I. INTRODUCTION

Early childhood, typically spanning the first eight years of a child's life, is a developmental stage that offers a critical window of opportunity to shape the trajectory of a child‘s holistic development. The rapid growth and establishment of foundational capacities during this period can significantly enhance outcomes throughout an individual's life. The quality of early experiences a child receives plays a vital role in establishing a solid foundation for their future learning and development. These early experiences not only shape cognitive abilities but also impact social, emotional, and physical development, laying the groundwork for future educational attainment, health outcomes, and overall well-being. (Chu et al., 2018; Geary et al., 2018; Koponen et al., 2019; Schneider et al., 2017).

According to UNESCO (2017), the early childhood period (birth to age eight) is crucial to facilitate a smooth transition through all educational stages, from playgroup through pre-primary, and from pre-primary to primary levels. Early childhood education is the recognised term for teaching young children, encompassing formal and informal educational programmes that guide their growth and development throughout their early years.

Research has repeatedly demonstrated that early childhood development programmes and opportunities for early learning improve child learning outcomes during subsequent schooling. Accordingly, Pianta and Cox (2016) pointed out the benefits of the coordination between preschools and primary schools. A few benefits are that, facilitates seamless transitions, allows kids to advance their preschool skills, and supports a planned, step-by-step approach to early learning, benefiting kids throughout their lives. High-quality early education fosters essential skills such as problem-solving, communication, and social interaction, preparing children for future academic success and lifelong learning (The Organisation for Economic Co-operation and Development –[OECD], 2017).

The 2030 Agenda for Sustainable Development has also embraced development in early childhood and has outlined specific commitments and targets that directly influence the services and enabling learning environments that young children need towards holistic development to the fullest potential (UNICEF, 2023).

Further, it is well realised that early childhood development is essential for attaining many of the Sustainable Development Goals (SDGs), namely, Target 1.2 of SDG1: End poverty in all its forms everywhere. Target 2.2 of SDG2: End hunger, achieve food security, and improve nutrition. Target 3.2 of SDG3: Ensure healthy lives and promote well-being for all. Target 4.2 of SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Target 5.4 of SDG5: Achieve gender equality and empower all women and girls. Target 6.1 of SDG6: Ensure the availability of safe and affordable drinking water for all, and Target 6.2 of SDG6: achieve access to adequate and equitable sanitation and hygiene for all. Target 13.1 of SDG13: Take urgent action to combat climate change and its impacts, and Target 16.2 of SDG16: Promote peaceful and inclusive societies for sustainable development (UNICEF, 2023).

The nurturing care framework UNICEF (2023) defines five interconnected and indispensable components of nurturing care that a child‘s body and mind need for holistic growth and development are: Good health, Adequate nutrition, Receptive caregiving, Security and safety, and Early learning.

Over the past few decades, the idea of Early Childhood Development (ECD) has changed from focussing only on physical growth to considering emotional, social, linguistic, and cognitive development (UNICEF, 2017). There is growing scientific evidence that early experiences have a major impact on brain development, school readiness, and long-term life outcomes (Black et al., 2017). This greater awareness of the needs of young children has led to a slow shift away from a purely developmental perspective and towards a more integrated and intentional approach. As a result of this evolution, Early Childhood Care and Education (ECCE) models have emerged that integrate rich learning opportunities that support overall development with crucial aspects of care, such as protection, nutrition, and health.

Early Childhood Care and Education (ECCE) refers to the holistic support and educational programmes provided to young children, typically from birth to around eight years of age. The foundation for children's lifelong learning, socialisation, and general development is laid by ECCE, as it aims at their holistic development during these critical early years. ECCE encompasses a range of services and interventions that aim to address the physical, cognitive, emotional, and social needs of young children (Yadav, 2023).

The enrolment rate in early childhood education (ECCE) for children between the ages of three and the official age of primary school entry is 54% worldwide, according to data from UNICEF and UNESCO covering 196 countries. From just 21% in low-income countries to 79% in high-income countries, this rate varies greatly (McCoy et al., 2021). Additionally, ECCE is widely provided by the private sector, accounting for 37% of all ECCE services. It is also estimated that 57% of children under three were enrolled privately in 2018 (UNESCO, 2021).

Similar to other nations, India has acknowledged the significance of ECCE in influencing children's early developmental trajectories, by making significant progress in offering early childhood education opportunities with the aid of the Integrated Child Development Services (ICDS) launched in 1975. It is one of the largest early childhood programmes in the world (Government of India, 2019).

The provision of early childhood services in India has long been conceptualised as an investment in human capital. This notion of ECCE informed India‘s National Policy for Children of 1974 and the launch of the Integrated Child Development Services (ICDS) in 1975, which is today the world‘s largest publicly funded early childhood system. This globally acknowledged India‘s ECCE framework has traditionally been characterised by a dual system of addressing malnutrition among children and promoting early childhood education through Anganwadi Centres of ICDS. ICDS provides universal access to health, nutrition, and education services. The operating infrastructure for these services includes 1.3 million Anganwadi centres (preschools), which served over 104.5 million beneficiaries in 2014, from expectant mothers to children (Kaul et al., 2017; Richter et al., 2016).

The most significant trajectories of Indian Government towards ECCE other than the National Policy for Children, 1974 and Integrated Child Development Services (ICDS), 1975, are as listed: the amendment in the National Policy on Education (NPE), 1986; Programme of Action (POA), 1992 on National Policy of Education, 1986; District Primary Education Programme (DPEP); Sarva Shiksha Abhiyan (SSA); 86th Amendment Act in the Constitution under Article 45 of the Directive Principles of State Policy in Part IV; National Plan of Action (NPA), 2005; Right of Children to Free and Compulsory Education Act (RTE), 2009 under Section 11; National Policy for Children (NPC), 2013 and thereafter. According to national survey reports, these programmes have the potential to promote the availability and accessibility of ECCE for all children.

According to the National Council of Educational Research and Training's (NCERT) survey report, there were 493,700 pre-primary institutions in the nation in 2000 (NCERT 2006), and by 2009, there were 655,493 (NCERT 2016). Similarly, the National University of Educational Planning and Administration (NUEPA) survey report (2016) revealed, 24.07% increase in primary schools with attached pre-primary sections in 2015-16, compared to 14.27% in 2002-03. These findings affirm India‘s efforts in making ECCE accessible to all children (Shamsu, 2023).

The Eleventh Five-Year plan of India (2007-2012), spanning a period that was a decade ago, stated that, the preschool education (PSE) component of ICDS Anganwadis was very weak with high repetition rates and low learning levels (Planning Commission, 2008). High repetition rate refers to the state of children being exposed to repeated lessons/content without progress in learning. The low learning levels indicate that these children were found not to progress either cognitively or developmentally through the education provided.

Recognising this, the Twelfth Five-Year Plan (2012-2017) was committed to placing high priority on provision and access to quality ‘ECCE (Planning Commission, 2013a). In this endeavour, the major initiatives of the Government for quality reforms in ECCE were through the Ministry of Women and Child Development (MWCD). Ministry formulated the National ECCE Policy, 2013; National ECCE Curriculum Framework (MWCD, 2013a); Quality in ECCE: Pictorial Handbook for Practitioners, 2014; Age-Appropriate Assessment Cards; Quality Standards for ECCE (MWCD, 2013b) and National ECCE Council, 2014.

In light of this, the NCERT has created a bilingual (Hindi and English) "Resource Package for Awareness on ECCE" in recognition of the need for different stakeholders to be aware of high-quality ECCE and their part in ensuring it (Chandra, 2018a and 2018b). Folk, print, and electronic media are all included in the package, which is further enhanced by a "Guide Book for Early Childhood Educators on Awareness Generation on ECCE" (Chandra, 2018). These programs are regarded as the most methodical, transparent, and sincere attempts to raise the standard of ECCE in the nation.

All Indian children are guaranteed fundamental rights under the Constitution, which also gives the nation the authority to create special provisions for children through several

articles. The importance placed on protecting children and fostering their growth and education is reflected through several government education policies, laws, and initiatives. Indian constitutional amendments over the last ten years demonstrate the country's commitment to a rights-based system and the expansion of the federal and state governments' legal responsibilities to children. For instance, every child has the right to a full-time, reasonably quality basic education under the 2009 Right of Children to Free and Compulsory Education Act (Right to Education Act) (GOI, 2009). The Right to Education Act was amended again in 2017 and 2019.

The Annual Status of Education Report (ASER) of 2024 confirmed a leap in rural enrolment with a specific focus on pre-primary institutions, through a nationwide rural household survey including 649,491 children across 17,997 villages covering 605 rural Indian districts. The salient findings were threefold: Enrolment in ECCE centres, Type of ECCE centres, and Age of entry to Standard I.

Regarding Enrolment in ECCE centres, the key findings were:

- ✓ The enrolment in ECCE centres (government-run centres, including Anganwadi, private, stand-alone preschools) has increased consistently between 2018 and 2024
- ✓ Districts, namely, Gujarat, Maharashtra, Odisha, and Telangana, had attained approximately 100% enrolment among 3-year-olds, with an all-India figure of 68.1% in 2018 and 77.4% in 2024
- ✓ Among the 4-year-old children, the enrolment in states like Gujarat, Maharashtra, Karnataka, Tamil Nadu, and Odisha exceeded 95%, with the all-India figure of 76% in 2018 and 83.3% in 2024, and
- ✓ Karnataka, Gujarat, Maharashtra, Kerala, and Nagaland had shown 90% enrolment among 5-year-old children, whereas the nationwide figure showed a prominent increase from 58.5% in 2018 to 71.4% in 2024.

About the type of ECCE centre, ASER (2024) has stated that the Anganwadi centres continue to be the largest provider of ECCE services, with just 1/3rd of the 5-year-old children using other ECCE centres. They also found that the enrolment was 37.3% in 2018, with a fall in 2022 (30.8%) and again a rise to 37.5% in 2024. The reason may be attributed to the COVID-19 pandemic. The data on the age of Entry to Standard I, ASER (2024),

affirmed that the enrolment of underaged children is decreasing over time (from 25.6% in 2018 to 22.7% in 2022, and 16.7% in 2024).

Despite the various policies and programmes for ECCE in India, significant challenges remain in terms of accessibility, quality, and consistency across different regions (UNICEF, 2022). Anganwadis in India struggle to offer quality Early Childhood Education due to insufficient teacher training, poor amenities, and insufficient regulation (Rao & Kaul, 2018; Singh & Mukherjee, 2018). The substandard quality of these pre-primary programs has led to a widespread lack of school readiness, many studies revealing that preschoolers' pre-literacy and numeracy skills at age five fall significantly below expected levels (Beyond Basics, 2018). As India‘s rapidly growing economy places increasing demands on education, the services offered by Anganwadis are becoming inadequate (Streuli et al., 2011). Consequently, many disillusioned parents are turning to low-cost private preschools as an alternative (Alcott et al., 2019; Kaul et al., 2017).

Urban private sector initiatives, usually inspired by global models such as Montessori or Reggio Emilia, have offered creative alternatives that emphasise play-based, child-centred education. Despite their effectiveness in some situations, most children, particularly those in rural India, cannot access these programmes (Agarwal & Bhat, 2020). These institutions, generally situated in urban areas, cater to middle - and upper-income families and provide a more planned, play-based curriculum aimed at school readiness. However, access to these private preschools is limited for children from lower socio-economic backgrounds due to high fees. However, disparities persist between urban and rural areas, with children in rural settings often lacking access to high-quality programmes and resources (Bhadoria, 2024; Desai, 2017).

Bhadoria (2024) also found that one of the primary issues in early childhood education is the misalignment between the curriculum followed in preschools and that in primary schools. A child's early education should be play-based and concentrate on building foundational abilities like language, maths, and socioemotional learning. Nevertheless, a lot of preschools, especially private ones, use a curriculum that prioritises academic drills and memorisation over holistic development. Children often find it difficult to adjust to a more regimented and academically demanding environment once they start formal schooling.

On the other hand, teachers of both preschool and primary education are expected to play a crucial role in ensuring a smooth transition for children. But there is a lack of adequate teacher training in early childhood pedagogy in general and government-run Anganwadi centres in particular. Anganwadi workers, who are the primary caregivers and educators in these centres, often lack formal training in early childhood education and are underpaid, leading to low motivation and high turnover.

Parental involvement is a critical factor in a child‘s early learning journey. Many parents, mostly in rural areas, are not conscious of the importance of early childhood education and may not provide the necessary learning support at home. This lack of involvement can delay the development of foundational skills in children, making it difficult for them to adjust to the demands of primary education.

In most ECCE centres, formal instruction is heavily focused on the "3Rs" (Reading, Writing, and Arithmetic) and relies predominantly on rote memorisation (Kalakoti, 2022). Also, NEP, 2020 highlights that many governmental as well as non-governmental surveys indicate a severe learning crisis regarding foundational skills. A large percentage of students, over five crores, currently enrolled in elementary school have not attained basic literacy and numeracy, i.e., the ability to read and comprehend basic text and to perform basic addition and subtraction using Indian numerals.

Such a learning crisis in India is not new. According to the National Achievement Survey, 2021, one in three third-grade students struggle to comprehend small texts, and one in two of them are unable to use maths to solve everyday problems. The findings from the ASER, 2018, are even more stark, wherein only 50% of children in Grade 5 in rural India could read a Grade 2-level text, and only 28% of children in Grade 5 could solve a division problem (Mullick, 2019).

Many studies have shown that within the current education system, once students fall behind in foundational literacy and numeracy, their learning trajectories often remain flat for years, making it extremely difficult for them to catch up. Many capable students have thus found themselves trapped in this unfortunate cycle, unable to progress. For a significant number of students, this learning gap has become a major reason for low attendance and even dropping out of school altogether.

However, at what point do these learning disabilities start? Some answers emerge from the ASER, 2018 data in stating that 42.7% of rural Indian children in grade 1 could not even recognise the letters of the alphabet in their medium of instruction, and 35.7% could not recognise numbers from 1-9. Adding to this, a study by Ambedkar University in collaboration with ASER (2017) tells us that the origins of this crisis lie even before children enter grade 1. The alarming reality is that only 1 in 10 children aged 5 could match two pictures beginning with the same letter, and only 1 in 6 could complete a simple pictorial pattern. Suggesting that the children in India were simply not school-ready (Dhawan & Krishana, 2019).

Consequently, NEP, 2020 has recommended that to avert the learning crisis there will be an increased focus on foundational literacy and numeracy and generally, on reading, writing, speaking, counting, arithmetic, and mathematical thinking throughout the preparatory and middle school curriculum, with a robust system of continuous formative/adaptive assessment to track and thereby individualise and ensure each student's learning. The aim of education will not only be cognitive development, but also building character and creating holistic and well-rounded individuals equipped with the key 21st-century skills. For this assessment schooling system would shift from one that is summative and primarily tests rote memorisation skills to one that is more regular and formative. The system will be competency-based, promote learning and development of children, and test higher-order skills, such as analysis, critical thinking, and conceptual clarity.

The Ministry of Education, Government of India has already launched the National Initiative for Proficiency in Reading with Understanding and Numeracy (NIPUN Bharat) mission along with a detailed implementation guideline for the states to ensure that every child in the country necessarily attains Foundational Literacy and Numeracy (FLN) by the end of Grade 3, by 2026-27. The mission guidelines recommend shifting towards competency-based education and using school-based assessment to provide continuous guidance to teachers.

However, the Indian government has demonstrated the political will to enhance the ICDS; the system still suffers from a lack of resources, direction, and governance (Richter et al., 2016). Consequently, there remains a large gap between policy and practice, with a lack of research on the specificities impeding the ability to optimise

(Alcott et al., 2021). The main reason was attributed to the significantly large child population, with an estimated 158 million children in the age group 0–6 years. However, access to ECCE interventions for these children remains limited, and nearly one-fifth of the children between 3 and 5 years are not enrolled in any formal centre.

Access to quality ECCE services, issues of inadequate infrastructure and space, and financing and regulation of the sector remain key issues (Rao & Kaul, 2018; CBPS, 2018a, 2018b, 2018c, 2018d). Several studies on ‗best practices and ‗good' models of ECCE in India illustrate how research and policy are informed by normative notions of early childhood care practices that tend to be drawn from urban, middle-class, and upper-caste contexts (CBPS & UNICEF, 2017; Kaul et al., 2017).

Despite significant research and advocacy for ECCE at global and national levels, policy debates on improving the quality of provision often overlook the fact that notions of ‗quality' ECCE are largely grounded in models and practices of childcare and education that have been developed outside local communities. And there is a need for ECCE research and policy to take the contexts of marginalised communities more centrally into account. Communities themselves could have concepts and models of childcare and education, which can inform institutional practices, but this can happen only when there is scope for modification at the local level.

Consequently, the National Policy on Education (2020) proposed a range of significant reforms aimed at enhancing ECCE. Key changes include the formal recognition of ECCE as a guaranteed provision, extending its coverage to 8 years. The Policy proposed to introduce a specialised foundational literacy and numeracy curriculum designed to align with developmentally appropriate principles. Additionally, it emphasises the active involvement of communities and families in the ECCE process. To ensure that every child gets the support they require during these vital early years, a unified, developmentally appropriate curriculum framework that can be applied throughout India is urgently needed.

With this realisation, very long back the National Association for the Education of Young Children (NAEYC), very long back, had emphasised the importance of Developmentally Appropriate Practices (DAP) in early childhood settings, as these practices tailor learning experiences to children's age, individual abilities, and socio-cultural background. Implementing DAP-based curricula has been shown to enhance children's

engagement, problem-solving skills, and conceptual understanding, particularly in literacy and numeracy (Baroody & Purpura, 2017).

NEP 2020 also positions ECCE as an integral part of the continuum of foundational learning in literacy and numeracy, mandating that primary schools provide pre-primary education by 2030. Further, NEP 2020 envisions ECCE as a means to ensure holistic development in early childhood, focusing on physical, cognitive, socio-emotional, ethical, cultural, artistic, language, and numeracy domains. This comprehensive vision aligns seamlessly with the principles of Developmentally Appropriate Practice (DAP), which centres on meeting young children‘s developmental needs through responsive, play-based, and contextually relevant approaches.

Since both DAP and NEP 2020 emphasise child-centric, age-appropriate, and experiential learning, the DAP-based framework could offer a practical and pedagogically sound framework for implementing the ECCE vision. By adopting DAP, educators can translate policy into meaningful practice, ensuring that early learning environments truly support the optimal growth and development of every child.

According to Bredekamp (2017), an ideal ECCE framework should prioritise DAP that fosters holistic growth, including cognitive, social, emotional, and physical development. Research has shown that an effective ECCE curriculum should be flexible, inclusive, and responsive to the developmental needs of children. It should focus on creating a child-centred environment that encourages exploration, discovery, and critical thinking. Such a curriculum would not only aim to teach academic skills but would also support children‘s social and emotional development, preparing them for the challenges of formal schooling.

Further, the concept of DAP has been recognised and embraced globally for over four decades as a significant advancement in the pedagogy of teaching young children. This approach emphasises the need to tailor teaching methods to the individual needs, age, and cultural background of each child. Today, there is a widespread and urgent call for young children to be educated in a developmentally appropriate manner, underscoring the importance of Early Childhood Education (ECE) environments that are responsive to these diverse needs (Mswela, 2021).

Developmentally Appropriate Practice (DAP) is an evidence-based approach in early childhood education that emphasises the holistic development of children, as mentioned earlier. Grounded in decades of research, DAP is built on three core principles: a deep understanding of child development theory, responsiveness to each child‘s individual needs through on-going assessment, and sensitivity to the cultural and social context of the child, including family and community dynamics (Louis, 2018). These strengths make DAP a powerful framework for ensuring meaningful and effective early learning experiences.

Given that the NEP 2020 envisions ECCE as foundational to lifelong learning, with a strong emphasis on play-based, inclusive, and developmentally responsive pedagogy, DAP directly addresses the core requirements of ECCE implementation. Both share a commitment to holistic, child-centred, and culturally responsive education. Therefore, DAP is not only compatible with the ECCE goals outlined in NEP 2020 - it is essential to realising them in practice. DAP is an expansive, enveloping idea that covers a wide scope of formative perspectives for kids aged 0 to 8.

In 1997 and 2009, DAP proclamations were refreshed to reflect present-day educational requests and measures (Al Rub et al. 2022). In 1997, refreshed announcements accentuated three sorts of basic information for teachers: age propriety, individual reasonableness, and cultural appropriateness. Age, individual, and social and social climate are still remembered for the latest DAP announcements, which were given in 2009.

Later, modified standards and rules for settling on DAP were introduced, which incorporated the accompanying five arrangements: making a mindful local area of students, instructing to improve advancement and picking up, arranging educational plans to accomplish significant objectives, surveying kids' turn of events and learning, and laying out equal associations with families, to mirror a fresher system for ideal training and basic issues in youth schooling. Despite the way that DAP contains exact standards and models, there is no one-size-fits-all idea of developmentally hopeful practice. Instructors from different social, financial, and etymological foundations might decipher, apply, and carry out appropriate practices in various ways (Tariman, 2022).

The quality of early childhood education in India can be greatly improved by giving priority to inclusive classroom environments, bolstering early intervention services, guaranteeing fair access in both rural and urban areas, and utilising technology to facilitate

differentiated learning. By firmly establishing these initiatives in Developmentally Appropriate Practice (DAP), pedagogy is kept in step with children's social, emotional, and cognitive development. Such a framework, when in line with the transformative objectives of NEP 2020, not only closes systemic gaps but also helps young learners develop resilience, creativity, and empathy. Therefore, adopting DAP is not just a best practice; it is a fundamental component of creating an equitable, creative educational system.

Consequently, the rationale behind the research was to frame a DAP-based curriculum framework focused on Emergent Literacy and Numeracy Skills of preschoolers and to train preschool educators on the same to implement it in preschool settings, specifically designed for the Indian setting and evaluated its effectiveness in terms of enhancing the preschooler‘s Emergent Literacy and Numeracy Skills. With the rationale specified above, certain primary and secondary objectives of the study were framed as mentioned below:

Primary Objective:

To formulate a Developmentally Appropriate Practice (DAP)-based curriculum framework focused on Emergent Literacy and Numeracy Skills for 3-6-year-old children.

Secondary Objectives

- To understand the extent of acquisition of Emergent Literacy and Numeracy Skills of the selected preschoolers with the existing pedagogical framework.
- To examine the influence of socio-demographic factors on the existing levels of Emergent Literacy and Numeracy Skills of the selected preschoolers and
- To implement and evaluate a Developmentally Appropriate Practice (DAP)-based curriculum framework focused on enhancing the Emergent Literacy and Numeracy Skills of the selected preschoolers

Null hypotheses aligned with the various learning domains being measured concerning the Developmentally Appropriate Practice (DAP)-based curriculum were framed

$H_0$1: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Phonological awareness.

$H_0$2: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Print awareness.

$H_0$3: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Listening comprehension.

$H_0$4: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Alphabet writing capacity.

$H_0$5: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Number writing capacity.

$H_0$6: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Number and operation skills

$H_0$7: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Data analysis and measurement abilities

$H_0$8: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Algebra and pattern-making skills

$H_0$9: The Developmentally Appropriate Practice (DAP)-based curriculum has no significant effect on preschool children's Geometry and spatial awareness.