Research consistently shows the detrimental effects of poverty on children's reading attainment. Both word decoding and passage comprehension require significant cognitive processing, which can be compromised when cognitive functions are under strain.

So is mathematics ability. Knowledge about digits, randomization, size and estimation are some core elements of mathematics. Children do develop this knowledge along with the letter and phonemic awareness as they begin to go to school and start learning different concepts. Thus, growing up in poverty is presumed to have a negative impact on the cognitive predictors for reading, comprehension and mathematical ability.

iii. *PASS processes and Relation with Reading, Comprehension and Math*

Here is a brief review of cognitive processes which predict reading, comprehension and mathematical ability in children, followed by a report of an investigation. The study examines the structure of the relationship between cognitive processes on the one hand and Reading and Math competence on the other within a neurocognitive framework, the Planning, Attention, Simultaneous and Successive processing (PASS). A comprehensive review is given in the following abstract

Georgiou, G., Guo, K., Naveenkumar, N., Vieira, A. P. A., & Das, J. P. (2020). PASS theory of intelligence and academic achievement: A meta-analytic review. *Intelligence, 79*, 101431.

In short, the following is an informative abstract of the results of the meta-analysis:

> *……how well the PASS processes relate to academic achievement?. Thus, this study aimed to determine their association by conducting a meta-analysis. …. data from 62 studies with 93 independent samples revealed a moderate-to-strong relation between PASS processes and reading, r = 0.409, and mathematics, r = 0.461]. Moderato analyses further showed that (1) PASS processes were more strongly related to reading and math in English than in other languages, (2) Simultaneous processing was more strongly related to math accuracy and problem-solving than math*

fluency, (3) Simultaneous processing was more strongly related to problem-solving than Attention, and (4) Planning was more strongly related to math fluency than Simultaneous processing. Age, grade level, and sample characteristics did not influence the size of the correlations. Taken together, these findings suggest that PASS cognitive processes are significant correlates of academic achievement, but their relation may be affected by the language in which the study is conducted and the type of mathematics outcome. They further support the use(They further support the use of intervention programs that stem from PASS theory for the enhancement of reading and mathematics skills. (permission for quote obtained from George K. Georgiou.

Long before the meta-analysis study mentioned above, Long before the meta-analysis study mentioned above, Das, Kirby, and Jarman (1979), as well as Das, Naglieri, and Kirby (1994), established specific links between PASS processes and word reading. They proposed that successive processing contributes to word reading through phonological processing (sounding out words), while simultaneous processing aids word reading through orthographic processing. When children are learning to read, word recognition is often achieved through phonological recoding. This process involves identifying individual letters in words, recalling their corresponding sounds, storing these sounds in short-term memory, and finally blending them in a serial or successive order—steps that describe successive processing.

Familiar words, on the other hand, can be read by sight without the need for phonological recoding, thanks to orthographic knowledge. Orthographic processing involves simultaneous processing; for example, distinguishing between phonologically similar words requires simultaneous comparison to determine the correct spelling (e.g., "rain" vs. "rane"). Research has shown that children with reading difficulties often have significant deficits in both simultaneous and successive processing (Das, Naglieri, and Kirby, 1994). For instance, in a study by Das et al. (2007) involving Grade 3 and 4 English-speaking children, it was found that the probability of a child being a poor reader was 0.75 if their standard score in successive processing was below 80. The corresponding probability for simultaneous processing was 0.50.

PASS processes have also been linked to reading comprehension (e.g., Das, 2009; Georgiou & Das, 2014). Understanding a story requires children to grasp the relationships among the facts presented, which necessitates good simultaneous processing to integrate the main ideas in sentences. Additionally, planning and attention are crucial for reading comprehension. To effectively comprehend a passage, a reader must develop and actively revise a plan for approaching the text. Earlier work by Das et al. (1982) found that both planning and simultaneous processing were significant predictors of reading comprehension in fourth- and sixth-grade English-speaking children. More recent research has extended these findings, showing that simultaneous processing uniquely affects reading comprehension beyond the contributions of word and text-reading fluency (Georgiou & Das, 2014). Of course, working memory is indispensable for comprehension.

In the course of development in general and reading development in particular in children, poverty plays an important role. It has been argued that home literacy environment is one of the key factors for better reading development and academic achievement (Manolitsis, G, et al., 2011). In the present study, participants were from poor families. The study was conceptualised to examine different cognitive factors predicting different aspects of reading development. One of these was to compare the predictability of the cognitive factors for reading development and mathematic ability in typically developing children and children living in poverty. Apart from the environmental factor, we asked if in both groups of children, the same cognitive factors predict reading and mathematics ability.

The Present Study has the Following Objectives:

- To examine if PASS cognitive processes, assessed by CAS are significantly below the original American norms, same as in CAS.
- To identify the CAS cognitive processes that predict reading, comprehension and mathematical ability in children given that they are English language Learners (ELL),
- If CAS performance can predict achievement scores in Reading, Comprehension and Math (in English) of students in Grades 4 & 5.
- A comparison of cognitive and academic achievement of students in a typical school outside the slum.

II. Method

a) Participants

The study was conducted in Bhubaneswar Odisha, an eastern state of India. All children participated in the study were from a school in an extremely low economic area of the city. They were chronically poor. However, all of them were given free uniforms to wear to school. The school was clean and provided good sanitary facilities in contrast to the surrounding 'slum'. Discipline was not a problem and comparable to even schools in better socioeconomic areas. Teachers had requisite college education, and most lived in the same area where the school was located. They were exceptionally dedicated in spite of their low salaries compared to other schools. These factors might have mitigated and reduced the effect of chronic poverty on the children's academic learning.

The study included 80 pupils from grades four and five. Among them, 35 were girls and 45 were boys. The pupils were selected from a public school in

Odisha, where the medium of instruction was Odia. The school was selected on the basis of its language of instruction. The mean age for the sample was 9.8 years. The initial literacy instruction for the sample was Odia. However, they were introduced to English at an early age in school, when they usually begin to read. The approximate age would be five years when they start learning to read in English. The school uses Odia (native language) as the medium of instruction like the majority of schools do but English is taught as a subject. The school, as mentioned above, is located in the city's slum where all students live in poverty.

The children participated (Mean age 9.11 years) for the comparative study, who were not poor. They were from a private school, maintaining a high standard of principles and morale. This school is situated in the same city in an urban locality outside the slum area.

The medium of instruction for other subjects taught in the classroom was Odia and English is taught as a subject. The two-school followed simple methods for both languages, which were predominantly look and say, as is the practice in typical Odia-medium schools.

b) Measures

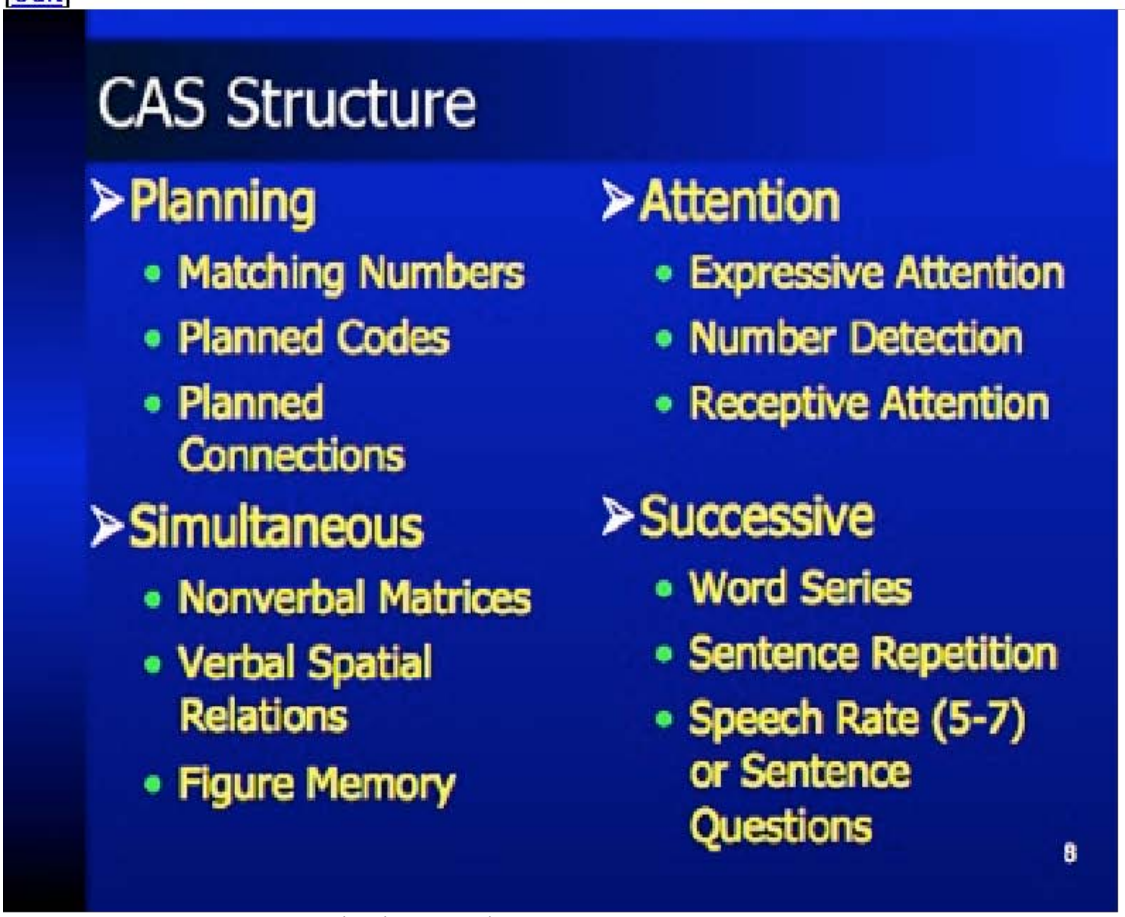
The study was designed to assess children's word reading, reading comprehension, cognitive and mathematical abilities. Word reading and Reading comprehension in English were assessed by Woodcock Johnson Test Battery. In addition, cognitive abilities of the children were assessed using Das-Naglieri Cognitive Assessment System (Naglieri & Das 1997). Mathematical problem solving and mathematical fluency were tested using WAIT- III.

Woodcock Reading Mastery Test: This test battery has test for word reading and reading comprehension in English. In word reading there are 106 items and the level of complexity increases with number of items. Basically, the words vary from high frequency to low frequency. The child is allowed to look to the word and say it out loud. The test stops at four consecutive errors. The reading comprehension test has 56 items and like word reading, the level of complexity increases with the number of items. The principle for stopping the test is same as word reading. The parallel test for word reading and reading comprehension in Odia follows the same norm and difficulty levels in items. The test administration and instructions were same for both the English and Odia tests.

- CAS is a system of assessment of 'processes', not abilities. Ability tests such as WISC/WAIS
- those that measure fluid and crystallized abilities address different constructs than process assessments. CAS process measures may have the same contents in several of its sub-tests (i.e. verbal, as in Simultaneous Verbal, and Word-series, see next section) but the codes are different (Simultaneous contrasted with Successive. see McCrea 2009[8] for further discussion).

The CAS battery

[edit]



Cognitive process subtests in the CAS battery

The CAS standard battery consists of three subtests for each PASS Scale (12 subtests in all) whereas the basic battery has 2 subtests for each scale (8 in total).The last test in each scale is dropped in basic battery. It takes an hour to administer the standard battery and 40 minutes for the basic battery (Naglieri & Das, 1997[9]).

The CAS basic battery provides a standard score for each process as well as a Full Scale standard score. The average internal reliability coefficients across ages 15–17 for the PASS scales are:

Das-Naglieri Cognitive Assessment System (CAS2 was not yet available): The CAS is an assessment battery designed to evaluate cognitive processing. It was developed to integrate theoretical and applied areas of psychological knowledge using cognitive processing theory and tests designed to measure—Planning,

Attention, Simultaneous, and Successive Processing (PASS)—in individuals ages 5–17. CAS is based on Luria's PASS model. The Planning, Attention, Simultaneous and Successive (PASS) cognitive processing model is a modern theory as it is based on Luria's analyses of brain structures (1966b; 1973). The model looks at information processing as dynamic instead of static. Children were administered 2 tests from each aspect, thus, giving a total of 8 tests for all the 4 components of cognition. The subtests for planning are matching numbers and planned codes. Expressive attention and number detection are the subtests for attention. The subtests for simultaneous processing are non-verbal matrices and verbal spatial relation. And the subtests for successive processing skills are, word series and sentence repetition. For details of the subtests of CAS and elaboration, please see *Das-Naglieri Cognitive Assessment System Interpretive Handbook* (Naglieri & Das 1997).

A recent paper on the history of CAS and PASS Theory is given in *The PASS View of Intelligence,* (Das & Kirby, 2022). We see intelligence as a cluster of cognitive processes that support individuals and groups in attaining goals and adapting to challenges. These processes are neurologically based, but this does not exclude roles for experience and the individual's cultural environment (Das, 2018). These processes are in principle responsive to development and learning, both spontaneously through experiences, and formally through instruction (Vygotsky, 1934, 1978).

WAIT-III: WAIT is a comprehensive test battery to assess a wide range of mathematical abilities through different kind of tests. Mathematical fluency and Mathematical problem solving are two among them. In the fluency test, the child needs to do a set of (contains 16 items) mathematical addition, subtraction, division and multiplication. The number of correct responses is the scores. On the other hand, problem solving has 70 items. They are mixed of kinds i.e.; matrices, spatial relation tasks and small comprehensive sums. The complexity of items increases with the number of items. The child has to understand the question and answer seeing the pictures or reading the question given in the task. The rule to stop the test is four consecutive errors.

c) Ethical Consideration

Before collecting the data, an ethical approval was obtained from the principal of the school, since the study required the involvement of school children. Initially a request was made to the principal of the school for the study. After getting the permission from the principal, the selection of participants was made after seeking their parental consent. All the pupils were briefed about the method and purpose of the study. They were also told that they were free to withdraw from the study any moment they want.

d) General Procedure

The studies were conducted in Bhubaneswar Odisha. After selecting the schools and children for the study, the children were briefed about the tests they were going to take. Each child was taking the whole set of tests in two different days to reduce the effect of fatigue and boredom. Each child was tested for 110 minutes approximately in total. The same child got a day break between the tests' day. The principals of the school were kind enough to provide the researcher with a quiet room for the tests. Before starting the tests, the researchers introduced themselves to the child and explained the child's importance in the study. Test administration began after establishing rapport with the child. It was prudently taken care that the child did not feel uncomfortable during the tests and continuous encouragement and positive feedback was given to each child during the tests. Before each test the child was given precise instructions and examples for the tests. The set of instructions for each test was provided in Odia with a mixture of English to promote easy understanding. A short meeting was also done with the parents in the first group of students, briefing about the objective of the study and every student was made clear that they may leave the study if they want at any point of time.

III. Result Analysis and Discussion

Table 1 shows the mean and standard deviation for all PASS components along with decoding, comprehension and math competency in poor children. Individual PASS scores indicate an average ability except in successive processing skill. The potential reasons of deficit are discussed later in discussion section. Additionally, skills in decoding, comprehension and math competency are explained in discussion section.

Similarly, Table 2 illustrates the mean and standard deviation for all PASS components along with decoding, comprehension and math competency in non-poor children. The scores in the table clearly show a difference in each individual PASS components along with decoding, comprehension and math competency skill. However, successive processing skill in non-poor children is also lower in comparison to the other individual PASS components. Successive processing skill found to be weak in the meta-analysis of PASS components. It could be presumed that lack of exposure to English language, medium of instruction in the school and poor home literacy environment are the possible reasons weakening the successive processing in the study. These determining factors are explained at a length in this result and discussion section.

Table 1: Mean and Standard Deviation of PASS Components, Decoding, Comprehension and Math Competency of the participants Assessed using Cognitive Assessment System, Woodcock Johnson Reading Battery and WIAT-III respectively (N= 80). *Poor Slum School*

Poor Children	*Means*	*SD*
Planning	91.75	10.86
Attention	90.67	11.10
Simultaneous	98.58	15.74
Successive	85.36	11.61
Decoding	36.85	17.01
Comprehension	05.47	03.65
Math Competency (Fluency)	37.63	14.18
Math Competency (Problem Solving)	39.07	05.88

Note: PASS Simultaneous standard score is exactly average. Planning and Attention are only one and half SD lower. Successive score reflects poor English proficiency, and examiner's effort to 'rescue' some of the participants to understand English as and when necessary.

Table 2: Mean and Standard Deviation of PASS Components, Decoding, Comprehension and Math Competency of the participants Assessed using Cognitive Assessment System, Woodcock Johnson Reading Battery and WIAT-III respectively (N= 70). *School Outside the Slum*

Non- Poor Children	*Means*	*SD*
Planning	105.88	21.48
Attention	108.58	01.76
Simultaneous	100.94	10.70
Successive	97.81	16.21
Decoding	44.52	18.61
Comprehension	18.77	16.29
Math Competency (Fluency)	88.24	15.45
Math Competency (Accuracy)	32.44	03.99

Note: PASS scores are average or over average (except Successive). This is for Non poor children.

The result of the study for poor children were unanticipated; evidence of mitigated poverty. Most likely a compelling evidence of favourable school climate. This is best explained by invoking the ecological notion of Bronfenbrenner.

Generally, it is expected that the impact of poverty will supress the cognitive as well as the reading skills of ELL students living in poverty Also, poor children are expected to exhibit poor academic achievements. The exception to this was the average PASS scores except successive processing skill. Here the question arises, what could be the possible mitigating factors for reducing the impact of poverty on their cognitive skills. In the introduction section we have explained about the climate of the school and role of teachers, we have explained about the motivating school environment and group of dedicated teachers who not only teach to educate the children of their own community, but they teach to build confidence and achieve academically. These teachers eventually have become their mentors. These are the rescuing factors to reduce the impact of poverty on their cognitive development and reading achievement.

Table 3, 4, 5, and 6 illustrate the age and grade equivalent score for decoding and comprehension in both poor and non-poor children. Comparing the age and grade between groups gives a picture of difference in performance. However, the difference in age can't be considered to be a reliable one because in India age is often manipulated at the time admission in the school. The manipulation in age is even more common in poor children since they don't have a proper birth certificate to produce. In that case, we take the grade equivalent score as the reliable score to measure the skill.

Besides, the test battery we used to assess the decoding and comprehension in children follow an American norm. Which further widens the gap between the chronological age and obtained reading age, and similarly between the normed grade and obtained grade. In both the poor and non-poor groups children are lagging behind in their grades from their original grade. Although the difference between the groups is not very wide, but it opens up the scope for discussion about the associated factors.

Table 3: Mean of Age Equivalent Score for Word Reading of the participants Assessed using Woodcock Johnson Test Battery (N= 80 and N= 70 respectively in each group)

Groups	*Means*	*SD*
Poor Children	7.19	1.66
Non-Poor Children	8.08	1.86

Table 4: Mean of Grade Equivalent Score for Word Reading of the participants Assessed using Woodcock Johnson Test Battery (N= 80 and N= 70 respectively in each group)

Groups	*Means*	*SD*
Poor Children	2.18	0.94
Non-Poor Children	2.88	01.80

Table 5: Mean of Age Equivalent Score for Reading Comprehension of the participants Assessed using Woodcock Johnson Test Battery (N= 80 and N= 70 respectively in each group)

Groups	*Means*	*SD*
Poor Children	05.88	01.23
Non-Poor Children	08.53	06.11

Table 6: Mean of Grade Equivalent Score for Reading Comprehension of the participants Assessed using Woodcock Johnson Test Battery (N= 80 and N= 70 respectively in each group)

Groups	*Means*	*SD*
Poor Children	01.17	0.63
Non-Poor Children	02.73	03.03

Table 7 depicts the math competency in both poor and non-poor children respectively. The means of both the groups revealed great difference in math competency. The variance is wide enough for an attempt to understand the underpinning factors associated with the skill level. The particular skill (math fluency) is measured through additions and subtraction in different difficulty level, needs digit knowledge, comprehension skills, information processing skill (speed component) as cognitive factors and familiarity and practice of simple equations in daily life as an individual and social factor. The role of home environment, exposure to basic transaction and calculation play a vital role in stimulating the competency of calculation in children.

We often learn basic concepts of mathematics like addition and subtraction from our family members before we go for formal education in school. The foundation of mathematics begins from home. More we talk about numbers and equation the more we gain the familiarity and practice with them. Only digit knowledge can't contribute significantly for developing knowledge on mathematical equation. Displaying a low score in math competency, poor children have raised interest to investigate every potential factor pulling back these children from acquiring a fair competency in mathematics.

Table 7: Mean of Math Fluency Score of the participants Assessed using WIAT -III Test Battery (N= 80 and N= 70 respectively in each group)

Groups	*Means*	*SD*
Poor Children	37.63	14.18
Non-Poor Children	88.24	15.45

Additionally, by taking children living in poverty has squeezed the diversity with regard the socio-economic status is concerned. Non-poor children belong to a group where the socio-economic status is wider and the distribution is spread. Thus, the result we obtained from the non-poor is more reliable than the poor children. To examine the significance of the difference that we found between the groups, we conducted a t-test for math fluency and the results is presented in Table 8. The difference between the groups found to be significant at .05 level (t (148) = -20.91, p = 0.22).

Table 8: Summary of t-test results for Math Fluency scores in both the poor and non-poor groups (N= 80 and N=70 respectively)

$Mean_a$—$Mean_b$	*t*	*df*	*p* value	Significance level
-50.60	-20.91	148	0.22	.05**

The t (148) = -20.91, p = 0.22. The result is significant at p < .05.

However, the focus of the paper was not on the performance of mathematics in both the groups but on PASS factors and how PASS components are predicting decoding, comprehension and math ability in children. Prior to investigating the PASS predictors for decoding, comprehension and math in this study, we checked the mean score of each skill. The reason why we didn't go for a regression analysis for decoding and comprehension is simply the low scores in each area. Examining the cognitive predictors for decoding, comprehension in this particular study would not suffice the literature to build a reasonable connection between the distal and proximal factors. Since we have found a significant difference in math competency in children, a regression analysis was done to examine the PASS predictors for math competency in both the groups.

Table 9 and 10 show the PASS predictors for math competency in both poor and non-poor children.

Table 9: Summary of regression analysis results for PASS measures predicting Math Fluency scores in the poor children (N= 80)

PASS	B	Std. Err	Beta	t	Sig.
Planning	.14	.15	.32	2.75	.00
Attention	.56	.13	.04	.40	.68
Simultaneous	.36	.10	.40	3.56	.00
Successive	-.15	.12	-.12	-1.17	.24

Note: The Dependent Variable is Math Fluency and as expected Planning and Simultaneous Processing Skills are the predictors for Math Competency.

Table 10: Summary of regression analysis results for PASS measures predicting Math Fluency scores in the non- poor children (N= 70)

PASS	B	Std. Err	Beta	t	Sig.
Planning	.11	.08	.15	1.36	.17
Attention	.33	.12	.31	2.61	.01
Simultaneous	-.04	.16	-.02	-.24	.80
Successive	-.20	.11	-.21	-1.86	.06

Note: Math Fluency measures accuracy and speed of calculation. Attention is the salient variable.

The regression analysis was done to examine which PASS component (s) predict the math fluency in children the most. Table 9 shows the regression analysis for poor children and table 10 shows the analysis for non-poor children. In case of poor children Planning (*Beta* = .32, *p* = .00) and Simultaneous processing skills (*Beta* = .40, *p* = .00) found to be predicting math competency as anticipated. However, Attention (*Beta* = 2.61, *p* = .01) is the salient variable for math fluency in non-poor children.

IV. Discussion & Concluding Remarks

Poverty greatly impacts the resources accessible to students, leading many to fall behind academically compared to children not living in poverty. The influencing key factors which affect student performance include family income, income sources, resources available, home literacy environment etc. (Lacour, M., & Tissington, L. D., 2011). In the present study, despite the trend of lower assessment scores among students from economically poor backgrounds, effective instructional methods, positive school environment and mentorship of the teachers have helped bridge the achievement gap by offering essential support for these students to excel academically.

The zone of proximal development (ZPD) Vygotsky, describes the range of skills an individual can achieve with expert guidance but is not yet able to accomplish independently. Vygotsky (1978), in his theory explains, this can be seen in classroom environments or any situation where a person has the chance to learn new abilities.

In our study, in the so—called 'slum school', the teachers have played an important role nourishing the students' mind with values, enthusiasm and hunger for academic achievement. The teachers' guidance and

support have enabled the students to perform better than the typical trend which poor children show.

In conclusion, we strongly emphasize the role of school atmosphere, based on Bronfenbrenner's framework. Resilience can be cultivated during childhood through the intricate social interactions children have with their parents and teachers within the microsystem (Bronfenbrenner, U. 1979). Emphasizing microsystem of the children, he meant the immediate environment i.e.; family and school.. Teachers who are the mentors for these children have contributed towards mitigating the impact of poverty to an extent. However, the results can best be viewed as an inspiring way to moderate the impact of poverty on children's education. In India to eradicate poverty huge and widespread as it is, is not an easy task at this point of time. Empowering families to provide a conducive learning environment is also dependent on several other complex factors—economics and cultural factors(see The Economist July 2024). The attainable task is to groom teachers as mentors who can actually change the academic trend found among children living in poverty.

Bonfrenbrener: School Climate

A recent article presents a practical application of Ecological. View of Bonfrenbrener Mitigating the effect of family poverty on academic and behavioral outcomes: The role of school climate in middle and high school Laura M. Hopson a, ∗, Eunju Lee b, 1a University at Albany, School of Social Welfare, 135 Western Avenue, Richardson Hall, Room 207, Albany, NY 12222, United States b University at Albany, School of Social Welfare, 135 Western Avenue, Richardson Hall, Albany, NY 12222, United States. *Mitigating the effect of family poverty on academic and behavioral outcomes: The role of school climate in middle and high school.*

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- Children and Youth Services Review 33(11): 2221-2229
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- The present study examines associations between family poverty, social supports, students' perceptions of school climate, behavior, and grades. Poverty is associated with poor grades and behavior, while positive perceptions of school climate are associated with positive grades and behavior. Perceptions of school climate moderate the association between poverty and behavior, such that students from poor families who perceive a positive school climate exhibit similar behaviors to their peers from higher income families. Implications for practice, policy, and research are discussed.© 2011 Elsevier Ltd.

What are the components of school climate that mitigate the effect of poverty on academic achievement.

The components of school climate that can mitigate the effect of poverty on academic achievement include:

1. *Supportive Relationships:* Creating a school environment where students feel supported by teachers, administrators, and peers can significantly impact academic achievement. Positive relationships can help buffer the negative effects of poverty by providing students with emotional support, encouragement, and a sense of belonging.
2. *High Expectations:* Setting high academic expectations for all students, regardless of their socioeconomic background, can empower them to strive for success. When students believe that their teachers and school believe in their potential, they are more likely to perform well academically, despite the challenges they may face outside of school.
3. *Safe and Inclusive Environment:* Schools that prioritize safety and inclusivity foster a conducive learning environment for all students. When students feel safe at school, they are better able to focus on their studies and engage in learning activities. Inclusive environments also ensure that every student feels valued and respected, regardless of their socioeconomic status.
4. *Quality Teaching and Learning:* Providing high-quality instruction and engaging learning opportunities is essential for supporting academic achievement, particularly for students from low-income backgrounds. Effective teaching practices, differentiated instruction, and access to resources can help level the playing field and ensure that all students have the support they need to succeed academically.
5. *Family and Community Engagement:* Building strong partnerships between schools, families, and communities can enhance student outcomes, particularly for students facing poverty-related challenges. When families are actively involved in their child's education and schools collaborate with community organizations to provide additional support services, students are more likely to thrive academically.
6. *Positive School Culture:* Cultivating a positive school culture characterized by respect, empathy, and a focus on continuous improvement can have a profound impact on student achievement. When schools prioritize positive behaviors and celebrate successes, they create an environment where all students feel valued and motivated to excel academically.

By addressing these components of school climate, educators and policymakers can help mitigate the effects of poverty on academic achievement and promote success for all students, regardless of their socioeconomic background.

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