Foundational Literacy and Numeracy Skills of Students of Nayagarh District of Odisha

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Abstract

Considering the criticality of foundational literacy and numeracy skills in lifelong learning, this paper analyses the status of literacy and numeracy skills of Grade III students of Government schools of Nayagarh district of Odisha. The paper also analyses the literacy and numeracy skills of students with respect to gender, and examines the relationship between literacy and numeracy skills. The study employed a descriptive survey method. Data was collected from 105, Grade III students from schools of Nayagarh district, Odisha. For the analysis of data, descriptive statistics, i.e., mean, standard deviation, t-test, percentage, range and Pearson co-efficient of correlation were employed. Analysis showed that the level of foundational literacy is better in comparison to the level of foundational numeracy, however, the study also found that 19.04 per cent of students were unable to read. Result of the study also indicated that there is no considerable difference both in literacy and numeracy skills of students with respect to gender. The study identified a positive relationship between literacy and numeracy skills. The study recommends for innovative and interdisciplinary pedagogical strategies for the classrooms at foundational stage with due emphasis on different sub skills and components of foundational literacy numeracy.

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Introduction

It is widely accepted that quality early year learning experiences of children lead to their overall development. These experiences help in improving enrolment, participation and in attainment of learning outcome of children in formal schooling. Academic skills are the important channels by which grade attainment is highly influenced (LeVine et al., 2012).

In addition, researchers also noted that development of foundational skills at early age helps the children in accessing higher order skills and other aspects of their curriculum (Evans and Hares, 2021). This is in consonance with the fourth Sustainable Development Goal (SDG-4) which underlines, "all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy" (United Nations, 2016). This statement reveals the significance of focusing on this critical element. National Education Policy 2020 (NEP 2020) provides an important opportunity to re-orient Indian education system and the policy prioritises achieving Foundational Literacy and Numeracy (FLN) among children as the catalyst for progress of the country. In order to achieve this objective, Ministry of Education launched National Initiatives for Proficiency in Reading with Understanding and Numeracy (NIPUN Bharat Mission) in 2020 where guidelines are provided for developing early literacy and numeracy skills among children. NEP 2020 stated that "our highest priority must be to achieve universal Foundational Literacy and Numeracy in primary schools by 2026–27". As per NIPUN Bharat Guidelines, every child is supposed to achieve learning competencies in reading, writing and numeracy at the end of the Grade III in a joyful manner through play, stories, rhymes, activities, local art, craft and music. Recognising that achieving basic foundational skills keeps the child comfortable in dealing with learning situations at higher stage, learning outcomes for pre-schools have been designed in a spiral and progressive manner.

Foundational Literacy and Numeracy Skills

There is no uniformly accepted specific definition for foundational literacy and numeracy. In general, foundational literacy and numeracy is the basic skills in reading, writing and Mathematics in primary grades (Ball et al., 2014). PISA 2015 defines "reading literacy as the capacity to understand, use, reflect and engage on written texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society" (OECD, 2017). In a literate society, majority of children begin to learn from their early childhood (Morrow, 2011; Teale, 1986). Researchers defined foundational learning into three different skills, i.e., (i) Oral language skill which includes ability for comprehending and recognising parts of word, which is considered as phonological awareness, (ii) Logical

approach which includes ability to solve problem in counting numbers and to know the relationship between numbers and (iii) The skills to make inferences. These abilities can be acquired before entering primary school (Nag et al., 2014).

As per research findings, "Children literacy skills include print awareness, phonological awareness, letter knowledge, oral language, and writing development". A growing body of evidence has shown that these literacy skills are closely related to children's early literacy and are thought to be critical to the development of children's reading and writing skill sets (Purpura., Baroody., and Lonigan, 2013; Niessen., Strattman., and Scudder, 2011). The key components in foundational literacy as indicated in the NIPUN Bharat Mission document are: oral language development, phonological awareness, decoding, vocabulary, reading comprehension, reading fluency, concept about printing, writing and culture of reading. Well-researched findings indicate the significance of these skills and its development in home language followed by appropriate exposure to the school language for its further enhancement. Involvement of children in various processes to familiarise the skills in terms of print awareness, phonological understanding, etc., is very critical which results in further language literacy skills.

Many researchers have identified a number of Mathematics skills that are developed in childhood and play a significant role in their future educational success. All such early skills include numeracy, geometry, patterning and problem solving, and their acquisition is cumulative which means that they build on each other and thus, lay the foundation for subsequent and more advanced skills to appear (Jordan, Kaplan, Locuniak, and Ramineni, 2007; NMAP, 2008; NRC, 2009; Van de Rijt, Van Luit, and Pennings, 1999).

As per NIPUN Bharat Guidelines, "Foundational numeracy means the ability to reason and to apply simple numerical concepts in daily life problem solving". The development of pre-number concepts, knowledge and skills of comparing, serialisation, classification and recognising patterns during pre-school serves as foundation for Mathematics learning in early primary classes as per documents on FLN developed by NIPUN Bharat Mission. And, the identified aspects and components of early Mathematics are: pre-number concepts, numbers and operations on numbers, measurement, shapes and spatial understanding and patterns.

Review of Related Literature

Academic abilities learned in a child's early years such as math and reading, have a long-term impact on their academic progress and subsequent job success. A poor level of numeracy skills linked to basic Mathematics and writing development, place value, and subtraction in relation to two-digit numbers, was observed

(Barham et al., 2019). Study conducted to assess FLN of students of Jharkhand revealed that by the end of Grade II, 87 per cent of students could answer 80 per cent of pre-reading skills while only 74 per cent could answer 80 per cent of pre-numeracy skills (IPEL, 2022). This indicates the need for giving more focused interventions to improve FLN with special focus on foundational numeracy skills of students. Only a few researchers focused on considerable gender difference in early literacy and numeracy skills among children. It was reported that there is significant gender variation in literacy and numeracy skills among children. One of the studies, it is found that male students were found to be more.

Parents stated that literacy development was more important to them than numeracy development, and that they engaged in parent-child literacy practices more frequently than numeracy practices (Napoli et al., 2021). According to experimental observations in India, it was found that providing adult literacy courses to mothers, enhanced children's performance in mathematical tests (Banerji et al., 2017). The findings suggested that parents should implement appropriate and improved procedures to help their children learn during early ages (Eskela-Haapanen, 2018). One of the studies suggested that households' educational background, socio-economic status, and the school choice play key roles in achieving foundational literacy and numeracy (Kumar, I., and Choudhury, I.R., 2023). A meta review done by Kumar and Behera (2022) revealed that numeracy and literacy learning is affected by home environment factors such as family's learning background, reading and numerical activities, and availability of resources came out as the most influencing components. The review of related literature indicate that there are studies determining the contributing factors of FLN, but very few efforts had been taken to assess FLN with special mentioning of the level of FLN specifying various components of it.

Rationale of the Study

Early literacy and numeracy skills are essential pre-requisites of development as they are the foundations of all education. All students at foundational stage must learn these skills before proceeding to the next level of education. Lack of achieving these abilities will have an impact on the learners' overall learning and achievement. Hence, foundational literacy and numeracy skills are extremely important for developing inclusive society, and these skills are directly related to the education system. But how these skills are developed through proper investment in early primary or later in a child's education requires conscious analysis. Research findings revealed that children develop at their fastest rate, and are most influenced by their environmental settings during early

childhood and toddlerhood (Gerber et al., 2010). It is also the time when early literacy and numeracy abilities lay the groundwork for the development of reading and Mathematical skills for their future. Students cannot read a book in their school life if they are unable to read a letter or a word, and they cannot study algebra, without the basic arithmetical skills. Numerous studies underlined the importance of foundational skills for the academic success of students. There are national level efforts by organisations such as National Council of Educational Research and Training (NCERT) through National Achievement Survey (NAS) and by NGOs on assessing learning outcome of children of the country. It is realised that in-depth studies which assess FLN of children can give detailed understanding of children's learning based on various components of FLN. Not many studies could be found on relationship between literacy and numeracy in case of FLN. In addition, the present study investigated the significant gender variation among students in their literacy and numeracy skills during the initial phase of children's life. The study adds value to the knowledge created in the area of literacy and numeracy skills in early years and its relationship between both the skills. The findings of this study can guide the academicians towards planning interventions to improve FLN skills among children.

Objectives

1. To study the status of foundational literacy and numeracy skills of Grade III students of Government schools of Nayagarh district.
2. To find out the relationship between foundational literacy and numeracy skills of Grade III students.
3. To study foundational literacy and numeracy skills of Grade III students of Government schools of Nayagarh district with respect to gender.

Research Question

1. What is the status of foundational literacy and numeracy skills of Grade III students of Government schools of Nayagarh district?

Hypotheses

1. There exists no relationship between foundational literacy and numeracy skills of Grade III students.
2. There exists no significant difference in foundational literacy and numeracy skills of Grade III students with respect to gender.

Method and Sample

A descriptive survey method was employed to study the foundational literacy and numeracy of the students of the Nayagarh district of Odisha. Grade III students studying in primary schools of the district constitute population of the study. There are eight blocks in the district,

from which one block, i.e., Daspalla was selected randomly for the present study. Eleven elementary state Government schools of the block was randomly selected wherein 105 (Boys=68 and Girls=37) Grade III students who are enrolled in these schools of Daspalla block of Nayagarh district were considered as the sample of the study. All students of Grade III available on the day of data collection in these schools had participated in the study.

Tools and Techniques

Foundational literacy and numeracy test in Odia was developed by the investigators including the following domains: reading comprehension (7 items) and writing (17 items), pre-number concept or place value (9 items), basic addition (6 items), subtraction (6 items), multiplication (7 items), division (7 items) and shape (6 items). The total score of the literacy test was 24 and for the numeracy test was 41. The content validity of the test was established by experts in the field including teachers and teacher educators.

Analysis of the Data

For analysing the collected data, mean, standard deviation, percentage, t-test and Pearson coefficient of correlation were used. Foundational literacy and numeracy are analysed separately.

Analysis of Foundational Literacy

Foundational literacy of students was analysed with reference to its components such as reading comprehension and writing, reading fluency, speed and expression, phonology including rhyme awareness and pronunciation.

Reading Comprehension and Writing

Reading comprehension and writing skills under foundational literacy skills was studied under three levels, i.e., high (17–24), moderate (8–16) and low (0–7) as indicated in the table given below.

Table 1
Level of Foundational Literacy Skills in Reading Comprehension and Writing

Students	High (17–24)	Moderate (8–16)	Low (0–7)
Boys	43 (63%)	17 (25%)	8 (12%)
Girls	28 (76%)	8 (22%)	1 (2%)
Total	**71 (68%)**	**25 (24%)**	**9 (8%)**

As seen in the table, 68 per cent Grade III students reported high level of literacy skills which includes reading comprehension, letter and word writing. It was also noted that 24 per cent students showed a moderate level of literacy skills and 8 per cent students are in the lower level of literacy range. Compared to boys, more percentage of girls was found in the high level category.

Reading Fluency

Reading fluency was analysed with reference to its components—accuracy, speed, expression, pronunciation and phonological awareness.

Accuracy in Reading

A passage in Odia (prose) was given to each individual student for reading aloud and based on the accuracy in reading, their responses are marked. 40 per cent of the participants were able to read the content accurately, whereas 38 per cent students were able to read the content, but could not read accurately and was found struggling to read difficult words. 22 per cent students were unable to read the words, letters and sentences accurately. It can be said that, more than 50 per cent students lack accuracy in reading.

Speed

According to the NIPUN-Bharat guidelines, it is underlined that a student enrolled in Grade III should be able to read accurately 60 words per minute. Accordingly, an oral test was conducted wherein each student was given a passage consisting of 85 words appropriate to the level of Grade III to read and the time taken by them was recorded to read the passage. The below given table represents the distribution of students under three categories such as 'students who could read 60 words and more in one minute', 'students who took more than one minute to read 60 words', and 'students who could not read at all'.

Table 2
Number and Percentage of Students in Different Speed Levels

Speed		
60 Words in one minute	**Taking more than one minute to read 60 words**	**Unable to read**
34 (32.38%)	51 (48.57%)	20 (19.04 %)

It was found that 32.38 per cent of Grade III students were able to read 60 words or more in one minute though accuracy was compromised by a few. Around 48.57 per cent students were not able to read 60 words in one minute. It was also observed that 19.04 per cent of students could not read the passage.

Expression

While the passage was read by each student, their way of expression was observed using a schedule and their expression was classified under three categories as given in the below table. (19.04 per cent students who could not read the passage was omitted for further analysis).

Table 3
Number and Percentage of Students in Different Expression Level

Expression		
Reading with appropriate expression	**Reading with expression but not appropriate**	**Mechanical reading**
68 (64.76%)	9 (8.57%)	8 (7.61%)

As seen in the above Table 3, about 64.76 per cent of students were able to read the passage with appropriate expression, where as 8.57 per cent students read the passage but not with appropriate expression. It is also observed that 7.61 per cent students were in mechanical reading without expression.

Pronunciation

Correct pronunciation is a significant aspect of literacy skills. In the present study, it was observed that 63.80 per cent students were able to pronounce the words correctly, where 17.14 per cent students could not pronounce the words accurately.

Table 4
Number and Percentage of Students with Respect to Appropriateness in Pronunciation

Pronunciation	
Appropriate	**Not Appropriate**
67 (63.80%)	18 (17.14%)

Phonological Awareness

Phonological awareness refers to awareness of children in identifying different components of sound in a spoken word. It includes a child's ability to recognise, merge, and fragment phonemes and identifying rhyming words.

As given in the Table 5, 31.42 per cent students could read the rhyme phonologically correct, where as 49.52 per cent students could not.

Table 5
Number and Percentage of Students with Respect to Phonological Awareness

Phonological Awareness	
Appropriate	**Not Appropriate**
33 (31.42%)	52 (49.52%)

Analysis of Foundational Numeracy

In the present study, numeracy skills include the ability of students in solving mathematical operation related to pre-number concept, shape (clock time reading), addition, subtraction, multiplication and division.

Table 6
Mean Score, Standard Deviation with Reference to Components of Foundational Numeracy

Numeracy skills	Mean	SD
Pre-Number Concept	5.895	3.128
Addition	3.638	2.066
Subtraction	3.219	2.307
Multiplication	3.685	2.470
Division	3.676	2.926
Shape	3.285	2.302

It is found that mean scores of pre-number concept, addition, subtraction, multiplication, division and shape are 5.895, 3.638, 3.219, 3.685, 3.676 and 3.285 respectively. It can be observed from the above table

that the mean value of pre-number concept (5.895) is found to be high in comparison to other numeracy skills, while mean value in subtraction (3.219) is found to be low among the students.

The Table 7 given below demonstrates the number and percentage of students belonging to different foundational numeracy levels such as high (28–41), moderate (14–27) and low (0–13).

Table 7
Level of Foundational Numeracy Skills

Students	High (28–41)	Moderate (14–27)	Low (0–13)
Boys	33 (49%)	13 (19%)	22 32%)
Girls	16 (43%)	14 (38%)	7 (19%)
Total	49(47%)	27(26%)	29(27%)

It is revealed that less than 50 per cent students are in the high level of numeracy related to pre-number concept, shape, addition, subtraction, multiplication and division. The percentage of boys in the high level is more than that of girls.

Relationship between Foundational Literacy and Numeracy

The second objective of the study was to examine the relationship between foundational literacy and numeracy skills of Grade III students. To investigate the relationship, Pearson Coefficient of Correlation was used. It is observed that there is a high degree of relationship (r = 0.788), which indicates positive correlation between literacy and numeracy skills of students. So the hypotheses, i.e., there exists no relationship between foundational literacy and numeracy skills of Grade III students is not accepted.

Foundational Literacy with Respect to Gender

Objective of the study was to determine whether foundational literacy skills of students differ with respect to gender.

From the t-test analysis, it was found that the mean score of boys (16.6912) is low as compared to

Table 8
Difference of Literacy Level with Respect to Gender

Gender	N	Mean	SD	Df	t-ratio	P-value	Remarks
Boys	68	16.691	6.395	103	0.139	2.626	Not significant
Girls	37	18.540	5.444				

**0.01 level of significance*

the mean score of girls (18.5405). However, there is no considerable difference found as the obtained t-ratio (0.139) does not exceed the p-value of 2.626 with the df 103 at 0.01 level of significance. Hence, the hypothesis of the study, i.e., there exists no significant difference in foundational literacy skills of Grade III students with respect to gender, is accepted under the study.

Numercy Skills of Students with respect to Gender

In terms of numeracy the mean score of girls (24.56) is found to be higher than that of the boys (22.76). The above table depicts that obtained t-ratio (0.496) does not exceed the p-value of 2.626 with df 103 at 0.01 level of significance. Analysis of mean difference showed no significant gender difference in foundational numeracy skills. Hence, the hypothesis, i.e., there exists no significant difference in foundational numeracy skills of Grade III students with respect to their gender, is not rejected. That means, there is no significant difference between boys and girls in foundational numeracy.

Major Findings

- Majority of Grade III students have overall good level of literacy skills with respect to reading comprehension, letter and word writing in Odia. However, it was also found that more than 50 per cent students lack accuracy in reading and almost similar percentage students lack phonological awareness. Many students were able to read the passage with appropriate expression and pronunciation, however, only less than half of Grade III students were able to read 60 words in one minute.
- The proficiency in numeracy level of Grade III students is found to be low in comparison to literacy and only less than half percentage of Grade III students were accurately able to solve basic arithmetic problems.
- No difference was found both in foundational literacy and numeracy with respect to gender.

Table 9
Difference of Numeracy Level with Respect to Gender

Gender	N	Mean	SD	Df	t-ratio	P-value	Remarks
Boys	68	22.764	13.521	103	0.496	2.626	Not significant
Girls	37	24.567	11.772				

**0.01 level of significance*

- A positive relationship between foundational literacy and numeracy skills was found in the present study.

Discussion

Children growing up in society are expected to learn habits and values that lay the foundation for their membership in a 'literate society'. It is recognised that literacy and numeracy are essential life skills for the long-term improvement in child's learning. In the present study, foundational literacy and numeracy skills of students are investigated, and the findings are discussed in line with the existing literature. The study identified a positive relationship between foundational literacy and numeracy skills of student which is similar to the findings of recent studies (Olaghere et al., 2021).

In general, the literacy level of the participants is promising. The reason could be that primary school teachers focus on pre-writing skills, such as letter formation and the mechanism underlying writing. However, worth noting is the need for giving focus on detailing as students lack skills with reference to speed, accuracy, pronunciation. As around 20 per cent students find reading the passage difficult requires immediate action to bridge the learning gap. With reference to numeracy, more effort is required to develop skills of using mathematical operations by using innovative pedagogical strategies and engaging learning resources. National level FLS study conducted also indicate similar result. In-service teacher education programme to teachers would give them insight into different ways of improving FLN among learners. Play-based, activity-oriented, joy-based learning experiences if implemented may bring considerable change in the learning outcome with reference to FLN. The positive relationship between literacy and numeracy indicates the significance of interdisciplinary integrated approach of developing literacy and numeracy skills of students. Interesting observation of the study is that there is no gender difference in early literacy and numeracy skills among students though not in alignment with the findings that there is no considerable effect of gender on foundational skills (Barham et al., 2019).

Educational Implications

- The study would pave a way for educators and policymakers of the State in considering different innovative strategies in a more integrated approach to develop FLN among students. The students who have difficulty in achieving FLN need to be identified, indigenous resources to be developed and the materials developed by the State could be extensively used for improving their FLN.
- The knowledge of numerical identification may support learners in relating it to literacy

skills and so efforts have to be made to consider strategies for developing FLN in an integrated manner. Supplementary materials integrating both literacy and numeracy aspects could be developed considering the specific needs of the State.

- The research has expanded on previous studies by measuring different literacy skills, i.e, reading, reading comprehension, writing, rhyme awareness, reading fluency and reading speed, pronunciation; and numeracy skills in addition, subtraction, multiplication, division, pre-number concept, shape, etc. As per the findings, various innovative pedagogical interventions can be introduced by the educators to develop these skills. Special emphasis could be given to improve each of these sub-skills of FLN.
- Teachers of Foundational stage could be reoriented to implement play-based joyful learning environment which facilitates development of FLN.

Conclusion

All countries around the world are attempting to enhance literacy and numeracy skills of children realising its long lasting benefits. Considering the importance of early literacy and numeracy skills, the current study was conducted with children's literacy and numeracy skills, the early foundational skills are helpful in promoting lifelong learning and education over time. Early literacy-numeracy skills in children are not only related to later academic achievement, but they are also required for the development of higher order Mathematics and problem solving skills, skill in creative linguistic expression. This study will help educators and policymakers to explore, and then implement the best ways and strategies in fostering basic literacy and numeracy in children.

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