**Development of Foundational Literacy and Numeracy skill among Primary School students: Theoretical Analysis of Gender and Parental role**

**Abstract**

*Lower-level Foundational literacy and numeracy skills among primary students is a global concern of educational policy framers, researchers and teachers due to their positive implication for individual student’s academic progression, employment opportunity and national progress. Although research literature is enriched with findings of cognitive and institutional perspective of FLN skill of student but influence of child’s gender and parental role is less focused, more specifically how these social demographical factors affect development of foundational literacy and numeracy skills among students. In this thematic paper, attempt has been made to propose on hypothetical model about role of gender and parents for child’s foundational literacy skill development, from the existing literature. This model can be used to understand social perspective of differential FLN skill among students*

***Keyword’s:* Foundational Literacy, Foundational Numeracy, Gender Differences, Parental Role, Learning Poverty, Socioeconomic Status, Educational Inequality**

**Introduction**

Decrease in Foundational Literacy and numeracy skills among primary student is an issue which caught the attention of educational policy framers, teachers and parents due to its multiple adverse effect on individual student and the education system. Why do some students have better FLN skills and others have less, is a research focus. Multiple causes intricately effect development rate of these skill among students which may be broadly categorized as child related psych-cognitive factors, institutional factors, and the social factors. Although it has been consistently reported that child’s cognitive abilities and the institutional factors such as teaching quality, resource, teacher’s role have significant effect in this regard, but the social perspective is not only less focused but also their influence are contextual. In this paper attempt have been made to explore variation in foundational literacy and numeracy among primary students due to social variables such as child’s gender, parental role.

**Back Ground of the study**

Assuring foundational Literacy and numeracy skills among students is a global focus due to its instrumental implication for effective navigation in subsequent educational stages and all facets of life. Importance of foundational literacy and numeracy skills in general and for the school students in particular is beyond doubt and debate. Foundational literacy is the ability to comprehend written text meaningfully, and ability for verbal and written expression of own thoughts, and critically analyze information; foundational numeracy is about the capacity to understand and use the numbers for performing day to day activities. But interestingly, it has been found that 40% global students at the age of 15 don’t have basic reading and numeracy skills (UNICEF, 2022), and this problem is acute among students from lower income countries, where nine out of ten students cannot read a text with comprehension (World Bank, 2019a ). These low-level foundational literacy and numeracy skills among school students from developing and undeveloped countries have been coined as “learning poverty”, “learning crisis”. This problem of learning crisis among school students became acute due prolonged lock down, lack of physical teaching in school, and unequal access to internet and digital media by students during COVID pandemic. This global scenario leads to formulate Sustainable Developmental goal-4 which has focus on importance of pre-primary education for children from low socio-economic back ground.

Specific reference to India, although the target of universal access and enrollment to primary education is successful to a large extent after implementation of RTE, Act, 2009, Sarvasikhya Abiyan, Mid day meal schemes, but substantial learning gap among students is a major problem for quality education. 25% students in the age group 14-18 cannot read class-III text book in regional language, more than 50% face problem to divide 3-digit number by 1 digit, 57.3% only read sentence in English (ASER, 2023). These learning problems are acute among rural students studying in Govt. schools (Prathama, 2014) and is more among some states of India. As per the National Achievement survey report, 2017 & 2021, due the policy level initiative by both the central (Nipun Bharat) and concerned state Govt., although improvement is noticed in foundational literacy numeracy skills among primary school students from states like Kerala, Mizoram and Himachal Pradesh, but states like Bihar, Uttar Pradesh, Jharkhand, Odisha, and Madhy Pradesh are found to be low performing in terms of overall index ranking (ASER, Rural, Report, 2023).

With reference to the state of Odisha, assuring foundational literacy among primary school students or decreasing learning gap is a concern of the state government. Along with the National level policy frameworks such as implementation of NEP, 2020, Nipun Bharat scheme, the state Govt. has its own frameworks in this regard such as Learning Enhancement Programme (2018), implementation of Ujjal, Utthan, and Utkarsha schemes, grassroot level monitoring systems, development of teacher training modules, teaching learning materials, organizing training for teacher educators etc. These policy intervention frameworks for foundational literacy numeracy are largely curricular or institutional. On the other hand, although research literature has theoretical claim for influence of social variables on FLN skills , but there is a lack of research findings about how the social factors cause increase or decrease development of FLN skills among students, more specifically, child’s gender, and parental role for development of FLN skill.

Development of foundational literacy and numeracy among school students depends upon multiple factors which can be broadly categorized under personal, social and institutional. Personal factors include students own cognitive, and affective abilities such as intelligence, memory, interest, self-effort and motivation. Found that self-effort to learn is positively associated with psychological abilities of conscientiousness and self-control (Heckman, 2006).

Similarly, the broad social factors include family cum parental role, their educational and social competency, child’s gender and residential locality etc. But role of child’s gender and parents for FLN is not only less focused but also largely complicated to understand.

**Child’s Gender and FLN skills:**

One of the social variables is the gender which is based on differential social norm, roles, values and expectations for male and female, which shapes behaviour and identity. Social science research has significant focus on gender as a predictor of multiple developments.

Whether gender of the student is a predictor for FLN skills among them is a crucial issue for educational policy framers and researchers. Its effect on literacy and numeracy skills development has been claimed from their differential nature of carrier choice and work force participation. Found that a greater number of girls have Arts and huminites as career choice, whereas more boys have for STEM subjects globally (Card and Payne 2021; OECD 2015). This gender differential academic career choice is related with their differential linguistic and numeracy skill. Specific reference to school stage, substantial body of research findings supports for more linguistic skills among girls (Reilly, Neumann, & Andrews, 2019) but more numeracy skills among boys (Halpern et al.,2007; Reilly, Neumann, & Andrews, 2015). Although this gender difference in numeracy and literacy is claimed by researchers as “well established” and robust (Maccoby and Jacklin, 1974, Page-351), but it is debatable and contextual.

The assumption that girls prefer Arts and humanity as career due to their better literacy skills, and preference of boys for STEM due to their higher numeracy skills will lead to incorrect conclusion without considering different perspectives of differential nature of skill development among boys and girls. Although inconclusive, but multiple reasons exit in support of more language skills development among girls, such as biological, and socio-cultural. It has been claimed that girls have more language processing areas in the brain than boys such as cerebral cortex, and have faster brain development. Similarly, sex related hormonal difference between boys and girls has connection with differential language development via their connection with anatomy of language related brain. Female sex hormone, i.e. Estrogen  is positively related with high rate of language and social skill development due to their influence on linguistic part of brain development. On the other hand, testosterone hormone among boys is inversely related with language, and social development (Lutchmaya S, Baron-Cohen S, Raggatt P., 2002; Lombardo MV, Ashwin E et al., 2012). Along with biological perspective of differential rate of language development between boys and girl, the social perspective has vibrant explanation. From the “social brain hypothesis”, it has been proposed that “cognitive demands of living in complexly bonded social groups” which results in differential rate of development of human brain (Dunbar, R. I. M., 2003). From traditional gender-based division of work, it is found that primary work of female are domestic work, food preparation, and nursing, known as “women’s work” which contributes for functional development of speech, where as traditional role of men is earning, doing hard labour, tool preparation, known as “men’s work” contributes for development for visual spatial skills (Joseph, R., 2000). Similarly, Gender socialisation process has influence on development of cognitive and behavioural skills among boys and girls which has influence on differential choice for academic subjects and carrier. Social stereotyping exist on certain academic cum carrier fields are the domain of certain genders (Le and Nguyen, 2018; Marx and Roman, 2002).

With regard to gender difference in numeracy, mixed types of findings have been reported Although some findings claim for superiority of boys over girls in numeracy skills but development of numeracy skills are largely influenced by interactive force of socio-cultural and educational factors, rather than sex specific abilities. Found that boys have better performance in mathematical problem-solving abilities, whereas girls have higher performance in computational skills (Lindberg et al., 2010). It has been claimed that this gender difference in numeracy skills is relatively small, and resulted from societal stereotypes rather than Sex differences (Hyde et al., 2008). Major socio-cultural and educational reasons for higher mathematical performance of boys is parental biased support, gendered socialization and gender stereotypes where girls are discouraged for mathematic related study and carrier (Gunderson et al., 2012). Recent findings claim that gender difference in numeracy skills would diminish when equal educational opportunities, support and encouragement are provided for boys and girls (Else-Quest et al., 2010).

**Parental Role and FLN skills of Child**

Parental role for child’s learning outcomes, including development of FLN skills has two inter related perspectives, i.e. nature and nurture. The nature perspective assumes that the quantity and quality of children’s academic achievement depends on parental Genes. In the empirical studies conducted on Pre-school children from USA about their Pre-reading skill, found that heritability is a significant predictor of letter knowledge and phonological awareness (Petrill et al., 2006;  Knopik et al., 2002). Effect of hereditability on child’s early phonological awareness have been reported on samples from Australia also (Samuelsson, S., et al., 2007). But this genetic or heredity determinant is also indirectly related with nature perspective, i.e. effect of heritability on child’s linguistic skill development is higher for families from upper socio-economic status (Turkheimer et al., 2003). From nurture perspective, it has been claimed that Family or parental financial and human resources or capital positively contribute for child’s linguistic and numeracy skills development via parenting practice, parental aspiration, and cognitive stimulation (Chazan-Cohen et al., 2009; Pelletier & Brent, 2002). Unequal development of cognitive abilities and learning among pre-school children is caused by differential rate of parental socioeconomic status via child’s unequal opportunity to access educational resource and family level cognitive support and stimulation (Vegas & Santibanez, 2010). Family level poverty causes low level of opportunity for the child to access education in general and quality education in particular, parental low level educational status hampers their ability for involvement in educational matters, which negatively affects child’s linguistic and numeracy skills development. In the context of association between parental socio-economic status and child’s foundational literacy skill, it has been consistently reported for their positive association via increase rate of parental involvement in both formal and informal literacy and numeracy activities (Dunst et al.,2017; Segers et al.,2016). Similarly, it has been found that high educated parents have higher expectation for ward’s academic progress which leads to high rate of their involvement in literacy and numeracy activities of their children (Daucourt et al.,2021; Skwarchuk et al.,2014). It has been found that if the parents are precocious reader, there is a high chance for higher literacy skill development among children due to their high responsiveness and encouragement for reading skill development among wards (Olson et al., 2006).

Parental perspective for development of Foundational literacy and numeracy skills among child is also an interest area of research where focus is on parental socioeconomic status, home environment, parent-child activities, parental attitude, expectations and beliefs for education in general and FLN in particular (Napoli & Purpura,2018 ; Skwarchuk et al.,2014). With home, parental role for development of FLN skills among child may be formal or informal in nature. The formal or educational activities are commonly known as parental involvement. It has been found that when parents read books with child, it develops child’s literacy skills (Sénéchal & LeFevre,2002). Similarly, when parents do calculations or involves in the mathematic related home assignments or solves problems with child, these practices develop numeracy skill among child (Daucourt et al.,2021; Mutaf-Yıldız et al., 2020). Similarly, informal or causal activities in the family have indirect developmental effect on foundational literacy and numeracy skills of child without deliberate focus on teaching of letters or number (Daucourt et al.,2021). Informal activities such as doing family marketing or attending grocery shops by child and parents, playing board games with child, studying story books with child, develops numeracy skills among them (Purpura et al., 2020; Sénéchal&LeFevre,2002). It has been widely reported that informal linguistic activities in the family environment have higher implications for development of language acquisition sub skills such as phonological awareness, development of vocabulary and speaking ability among child (Khanolainenetal.,2020; Torppaetal.,2022; Skwarchuketal.,2014). Although some findings claim for direct implication of formal numeracy activities for development of numeracy skills (Le Fevre et al.,2010b; Purpura et al., 2020), but some findings also support for instrumental implication of informal numeracy activities for development of numeracy skills among child (DeKeyser et al.,2020; Trickett et al.,2022). In this context, it can be mentioned that not only less number of research have been conducted but also the findings are inconsistent about role of informal numeracy home environment, in comparison to research literature on role of literary home environment for development of literary skill among children (James-Brabham et al.,2023; Khanolainen et al., 2020).

So the parents role for differential rate of child’s foundational literacy and numeracy skills have multiple pathways such has inheritability, nurture, which may be direct or indirect. Parental nurture pathways for development of FLN skills depends on their socio-economic status, primarily, educational, attitude, expectation and involvement.

**Fig 1: Hypothetical Model on Association of child’s Gender and parental role for FLN.**

Bio-Socio-cultural

Literary Skill

Numeracy Skill

Social stereotypes, Gender discrimination

NATURE

&

NURTURE

Literary Skill

Heritability, Involvement, Expectation & SES

Heritability, Involvement, Expectation & SES

Numeracy Skill

**Discussion:** From the broad literature on socio-demographic factors of student’s foundational literacy and numeracy skill, the above hypothetical model has been proposed. The specific application of this model is to understand whether and how, student’s gender and parental role have differential effect on development of foundational literacy and numeracy development among school students. During focus on Gender on literacy skill development, both the biological perspective of Sex and socio-cultural perspective of gender has been considered. High rate of literacy skills among girls in comparison to boys happens due to their high rate of language processing area development of brain and hormonal effect. When this biological perspective interacts with socio-cultural perspective via gender-based work division and gender socialisation, it also has pro-literacy skill development input for girls. This socio-cultural perspective of differential nature and magnitude of literacy and numeracy skill development between boys versus girls is rooted in “social brain hypothesis” which propose that nature of cognitive development depends on social context. Higher communication skills, reception skills among skills are result of girl’s engagement in domestic works such as nursing, cooking, child rearing etc, where use of language is essentially required.

Similarly, higher numeracy skills among boys happen due to social stereo types, i.e. “mathematics and science is not girls”, rather boys have the capacity to study these subjects which require higher problem-solving ability and logical thinking. This gender based social stereotypes about academy and carrier affect individual student via gender socialisation process. Also, gender discriminatory investment and support by parents for sons versus daughters for studying STEM subjects, results in lower-level numeracy skill development among girls, and vice versa. These socio-cultural pathways of differential numeracy skills among boys versus girls is also based on **social** brain hypothesis, i.e. nature and amount of cognitive development happens due to socio-environmental force of support and constraints.

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With reference to parental role or in a broad perspective family environment on differential rate development of foundational literacy and numeracy skill among students, it has been proposed that the pathways are primarily nature and nurture which has interactive effect. Early Literary and numeracy ability of child may come from parental gene and chromosomes. Similarly, family environmental input in the form parental formal and informal activities related with literacy and numeracy development have significant nurturing effect. But this parental nurturing perspective for FLN is directly dependent upon parental educational status, expectation for child’s academic growth, and capacity to involve. Parental differential role for development of FLN skill development among son versus is moderated by their educational status, i.e. educated parents have gender neutral attitude, investment and involvement for development of foundational literacy and numeracy among children, whereas uneducated or less educated have higher gender stereotypes, biased in this regard.

**Objective 1:**

To examine how biological and socio-cultural gender differences influence the acquisition of foundational literacy and numeracy skills among boys and girls at the primary education level.

The model assumes that girls are biologically more inclined toward literacy skills due to earlier brain maturation and hormonal factors, such as the effect of estrogen on language development. These are further reinforced by socio-cultural gender roles, which often assign girls to language-rich domestic tasks, while boys are socialized into problem-solving roles, encouraging numeracy. The model visualizes how these two perspectives—biological and social—interact dynamically to affect skill development.

**Objective 2:**

To assess the influence of parental roles, both genetic (nature) and environmental (nurture), in shaping the foundational literacy and numeracy competencies of their children.

Parental roles are bifurcated into *hereditary contributions* (such as genetic predisposition to language or number sense) and *environmental practices* (like reading to children, helping with homework, or engaging in informal numeracy activities). Socioeconomic status, parental education, and aspirations significantly mediate these effects. Parents with higher educational attainment are more likely to exhibit gender-neutral involvement and provide cognitively stimulating home environments.

**Objective 3:**

To propose a conceptual framework for understanding how gendered social expectations and parental investment interact to either reinforce or reduce disparities in foundational learning outcomes.

The model identifies **gender stereotyping**—such as the belief that boys are better at math and girls are better at reading—as a cultural mechanism that shapes parental investment in their children's education. These stereotypes can lead to differential encouragement, resources, and expectations for sons and daughters. The model posits that in educated and gender-progressive households, such disparities reduce, suggesting pathways for policy and intervention.

**Conclusion**

Foundational literacy and numeracy skills among school students are essential for individual, social and national level growth. Child’s gender and parental role as social demography have interactive influence on development of these skills among school students. But their pathways are very much complicated and contextual. During use of this proposed hypothetical model, necessary care should be taken to consider larger socio-cultural context of gender, and parental role for child’s education.

**Disclaimer (Artificial intelligence)**

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Details of the AI usage are given below:

1.

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3.

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