

Observational Study of Early Childhood Care and Education Programs in Rural Government Primary Schools in Tamil Nadu, India

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Abstract

An Early Childhood Care and Education (ECCE) program in rural India was evaluated in terms of care and learning outcomes of children. The study was undertaken to observe and describe the ECCE system for children who were economically and educationally disadvantaged and enrolled in three Government Primary Schools (GPS) in India. In particular, the study tries to answer the question, ‘What factors affect the learning of Mathematics and English in the primary schools of rural Tamil Nadu?’ This Observational study was undertaken over a six-month period. The study included 183 children from LKG to Class 3 in normative stages of development as per their age and stage requirements. The parameters that were observed included learning outcomes in Math, English, Science and Social studies. An innovative daily baseline assessment was undertaken over a three-month period to understand children’s learning milestones. Results indicate that the learning outcomes were deplorably poor by Indian and international standards of education. Many challenges still remain in helping children gain a healthy start to life. There is a lack of an integrated framework that combines both health & well-being and learning. In the COVID-19 pandemic era, it is critical to move away from the traditional physical center models to a more hybrid scientific and technology driven systems for scale that are financially viable. These require a planned approach for introduction considering the scale in which it has to be implemented in India. Such plans need to be both top-down and bottom-up approach which entail large up-front investment in communicating and educating all the stakeholders. Personalized attention is not possible in traditional systems catering to such a large population. Additionally, and more importantly, there are no early warning mechanisms in place to help identify issues when it matters the most. Our analysis supports our research question and proves our hypotheses.

Keywords: Early Childhood Care and Education, ECCE, Learning, Rural Primary School, India

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Introduction

Universal early childhood care and education is a relatively recent development. India has made significant advances towards the United Nations' Sustainable Development Goals being a signatory. In particular, The Government of India has been proactive in subscribing to the objectives of Education for all (UNICEF, 2017).

The Right to Education Act as envisioned relied on The Constitution Act, 2002, which inserted Article 21-A in the Constitution of India to provide free and compulsory education to all children in the age group of six to fourteen years as a Fundamental Right (Ministry of Education, Government of India, 2020). It also urged all the States to enact suitable law to provide ECCE (Early Childhood Care and Education) to all children until they complete the age of six years in the Eighty-sixth Amendment.

The title of the Right to Education (RTE) Act incorporates the words 'free and compulsory'. 'Compulsory education' casts an obligation on the appropriate government and local authorities to provide and ensure admission, attendance and completion of elementary education by all children until fourteen years of age (Page 3). With this, India has moved forward to a rights-based framework that casts a legal obligation on the Central and state governments to implement this fundamental child right as enshrined in the Article 21A of the Constitution, in accordance with the provisions of the RTE Act. It provides for "...the all-round development of the child, building on the child's knowledge, potentiality and talent and making the child free of fear, trauma and anxiety through a system of child friendly and child centered learning." (Page 11) Central and state governments have invested on these commitments, launching a mass campaign - betting on the transformative power of education.

While, much has been achieved, sizeable challenges remain as the learning outcomes of children enrolled in government primary schools continue to be deplorably poor by Indian and international standards of education (Centre for Civil Society, 2014; Bruner, 1986). Many challenges also remain in helping children gain a healthy start to life as per child development milestones (Centre for Early Childhood Education and Development, 2017).

Background

A child's learning ability is associated with health and well-being of the child which

includes brain health, physical health, social and emotional health (National Scientific Council on the Developing Child (2020). Accordingly, the senior author developed a standard that combined both learning and health and well-being standards along with an assessment framework. In this observational study, we focused only on the child's ability to perform as per the class-wise standards for learning (English, Math, Science and Social Studies).

Research Question

What factors affect the learning of Mathematics and English in the primary schools of rural Tamil Nadu?

Hypothesis

- That if proper foundation is not created for children in learning Mathematics and English, before the age of 8 eight, then, there is reduced learning of the child subsequently.
- That if proper foundation is not created for children also for their health and well-being, before the age of 8 eight, then, the subsequent learning reduction is further aggravated.

Method

Study Design

The design was for an observational study of rural children enrolled in three Government Primary Schools (GPS) in India. The selection of classes for the study was based on the definition of foundational classes as per the National Education policy (Ministry of Education, Government of India, 2020). Children studying in Class 3 were chosen on the presumption that they would have acquired the requisite knowledge and skills as they progressed through Kindergarten (KG), Class I and Class 2. The three schools selected were English medium.

Children with known cognitive disabilities and other learning disabilities were excluded. Children who had change in media of spoken language in any of the classes between KG and Class I and 2 (e.g., switch over from Tamil to English transfer, social circumstances etc.) due to transfer or during the change in the study period; Children who were absent for more than 1 week during the study period due to family circumstances, or not being well. Two children from School 1, three children from School 2 and two from School 3 were excluded based on the exclusion criteria.

Approval of the protocol was provided by the Institutional-Children Ethics Committee.

Study population, recruitment, and samples

A public sector entity had approached for possible intervention in government primary schools for around 175 children. Since they wanted the choice of schools within 20 kms radius from the operational area, the District and Block got fixed. After inspection of six schools and the feedback from local stakeholders the choice of the schools was made. We accordingly undertook the study in three government primary schools from the rural areas of Tamil Nadu to determine a child's ability in understanding the concepts of English, Math, Science and Social Studies. The distribution of children in the three schools, class and school wise is in Table 1 below.

Table 1. *Frequency distribution of children by school and class level*

		School 1 (n = 72)	School 2 (n = 59)	School 3 (n = 52)	All Schools (n = 183)
Class 3	Number of students	21	11	7	39
	Boys: Girls ratio	13:8	6:5	3:4	22:17
	Mean age	8-9 years	8-9 years	8-9 years	
Class 2	No. of students	16	18	12	46
	Boys: Girls ratio	7:9	13:5	7:5	27:19
	Mean age	7-8 years	7-8 years	7-8 years	
Class 1	No. of students	18	11	16	45
	Boys: Girls ratio	10:8	5:6	7:9	22:23
	Mean age	6-7 years	6-7 years	6-7 years	
KG	No. of students	17	19	17	53
	Boys: Girls ratio	6:11	9:10	8:9	23:30
	Mean age	4-6 years	4-6 years	4-6 years	

The flow chart (Figure 1) shows the steps involved before initiating the study. The principal investigators initially met with the district administrators, block administrators and sought permission of the headmaster of the respective schools and respective teachers of the classes for conducting the study.

Flowchart on Study Protocol

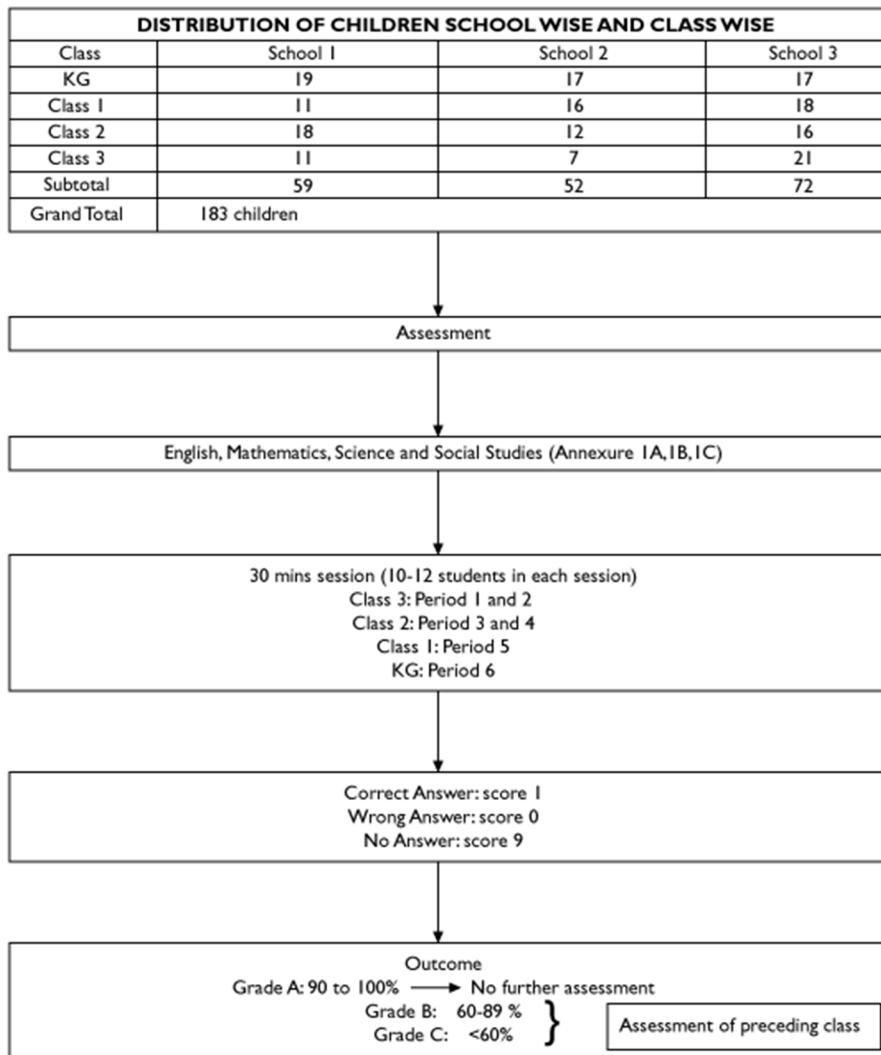


Figure 1. Flowchart on Study Protocol

Settings

The programs have been in operation for the past 10 years with changes in curriculum, infrastructure and training. On average, there were 20 children in each of the observed classes. The attendance rate was 70%. For every 20 children in each classroom there was 1 teacher from Class 1 to 3. There was no dedicated teacher for children in KG. The infrastructure for children in KG were being developed with the help of Non-Governmental Organizations.

Measurements

Learning outcomes were measured using Common Core States Standards, USA for the following subjects: Math, English, Science and Social Studies (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The standard instructions for administration and scoring were translated into Tamil and back-translated.

We wanted a comprehensive, detailed oriented, high quality framework to assess children's learning outcomes during their early years. We wanted a framework that would define the learning outcomes precisely at the end of every grade that children should be able to achieve and be able to consistently use it to judge development year on year. The Common Core Standards are in-depth and provide a last mile details in a precise manner. We were also looking using standards that are:

- Research- and evidence-based

- Clear, understandable, and consistent

- Aligned with college and career expectations

- Based on rigorous content and application of knowledge through higher-order thinking skills

- Built upon the strengths and lessons of current international standards

- Informed by other top performing countries in order to prepare all students for success in our global economy and society

Procedure

The baseline assessment in learning skills was done for English, Mathematics, Science and Social Studies. Accordingly, the curriculum advocated for KG, Class I and II that was expected from a Class III student for these subjects as indicated in Annexure 1 (A, B, C) was assessed.

The steps involved were briefly the following:

We instructed the coordinators who were selected as per the process. To prepare for the baseline assessments, qualified coordinators were selected after interviews by a committee consisting of the school officials, education department officials and our organization.

The instructors were also taught to observe children for four days even before starting their baseline assessment process. They were given two weeks training on how to conduct baseline assessments for young children, how to go question by question for each child with calmness, and how to enter the results.

We trained coordinators on how to document and record while observing children as soon as possible. For some baseline questions, the answer inputs were subjective. For example, can the child jump up and down on one foot. This required the coordinator to look at how the child was performing and answer in a binary yes or no format. For questions in learning, children were given the activity and scored on how many questions were responded to and if they responded, whether the answers were correct or wrong. These were entered into the system and collated. This baseline activity took one month. Before conducting the baseline assessments, parent, teacher, school and community meetings were arranged where the details were explained, and individual parent consent was obtained in our consent form.

The study period was between July and September 2019. All the 3 schools had six study periods, each for 45 minutes on all days except the weekends. A 30-minute session for assessment was done during each of the 6 periods (i.e., 180 minutes) for assessing the knowledge acquired in prior to the study.

The students were included in batches of 10-12. Class 3 were assessed in 1st and 2nd period, Class 2 in 3rd and 4th period, Class 1 in 5th and KG in the 6th period. Assessment for skills acquired were for the immediately preceding year(s). For example, Class III were assessed for KG, Class I and II and so on. (Annexure 2).

The student response was graded as ‘1’ if correct, ‘0’ if incorrect and ‘9’ if unanswered. Performance in a given subject was graded as A, B and C when the grade range was 90 to 100, 60 to 89 and 0 to 59 respectively. This is based on our Grading and Reporting Framework for quality education, as per international standards used in several forward-looking countries such as United States of America, ~~Singapore and Switzerland~~ (Bruner, 1986; Cameron, 2018). If the student did not secure grade A in a given subject for that class, they were assessed for skills acquired in the immediate previous class and so on.

The sessions were conducted by three observers who had a bachelor’s degree in and were fluent in English. The observers underwent a fifteen-day training on various aspects of the study including:

1. Methodology of testing the concepts in English and Mathematics,
2. Data entry in the proforma (Annexure 2) as a hard copy and thereafter data entry in the excel sheet designed by the investigators.

The Ethics Committee of the Institute approved the study vide number NC/EC/PUB/2020-1.

Informed Consent: Informed consent for the study was obtained in written form Tamil, from any one of the parents in the presence of headmaster, teachers and block education officials after detailed discussion on what was the purpose of the study and later on consider interventions if indicated to improve the outcome.

Class 3 in focus: In the beginning of class 3 academic year, students had just graduated from Class 2 and tested on class 2 curriculum in English (reading and writing), Math, Science and Social Studies.

Testing Process: The coordinators assembled children in groups as per their class. Then each child was called to come and sit next to the coordinator. Then the coordinator showed the child the relevant flashcard for every subject and milestone to be tested. If the child answered or performed the activity correctly, then the coordinator recorded the answer as ‘1’. If the child answered incorrectly or did not perform the activity, then the coordinator recorded the answer as ‘0’. If the child did not do anything, then the coordinator recorded the answer as ‘9’. Children were shown flashcards individually from each subject and for a specific milestone activity. The flashcards covered the following:

1. English

- a. Standard 1 - Reading – Literature (Monster Party Analyze the Structure of Texts V1.0)
- b. Standard 2 - Reading Informational Text (Monster Party identify characters, settings, and major events in a story V1.0)
- c. Standard 3 - Reading - Basic Skills (Monster Party How to Read Left to Right V1.0)
- d. Standard 4 – Writing (English Monster Party Opinion Writing V1.0)
- e. Standard 5 - Speaking and Listening (Monster Party - Present What they felt about Monster Party)
- f. Standard 6 – Language (English Verbs1 V1.0)

2. Math

- a. Standard 2 - Counting and Cardinality (Math Counting by Tens V1.0 - 1)
- b. Standard 3 - Operations and Algebraic Thinking (Math Find the number that makes 10 when added to the given number V2.0 – 1)
- c. Standard 4 - Number and Operations in Base Ten (Math Decompose Number 11 V1.0)
- d. Standard 5 - Measurement and Data (time and sequence)
- e. Standard 6 – Geometry (Math Describing Shapes via Informational Language V1.0)

3. Science

- a. Standard 1 - Life Science (Science observe and describe structure of Isopod V1.0)
- b. Standard 2 - Physical Science (Science What is it made of V1.0)
- c. Standard 3 - Earth and Space science (Science identify earth resources in wood, paper, cloth products used every day V1.0)
- d. Standard 4 - Nature of science (Science resources are materials we get from the environment to meet our needs V1.0)

4. Social Studies

- a. Standard 1 – History - Applies historical thinking to understand significant events, ideas, individuals, and themes in history and the ways they shape the present and future (SS Knows origins of different festivals India and world V1.0)
- b. Standard 2 - Geography - Applies a spatial perspective to understand the inter relationships of people, places and resources and the ways they shape environments and the diverse societies that inhabit them (SS class community is made of people from different places V1.0)

- c. Standard 3 - Civics - Applies understanding of rights and responsibilities, laws and government to make decisions about local and global issues and to demonstrate thoughtful, participatory citizenship (SS Explains the purpose and importance of rules - Government V1.0)
- d. Standard 4 - Economics - applies understanding of economic concepts to analyze economic decision making and interactions between individuals, households, businesses, governments and societies (SS Understands people have to make economic choices and evaluate V1.0)

It is important to note that the assessment was conducted in a similar way in all the three schools and classes. The combined assessment results are presented in Table 2. a Baseline assessment included total of 39 children in class 3 from all the three schools. No child's result was in Grade A in all aspects of English in Level 3 and so all children were tested for Level 2. In Math, no child's result was in Grade A in all aspects of Math in Level 3 and so all were tested for Level 2. In Science, 10 children were in Grade A and accordingly, they were not tested in lower levels in Science. In Social Studies, four children's results were in Grade A and accordingly, those four children were not further tested for the lower classes in Social Studies.

Table 2. *Average subject scores by school and class level: School 1 Average Scores for Class 3*

Class	English	Math	Science	Social Studies
3 (Level 3) (n = 21)	33.68	36.12	42.87	38.72
3 (Level 2) (n = 21)	47.21	52.67	58.43	58.32
3 (Level 1) (n = 21)	56.47	62.20	91.69	78.77
School 2 Average Scores for Class 3				
Class	English	Math	Science	Social Studies
3 (Level 3) (n = 11)	32.57	39.43	41.79	36.28
3 (Level 2) (n = 11)	42.93	51.38	53.91	53.46
3 (Level 1) (n = 11)	52.87	53.87	55.81	54.86
School 3 Average Scores for Class 3				
Class	English	Math	Science	Social Studies
3 (Level 3) (n = 7)	35.83	39.87	45.38	39.56
3 (Level 2) (n = 7)	49.90	57.19	59.18	59.87
3 (Level 1) (n = 7)	57.43	64.55	93.77	79.23

In a similar fashion, the class 3 children were assessed in Level 2 (the curriculum of class 1). While doing so, the children who had got grade A in Level 3 were excluded from those tests especially in science and social studies. It was found once again that no children's results were in Grade A in English and Math. Out of the 29 (39-10) who had tested for Science, 15 got Grade A and they were not tested in level 1 of Science. In Social Studies, it was found that 3 out of the 35 (39-4) children's results were in Grade A and were not tested in level 1 of Social Studies. Following a similar methodology, all 39 children were tested for English and Math at Level 1. For Science, 14 children (29 – 15) were tested and in Social Studies 32 children (35-3) were tested.

Analysis and Evaluation

We studied the baseline data provided by the coordinators as well as those that were captured by the system through children's interactions objectively. The results of these tests from all three schools for class 3 is presented in Table 2.

In a similar fashion, the assessments were done for children in class 2 in level 2 and then in level 1. Since children in class 2 also did not perform well in level 2, all of them were tested in level 1. Similarly, all children of class 1 were also tested in level 1. The result of the assessment is presented in Table 3.

The observational study revealed that whether the children were in class 1, 2 and even 3, their knowledge of English was poor even at KG Level standards as taught in urban private schools. Excepting for two children, all the 181 (183-2) were fit for Level 1 only. Accordingly, we analyzed the results in Level 1 for all classes in greater depth and the results are presented in Table 6.

Assessment results for Mathematics for all class levels is presented in Table 7

Interestingly, children had good understanding in science (Table 8). This could be due to the fact that rural children have better exposure to nature and thus learn about the flora and the fauna. Thus, they could easily identify birds, animals, flowers and leaves and scored high in science.

Table 3. *Average subject scores by school and class level: School 1 Average Scores for Class 2 and 1*

Class	English	Math	Science	Social Studies
2 (Level 2) (n = 16)	44.87	49.61	53.49	54.92
2 (Level 1) (n = 16)	58.83	67.34	97.89	78.21
1 (Level 1) (n = 18)	47.20	58.72	92.86	72.19

Table 4. *Average subject scores by school and class level: School 2 Average Scores for Class 2 and 1*

Class	English	Math	Science	Social Studies
2 (Level 2) (n = 18)	41.23	51.18	51.93	56.32
2 (Level 1) (n = 18)	51.65	60.83	65.12	63.87
1 (Level 1) (n = 11)	43.67	52.86	56.87	53.93

Table 5. *Average subject scores by school and class level: School 3 Average Scores for Class 2 and 1*

Class	English	Math	Science	Social Studies
2 (Level 2) (n = 12)	46.28	51.89	53.94	57.14
2 (Level 1) (n = 12)	59.54	69.56	98.23	79.93
1 (Level 1) (n = 16)	48.89	59.65	94.57	77.39

Table 6. *Level 1 Assessment in Different Standards for English for all Class levels*

English	Class	Grade A (No. %)	Grade B (No. %)	Grade C (No. %)
Apply reading skills and strategies to comprehend a variety of texts	Class 3	1%	59%	40%
	Class 2	1%	65%	34%
	Class 1	0%	25%	75%
Apply writing skills and strategies to create a variety of texts	Class 3	1%	51%	48%
	Class 2	1%	60%	39%
	Class 1	0%	20%	80%
Apply writing skills and strategies to communicate effectively	Class 3	1%	30%	69%
	Class 2	1%	35%	64%
	Class 1	0%	20%	80%
Use conventions to communicate effectively	Class 3	1%	5%	94%
	Class 2	1%	10%	89%
	Class 1	0%	8%	92%

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Table 7. *Level 1 Assessment in Different Standards for Math for all Class levels*

Math	Class	Grade A (No. %)	Grade B (No. %)	Grade C (No. %)
Counting and Cardinality	Class 3	1%	60%	39%
	Class 2	1%	67%	32%
	Class 1	0%	23%	77%
Operations and Algebraic Thinking	Class 3	1%	49%	50%
	Class 2	1%	55%	44%
	Class 1	0%	18%	82%
Measurement and Data	Class 3	1%	32%	67%
	Class 2	1%	37%	62%
	Class 1	0%	22%	78%
Geometry	Class 3	1%	3%	96%
	Class 2	1%	15%	84%
	Class 1	0%	10%	90%

Table 8. *Level 1 Assessment in Different Standards for Science for all Classes*

Science	Class	Grade A (No. %)	Grade B (No. %)	Grade C (No. %)
Life Science - As a basis for understanding Life Science, students will explore the skills, knowledge and understandings in life science	Class 3	91%	6%	3%
	Class 2	95%	3%	2%
	Class 1	93%	4%	3%
Physical Science - As a basis for understanding Physical Science, students will explore the skills, knowledge and understandings in physical science	Class 3	92%	7%	1%
	Class 2	97%	2%	1%
	Class 1	95%	3%	2%
Earth and Space Science - As a basis for understanding Earth and Space Science, students will explore the skills, knowledge and understandings in earth and space science	Class 3	94%	4%	2%
	Class 2	96%	3%	1%
	Class 1	93%	4%	3%
Nature of Science - As a basis for understanding Nature of Science, students will explore the skills, knowledge and understandings in Nature of science	Class 3	97%	2%	1%
	Class 2	98%	1%	1%
	Class 1	92%	5%	3%

Table 9. *Level 1 Assessment in Social Studies for all Classes*

Social Studies	Class	Grade A (No. %)	Grade B (No. %)	Grade C (No. %)
History - Applies historical thinking to understand significant events, ideas, individuals, themes in history, and the ways they shape the present and future.	Class 3	10%	75%	15%
	Class 2	11%	72%	17%
	Class 1	8%	70%	22%
Geography - Applies a spatial perspective to understand the inter relationships of people, places and resources and the ways they shape environments and the diverse societies that inhabit them.	Class 3	11%	77%	12%
	Class 2	14%	72%	14%
	Class 1	7%	72%	21%
Civics - Applies understanding of rights and responsibilities, laws and government to make decisions about local and global issues and to demonstrate thoughtful, participatory citizenship	Class 3	12%	73%	15%
	Class 2	11%	78%	11%
	Class 1	9%	71%	20%
Economics - Applies understanding of economic concepts to analyze economic decision making and interactions between individuals, households, businesses, governments and societies	Class 3	97%	2%	1%
	Class 2	98%	1%	1%
	Class 1	92%	5%	3%

Similarly, in Social Studies in level 1, most of the children had fair understanding on the important body parts and could identify family members and the relationships. But when it started progressing to concepts that were not rooted to their day-to-day living arrangement like world cultures and world festivals and healthy foods, etc., the performance began to falter. It can thus be deduced, that abstract conceptualization was proving to be difficult for these children. Hence, the drastic fall in their scores as the assessment to level 2 and level 3 (Table 9)

Even so, there were a few children with exceptional abilities, in some or all the subjects. If the teacher focused only on the average children, then these exceptional children are likely to get bored and let their mind wander (Diezmann & Watters, 1997). In the absence of adaptive learning and or personalized learning, for such exceptional children, they are unlikely to realize their full potential.¹² Table 10 below shows these exceptional children's

¹ **Adaptive learning** is a computer-based and/or online **educational** system that modifies the presentation of material in response to student performance.

² **Personalized learning** is an **educational** approach that aims to customize **learning** for each student's strengths, needs, skills and interests.

scores (highest and lowest) at Level 1 for English and Math for all Classes from School 1.

As can be seen from the data on Class 3 above, Student 1 would benefit from adaptive learning in English, whereas Student 3 who could score 100% in both English and Math could easily qualify for personalized learning, may be at Level 2. On the other hand, Student 2 and 4 would need adaptive learning for slow learners for English and math respectively.

In Class 2 similarly, Student 5 would be similar to Student 3; Student 7 similar to Student 1. In Class 1, Student 9 and Student 11 are exceptional. Student 10 and Student 12 on the other hand need personalized learning for slow learners.

Table 10. *Level 1 Outliers, Adaptive & Personalized Learning – Class 3*

Student	English	Math
Student 1	100.00	50.00
Student 2	44.44	40.00
Student 3	100.00	100.00
Student 4		38.46

Table 11. *Level 1 Outliers, Adaptive & Personalized Learning – Class 2*

Student	English	Math
Student 5	95.00	100.00
Student 6	41.00	15.00
Student 7	94.00	20.00
Student 8	38.00	37.00

Table 12. *Level 1 Outliers, Adaptive & Personalized Learning – Class 1*

Student	English	Math
Student 9	94.00	99.00
Student 10	40.00	14.00
Student 11	93.00	19.00
Student 12	37.00	36.00

Discussion

The study's findings have implications for practitioners in the field of early childhood development (learning and health & well-being) and for future research in ECCE settings. Mechanisms for obtaining and analyzing real time or near real time data about children will provide educators a tool to intervene effectively as needed. This early boost in the early years of schooling is likely to pave the way for improved learning and better health and well-being then and in later years for these children and help them achieve their full potential.

Let us look at all these data and analysis from a holistic perspective. A child of class 3 would have definitely spent a minimum of two years in school. The school is open normally for 200 days in a year. From the 200 days, even if we remove 50 days for exams and other miscellaneous activities, we are left with 150 days of school in a year.

In a day, children are taught in 5-6 periods depending on the availability of the teacher. If we realistically assume that in a period of 45 minutes, the teacher gets an effective time of 35 minutes to teach, then at a minimum, in a day, they would have 5×35 minutes = 175 minutes which is around 3 hours. Thus, in a year, the child is educated for $150 \text{ (days)} \times 3 \text{ (hours per day)} = 450$ hours per year; and in two years, class 3 children would have been taught for 900 hours. Similarly, Class 2 child would have done 450 hours of learning in one year.

Somehow, our observational study of children who have entered Class 3 or in Class 2 do not show that the child has learned anything. Children were not able to speak, read or write in English as per national or international standard. When asked a simple question in English, even the children in Class 2 and those who had entered Class 3 stared blankly at the observer even though these were English medium schools. Less than ten percent of the children in Class 1, 2 and 3 were able to answer questions in English and have some conversation in English. Similar was the result in Math.

The National Educational Policy 2020 of the Government of India defines, KG to Class 2 as the foundational stage. The NEP Policy has been released and can be accessed from the Ministry of Human Resource Department website. In that, the foundational stage have been defined to be from 3 years to 8 years (Page 6, National Education Policy, Ministry of Education, Government of India).

In India, normally children from the rural areas from 3-6 years do all their activities in Anganwadis which are the control of Ministry of Women and Child Development at the Government of India level and at the Department of ICDS at the State level. However, children from 6-8 years, class one and two, fall under the Department of Primary Education at the State level.

It is the time where conceptual clarity is built, and the linkage between education and health and well-being is to be achieved. From class 3 onwards, the syllabus becomes challenging and the children who have not received a solid early childhood foundation will find it difficult to cope. This gap keeps increasing.

This can also be seen from these three schools where the number of children from class 3 has drastically reduced. All these children come from local fisherman's community. The girls leave school and start helping the women folk in the family business and the boys go with the fishermen out to sea.

As we were assessing the children for levels of learning and found that it was ~~abysmally~~ ^{abysmally} low, we thought it fit to also measure in a limited manner, their development milestones. The results of this and association if any between learning and health and well-being will be presented in another manuscript.

Children's learning and literacy are intricately dependent upon their environment, social and economic settings, and readiness of the infrastructure present in schools. Accordingly, we would need to look into readiness of school infrastructure, availability of technology, training of staff, and awareness of parents (Arnett, 1990). These would involve investment of resources on a multiyear basis and hence a sustainable structuring and financing model using public-private partnerships is necessary. Our project is attending to these issues and with suitable strategies strives to create the best possible learning and healthy environments of these children. The progress made will be shared through future publications.

In a comparative study commissioned by "Save the Children", the Centre for Budget and Policy Studies has done a series of research, and has come out with some recommendations based on baseline studies from three states of India, namely, Delhi, Odisha and Telangana. The recommendations try to address the issues of quality, costs, scaling and resources (Centre for Budget and Policy Studies, 2018). In particular, the suggestion is for the State to collaborate with non-state stakeholders with clear provisioning for outcomes and evidences.

It is acknowledged that India has missed the target of ensuring quality in ECCE. There are low achievements in some aspects in some regions. However, there are also improvements in other areas that endorse the idea that attaining quality is possible (Chandra, Gulati & Sharma, 2017). Major challenges lie in the areas such as Teaching and learning; Infrastructure and physical facilities; Health facilities and Management of ECCE programs and centres.

Earlier, in a similar study from Bangladesh, it was found that to implement a high-quality program in rural sites of developing countries, a mix of play and teacher-directed instruction that were culturally appropriate was necessary (Aboud, 2006).

Our study corroborates the above works and provides a feasible solution for a country like India.

Conclusion and Way Forward

In summary, many challenges still remain in helping children gain a healthy start to life. There is a lack of an integrated framework that combines both health & well-being and learning. In the COVID-19 pandemic era, it is critical to move away from the traditional physical center models to a more scientific and technology driven hybrid models for scale that are financially viable. These require a planned approach for introduction considering the scale in which it has to be implemented in India. Such plans need to be both top-down and bottom-up approach which entail large up-front investment in communicating and educating all the stakeholders.

The learning analytics of NC ECCE acts as a formative assessment tool that supports all learners, but it is especially critical for children who are struggling as it holds the potential for changing the learning outcomes. As opposed to summative assessment, formative assessment emphasizes the terms as a process during ongoing instruction.

NC ECCE uses evidence of current learning to improve subsequent learning as NC ECCE collects real time information from each of the children while s/he is interacting with NC ECCE's digitally delivered learning content. This near real-time formative assessment during learning tasks helps NC ECCE to provide appropriate content to support their learning.

In a traditional center-based approach a teacher normally has the responsibility for on average 30 children in rural areas. In some places the numbers are higher because of absenteeism of teachers. In such a situation, daily formative assessments of every child on every learning and health & well-being milestone is extremely difficult leaving room for subjective biases and errors.

In technology driven approaches, every child can be individually accounted for. Milestones can be measured and monitored on a daily basis. Even when the child is absent, they can pick up where they left off and continue on their development path. Such personalization can be achieved only through technology-based systems. When the daily data are combined and analyzed using analytics tools, we have rich summative assessments. These indicate in which areas the child is performing well so that it can be nurtured accordingly and also areas that need improvement.

As the COVID-19 pandemic is still raging on (second and third waves) it may be necessary to experiment with hybrid models that include both virtual and in-person sessions. Parents, teachers and students across the country are waiting for the schools to open. But how will the school look like is still a mystery. Some schools are having plans for hybrid model wherein schools plan children to learn remotely too during the school year (especially for children from higher classes). Many educators remain hesitant to return to in-person classes without adequate safety measures in place.

There is no doubt that many children are safer and happier in their schools. Possibility of mental health issues, obesity due to inactivity, missing routine medical care and the risk of child abuse — on top of the loss of education are some examples.

Experts feel that the country as a whole has made little progress toward practices that would allow schools to make reopening safer — from rapid and regular testing, to contact tracing to identify the source of outbreaks, to reporting school-associated cases publicly, regularly and consistently.

What would having all kids in school look like? Ideally, they would still be socially distanced. They will be wearing masks. The challenge, though, is ideal runs headlong into the real. When you space out desks, suddenly you have to start having class outside — and then suddenly you also need more teachers to be able to do that. Frequent washing requires lots of water. No one is sure of reconciling the ideal with the real.

There are reports from Mumbai that there are additional complications in children who were reported infected and recovered from Covid -19. Additional inflammatory organs/ body parts affected/ rashes/ redness, and repeat is being observed in those children who had recovered from Covid 19.

Are mask mandates for schools? Are the schools planning on-site Covid19 testing for teachers and staff in the school? What about older children? Testing is expensive. It's a question of access; it's also a question of logistics. What happens when a student or teacher tests positive for Covid19? Will the whole school be quarantined for two weeks and then retested? Many policy challenges remain to be addressed. Whatever be the decision, NC ECCE will help children to remain in the learning mode; be mentally active and help build the neural network.

Extensive contact tracing in two southern Indian states offers the strongest evidence yet that a few super-spreading individuals are responsible for a disproportionate share of new coronavirus infections, according to a study published in the journal *Science*. It also suggests that children are more efficient transmitters of the virus than widely believed.

Laxminarayan of the Center for Disease Dynamics, Economics and Policy, in New Delhi and his colleagues found that just 8% of people with COVID-19 accounted for 60% of the new infections observed among the contacts (Laxminarayan, 2020). The finding underscores the essential role of super-spreaders in the COVID-19 pandemic: One individual or event, such as in a poorly ventilated indoor space, can trigger a high number of new infections, while others might not transmit the virus at all.

The study also found that although children younger than 17 were the least likely to die of COVID-19, they transmitted the virus at rates similar to the rest of the population, underscoring the idea that the disease doesn't spare young people (Laxminarayan, 2020). One data point in particular holds implications for reopening schools: Children ages 5 to 17 five to seventeen passed the virus to 18% of close contacts their own age. Antonio Salas, a Spanish researcher who has investigated the role of super-spreaders in the pandemic, said the study's findings regarding children were important in light of "previous reports suggesting a minor role of children in the pandemic....children can infect as efficiently as adults, and even more, they could also behave as super-spreaders" (Bengali, 2020).

Personalized attention is not possible in traditional systems catering to such a large

population. Additionally, and more importantly, there are no early warning mechanisms in place to help identify issues when it matters the most. In such an environment, with large child population, scaling up and providing quality education and care demand innovative and technology driven approaches. Every child can then be individually cared for. Our analysis supports our research question and proves our hypotheses.

Personalized attention is not possible in traditional systems catering to such a large population. Additionally, and more importantly, there are no early warning mechanisms in place to help identify issues when it matters the most.

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Definitions/ Glossary

Early Childhood Care and Education (ECCE): According to UNESCO, Early childhood, defined as the period from birth to eight years old, is a time of remarkable growth with brain development at its peak. During this stage, children are highly influenced by the environment and the people that surround them. Early childhood care and education (ECCE) is more than preparation for primary school. It aims at the holistic development of a child's social, emotional, cognitive and physical needs in order to build a solid and broad foundation for lifelong learning and wellbeing. ECCE has the possibility to nurture caring, capable and responsible future citizens. (UNESCO).

Source: UNESCO

Learning: Learning is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences.

Source: Richard Gross, Psychology: The Science of Mind and Behaviour 6E, Hachette UK, ISBN 978-1-4441-6436-7.

Rural Primary School, India: a school located in rural area is an open swath of land that has few homes or other buildings, and not very many people. A rural area's population density is very low, catering to children between the ages of six to fourteen.

Source: National Geographic, Ministry of Human Resource Development, Government of India

Economically and Educationally disadvantaged: As per World Bank definitions, families whose income is \$1,025 or less, that is Rs 70,069 or less are defined as low-income families or from the bottom of the pyramid families.

Government Primary Schools: Schools operated by the Government of India which cater to children to children from low-income families from LKG to Class five as considered as Government Primary Schools.

Source: Ministry of Human Resource Development, Government of India

LKG: Lower Kindergarten

Math: As defined by the United States Common Core, Math is defined as per below standards:

Standard1: Counting and Cardinality

Standard 2: Operations and Algebraic Thinking

Standard 3: Number and Operations in Base Ten

Standard 4: Measurement and Data

Standard 5: Geometry

English: As defined by the United States Common Core, English is defined as per below standards:

Standard 1: Apply reading skills and strategies to comprehend a variety of texts.

Standard 2: Apply writing skills and strategies to create a variety of texts

Standard 3: Apply writing skills and strategies to communicate effectively

Standard 4: Use conventions to communicate effectively

Source: US Common Core Standards

Science: As defined by the United States Common Core, Science is defined as per below standards:

Standard 1 - Life Science - As a basis for understanding Life Science.

Standard 2 - Physical Science

Standard 3 - Earth and Space Science

Standard 4 - Nature of Science

Source: US Common Core Standards

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Social Studies: As defined by the United States Common Core, Social Studies is defined as per below standards:

Standard 1 - History - Applies historical thinking to understand significant events, ideas, individuals, themes in history, and the ways they shape the present and future.

Standard 2 - Geography - Applies a spatial perspective to understand the inter relationships of people, places and resources and the ways they shape environments and the diverse societies that inhabit them.

Standard 3 - Civics - Applies understanding of rights and responsibilities, laws and government to make decisions about local and global issues and to demonstrate thoughtful, participatory citizenship

Standard 4 - Economics - Applies understanding of economic concepts to analyse economic decision making and interactions between individuals, households, businesses, governments and societies.

Source: National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). Common Core State Standards. Washington, DC, 2021

Daily Baseline Assessment: Everyday, there were new milestones that had to be assessed to determine the existing levels. The number of milestones were numerous and therefore, before any intervention, milestone levels were assessed daily in small bits to ensure adherence to time.

Source: Nidara-Children

Brain Health: In the context of this study Executive function and self-regulation skills are the mental processes that enable us to plan, focus attention, remember instructions, and juggle multiple tasks successfully. These include skills such as attention, working memory, speed and agility, cognitive flexibility, self-control, resilience, plasticity.

Working memory governs our ability to retain and manipulate distinct pieces of information over short periods of time.

Mental flexibility helps us to sustain or shift attention in response to different demands or to apply different rules in different settings.

Self-control enables us to set priorities and resist impulsive actions or responses.

Source: Center on the Developing Child, Harvard University

Physical Health: Physical development includes both growth and the ability to use muscles and body parts for particular skills. Both gross (large muscle movements) and fine (small movements) motor skills are included.

Source: Centre for Research in Early Childhood UK

Social and Emotional Health: Social and emotional development is the change over time in children's ability to react to and interact with their social environment.

Social and emotional development is complex and includes many different areas of growth. Each is described in more detail below:

temperament: the way a young child acts and responds to different situations, caregivers, and

strangers attachment: the emotional bond between a child and caregiver social skills or social

competence: the ability to get along with other people

emotion regulation: the ability of a child to control his or her emotions and reactions to the environment.

Source: Urban Child Institute

Rural: A rural area is an open swath of land that has few homes or other buildings, and not very many people. A rural area's population density is very low.

Source: National Geographic

Cognitive Disabilities: Intellectual disability (used to be Cognitive Disability) is a term used when a person has certain limitations in mental functioning and in skills such as communicating, taking care of themselves-, and social skills. These limitations will cause a child to learn and develop more slowly than a typical child. Children with intellectual disabilities may take longer to learn to speak, walk, and take care of their personal needs such as dressing or eating. They are likely to have trouble learning in school. They will learn, but it will take them longer. There may be some things they cannot learn.

Source: Ohio Coalition for the Education of Children with Disabilities

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Learning disabilities: A learning disability is a neurological disorder. In simple terms, a learning disability results from a difference in the way a person's brain is "wired." Children with learning disabilities are as smart or smarter than their peers. But they may have difficulty reading, writing, spelling, reasoning, recalling and/or organizing information if left to figure things out by themselves or if taught in conventional ways.

Source: LD OnLine

Public Sector Entity: Governments and all publicly controlled or publicly funded agencies, enterprises, and other entities that deliver public programs, goods, or services.

Source: Institute of Internal Auditors

District: an official division of a town or country

Source: Districts, Know India, National Informatics Centre, Government of India

Block: Block is a district sub-division for the purpose of rural development department.

Source: Source: Districts, Know India, National Informatics Centre, Government of India

Tamil Nadu: a state in Southern India

Source: Districts, Know India, National Informatics Centre, Government of India

Common Core States Standards, USA: The Common Core State Standards Initiative is an educational initiative from 2010 that details what K–12 students throughout the United States should know in English language arts and mathematics at the conclusion of each school grade.

Source: National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). Common Core State Standards. Washington, DC, 2021

Baseline Assessment: A baseline assessment provides information on the situation the intervention aims to change. It provides a critical reference point for assessing changes and impact, as it establishes a basis for comparing the situation before and after an intervention, and for making inferences as to the effectiveness of the intervention.

Source: UN Women

Informed Consent: Informed consent is the process in which a health care provider educates a patient about the risks, benefits, and alternatives of a given procedure or intervention. The patient must be competent to make a voluntary decision about whether to undergo the procedure or intervention. Informed consent is both an ethical and legal obligation of medical practitioners and originates from the patient's right to direct what happens to their body.

Source: National Center for Biotechnology Information, U.S. National Library of Medicine

Adaptive learning: Adaptive learning, also known as adaptive teaching, is an educational method which uses computer algorithms to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner.

Source: Brusilovsky, Peter | Peylo, Christoph, Adaptive and Intelligent Web-based Educational Systems, International Journal of Artificial Intelligence in Education, vol. 13, no. 2-4, pp. 159-172, 2003

Personalised learning: Kids learn in different ways and at different paces. Personalized learning is a teaching model based on that premise. Each student gets a “learning plan” based on how he learns, what he knows, and what his skills and interests are. It’s the opposite of the “one size fits all” approach used in most schools.

Source: Understood For All Inc.

Adaptive learning for slow-learners: Adaptive learning, also known as adaptive teaching, is an educational method which uses computer algorithms to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner. In the context of slow learners or children who are learning at slower pace than their peers, we use computer algorithms to help children learn at the pace that is optimal for them.

Source: Brusilovsky, Peter | Peylo, Christoph, Adaptive and Intelligent Web-based Educational Systems, International Journal of Artificial Intelligence in Education, vol. 13, no. 2-4, pp. 159-172, 2003