OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 218-233

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5508

Deep Learning Implementation Strategies in Indonesia National Curriculum: A Culturally Responsive Framework for Pinrang Regency

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Received: 11 October 2025; Accepted: 10 November 2025; Published: 30 November 2025.

Abstract

This research develops implementation strategies for Deep Learning approaches within Indonesia's National Curriculum specifically adapted for Pinrang Regency's educational settings. The study employs descriptive qualitative methodology through document analysis and literature review to create strategic frameworks addressing regional educational challenges while honoring Buginese cultural heritage. Five primary strategic domains emerged: conceptual foundation development integrating "sipakainge" and "sipakatau" values; national curriculum adaptation through low-tech high-impact approaches; practical school-level implementation utilizing local phenomena and collaborative "assitulung-tulungeng" patterns; educator capacity building via district-based learning communities; and evaluation systems with situational indicators for sustainability. The research demonstrates that Deep Learning principles can be successfully adapted to diverse local conditions while maintaining pedagogical rigor through systematic integration of cultural wisdom, economic potential, and available resources. The strategic framework creates authentic learning experiences engaging students meaningfully while building 21st-century skills through community partnerships, intergenerational learning, and cultural documentation projects. Findings reveal that effective educational reform requires adaptive strategies responding to local conditions rather than standardized approaches, emphasizing pedagogical creativity over technological sophistication. The framework provides practical guidance for educational leaders implementing culturally responsive Deep Learning approaches, offering replication potential across Indonesian regions through systematic balancing of national standards with local distinctiveness. Success measurement encompasses not only academic outcomes but also cultural identity strengthening, community cohesion enhancement, and students' sense of place development within local and global communities.

Keywords: Deep Learning; National Curriculum; Cultural Responsiveness; Educational Implementation; Local Wisdom.

Introduction

Integration of deep learning approaches into educational curricula represents a paradigm shift toward improving the quality and relevance of education in the digital age. These methodologies focus not only on knowledge acquisition but also on developing competencies that are aligned with global standards. A primary objective is to enable workforce development that is adequately prepared for the demands of an ever-increasingly digital environment where artificial intelligence plays pivotal roles in various sectors (Wijaya, 2025; Wathon, 2024). As Wijaya outlines, the implementation of a curricula that integrates both theoretical and practical dimensions alongside ethical considerations becomes crucial in equipping students with the necessary skills to thrive amidst technological advances. The relationship between traditional educational frameworks and innovative approaches such as deep learning becomes particularly evident in discussions about Indonesia’s Independent Curriculum. Wathon demonstrates how the incorporation of deep learning principles can significantly augment existing educational frameworks to meet the challenges posed by an evolving digital landscape (Wathon, 2024).

OPEN ACCESS

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This integration aims at raising overall standards of education within Indonesia for the benefit of students through enriching their learning experience and preparing them for future endeavors. Advanced methodologies, as discussed by Long et al., emphasize how cutting-edge deep learning technologies can improve educational content alignment and streamline pedagogical strategy effectiveness (Long et al., 2024). By integrating such techniques, educators will be able to better match learning materials with student needs thereby creating more dynamic and tailored educational experiences. Furthermore, curriculum development that encourages deeper learning approaches has been widely acknowledged as vital for not only knowledge acquisition but also problem-solving and critical thinking skills (Fritz et al., 2019). The relevance of metacognitive strategies within deep learning curricula is underscored by studies advocating the reevaluation of learning outcomes to include such skills (OK & Kaya, 2024). By encouraging metacognitive awareness, educators can enable students to become more conscious about their learning processes thereby fostering independent lifelong learning habits. Cooperative learning environments as suggested by Biem and Morrison's findings emphasize that collaborative learning experiences enhance understanding depth and knowledge retention (Biem & Morrison, 2023). Adopting deep learning approaches in educational curricula offers multifaceted opportunities for rethinking and improving educational practices at all levels. As Wijaya proposes, working together with important people and organizations like the government, schools, and businesses can help share efforts to make the important changes in technology needed to stay up to date with global advancements in technology and education.

In modern learning, improving how students grasp ideas can be seen from different views. One major method is personal learning, which changes teaching based on each student's needs and likes. Shemshack and Spector wrote a detailed review about personalized learning and stressed that these approaches focus on customizing learning experiences to meet specific student needs. From their synthesis, personalized learning has five important aspects: knowing what students need; giving customized feedback; and aligning teaching methods with individual goals, all of which are crucial for enhancing student understanding in varied classrooms (Shemshack & Spector, 2020). Another key method is nurturing student independence, which builds self-directed learning settings. Stevanus et al. noted the importance of independence in online study during the pandemic. They discovered that encouraging independence allows learners to develop their study plans manage time wisely and find suitable study aids on their own. This freedom eventually results in a greater grasp of the material as students become more involved in their educational journey (Stevanus et al., 2022).

Learning frameworks that promote critical thinking and problem-solving skills further nurture independence, fitting global competencies as discussed in works by Palupi et al. (2020). In addition using new methods like inquiry-based teaching models can greatly affect how students understand things. Ramlee et al. showed that using online learning spaces with inquiry-based models could develop higher-order thinking skills (HOTS) in students leading to better problem-solving abilities (Ramlee et al., 2019). These results match those from Elian and Hamaidi who observed that flipped classroom techniques greatly improve academic performance suggesting that interactive student-centered strategies could help understand complicated ideas better (Elian & Hamaidi 2018). Using technology also backs up personalized learning experiences since AI tools can adapt teaching content to fit each student's speed and style of learning. Aslam *et al*highlighted the important part that different methods of teaching play in making learning better which becomes even more crucial when using digital technologies (Aslam *et al*2020). For example using media resources in teaching as studied by Деркач can meet various ways of learning making information easier to get and more exciting for students (Деркач 2018).

To boost how well students understand things in today's education teachers can also use teamwork strategies for learning. Jalinus et al. collaborative learning creates a community that helps share knowledge and increases student engagement and understanding. Collaborative work makes content clearer by encouraging students to express their ideas and discuss with each other (Jalinus et al., 2022). Improving student understanding through multiple ways in today's education can greatly enhance learning results. Using personalized learning, encouraging independence, implementing inquiry-based methods, using technology, and supporting collaborative learning can together form rich and effective studying spaces that satisfy the various needs of students today (Shemshack & Spector, 2020; Stevanus et al., 2022; Palupi et al., 2020; Aslam et al., 2020; Ramlee et al., 2019; Деркач, 2018; Jalinus et al., 2022; Elian & Hamaidi, 2018). Deep learning approaches in the National Curriculum of Indonesia have great potential for increasing student understanding in the era of education today.

OPEN ACCESS

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The Independent Curriculum is a direct example of this, where such approaches support the development of content and methods for active and contextual learning. Ansori states that developing a relevant and innovative curriculum is important, focusing not only on material but also on developing 21st-century skills which are strongly supportive of deep learning implementation (Ansori, 2021). The integration of technology to learning becomes part and parcel of deep learning approaches to education. The Driving School Program as described by Linda et al., it shows innovation in teaching methods that can improve the quality of education at the elementary level. More modern and relevant approaches are implemented by such programs creating a supportive environment for students to understand better the materials being taught (Linda et al., 2022). Also, Musaadah et al. highlight that implementing both the 2013 and Independent Curricula is oriented toward holistic student development, showing collaboration between curricula to enrich learning experiences in schools (Musaadah et al., 2023).

Then using educational technology to support deep learning increasingly becomes a focus especially within online learning settings. Sulistyarini et al. find that technology plays an important role in improving students' abilities and innovation which relates closely to teacher competencies and the use of technology by teachers in the learning process (Sulistyarini et al., 2021). It is expected that digital tools as well as Higher Order Thinking Skills (HOTS) implementation in the curriculum will provide profound and meaningful learning for students (Sulistyarini et al., 2021). A collaboration between teachers and students is very important to enhance student understanding in this modern era. Fadhilla proposes that teachers be facilitators and motivators who can utilize technology in teaching thereby increasing classroom interaction more actively (Fadhilla, 2023). Innovative programs applied in education as shown by Hasanah and Supriyanto also create better learning environments where students are more motivated to actively participate in the process of acquiring knowledge (Hasanah & Supriyanto, 2023).

In this case, e-learning and digital learning media play an important role. Zen argues that educational innovation based on information technology includes e-learning which supports shifts toward future education that is more inclusive and accessible. The use of digital media can attract interest among students as well as improve the quality of learning produced (Zen, 2019). This finding also supports research results stating that technology could help students develop digital literacy skills which are very important in the 21st century (Arfadila et al., 2022). Deep learning approaches in the National Curriculum of Indonesia with student understanding strengthening strategies enable education to be adaptive to challenges and opportunities in the contemporary era. Innovations in learning methods and the use of technology not only enhance understanding but also create a more holistic, relevant, and enjoyable learning experience for students (Ansori, 2021; Linda et al., 2022; Sulistyarini et al., 2021; Fadhilla, 2023; Arfadila et al., 2022).

The approaches of deep Learning or Profound Learning (PL) become an important strategy in the National Curriculum of Indonesia to improve educational quality by emphasizing conceptual understanding, not just memorization. PL is an approach that respects the atmosphere of learning that is Mindful, Meaningful, and Joyful by integrating cognitive aspects, emotional, aesthetic, and physical aspects holistically. Such approaches are aimed at developing higher-order thinking skills like critical thinking and creativity as well as collaborative and reflective abilities to prepare students for challenges in digital and global eras. In its implementation, PL does not mean a new curriculum but rather an approach integrated into the Independent Curriculum and 2013 Curriculum as reiterated in the Ministry of Primary and Secondary Education Regulation Number 13 Year 2025 about gradual implementation starting from academic year 2025/2026 through essential material adjustment reducing teacher administrative burdens as well as digital technology utilization.

This aim includes creating graduate profiles with eight competency dimensions: faith & piety; citizenship; critical reasoning; creativity; collaboration; independence; health & communication. Deputy Minister Atip Latipulhayat emphasized that PL encourages the transformation of education toward being more adaptive with students as active agents in building understanding rather than passive recipients of information. Implementation strategies include developing curricula based on PL training for teachers & lecturers project-based learning research on effectiveness supported by conducive ecosystems involving teachers principals supervisors parents communities industries partnerships However challenges such as low literacy numeracy levels one-way learning remain which can be resolved through improving teacher capacity strengthening facilitator roles teaching learning processes.The Independent Curriculum in Indonesia opens the way for the development of deep and meaningful learning approaches. Deep learning approaches provide a learning framework that supports conceptual understanding, higher-order thinking skills, and knowledge application in real situations.

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However, these approaches require contextualization based on regional specificities, such as those found in Pinrang Regency South Sulawesi. Pinrang Regency is a region with a rich Bugis cultural heritage, an economy based on agriculture and fisheries, and educational infrastructure problems. It demands implementation strategies for deep learning that are adaptive and responsive to local conditions. This research aims at developing strategies for implementing the deep learning approach within the National Curriculum that are suitable for educational settings in Pinrang Regency. By conducting an in-depth analysis of conceptual frameworks of deep learning and their contextualization with local Bugis wisdom, this study produces strategic frameworks which support learning transformation in schools located within Pinrang district. The significance of this study lies on bridging gaps between contemporary pedagogical frameworks and regional educational realities thereby enabling improved quality of learning while still respecting as well as strengthening local cultural identity. This research aims to develop deep learning approach implementation strategies within the National Curriculum suitable for educational settings in Pinrang Regency. More specifically, this research tries to: (1) identify strategies for developing the conceptual foundation of deep learning that is relevant to the conditions of Pinrang Regency; (2) formulate strategies for contextualizing national curricula by taking into account local wisdom and educational infrastructure conditions; (3) develop practical implementation strategies at school levels; (4) formulate strategies for developing educator capacity; and (5) design evaluation programs as well as sustainability strategies. By achieving these objectives, this research expects to bridge gaps between contemporary pedagogical frameworks and regional educational realities.

Literature Review

Deep Learning techniques are the practical answer to challenges faced by students in mastering academic content today. It is not just about knowledge acquisition but how the knowledge is transmitted to engage students actively and ensure their understanding of the material (Morozova & Rozhnenko, 2021). This method emphasizes critical thinking skills and real-world application of knowledge which modern educational curricula increasingly stress. The Independent Curriculum of Indonesia (Kurikulum Merdeka) happens to be an example of an educational framework that supports such approaches. The stated curriculum offers learners freedom to explore domains of knowledge creatively and build cooperative relationships with peers (Demidov & Mokhorov, 2018). The basic principle on project-based and problem-based learning fits deep learning objectives since it requires students to integrate various disciplines forming holistic thinking patterns strengthening mastery in academic subjects ("The Use of Modern Electronic Gadgets in Educational Process of University", 2019). Technology integration has become indispensable in modern education. Digital learning tools and e-learning platforms effectively extend access to education while enhancing the student experience (Cui et al., 2023).

Technology provides opportunities for self-paced learning as well as independent study which are basically principles of deep learning that enable students diverse access to educational resources (Cui et al., 2023). Research shows that educational technology increases student motivation and fosters active participation throughout the process of learning (Garrad & Nolan, 2022). In today's education, student understanding relies heavily on supportive learning environments; research shows that positive collaborative classroom atmospheres boost both motivation and performance significantly (Gordeeva et al., 2018). Better understanding can be sought by creating spaces encouraging active social interaction. Teachers need to change from being mere providers of information into facilitators who guide students towards developing critical thinking and analytical skills (Demidov & Mokhorov, 2018). The links between Deep Learning methods national curricula and student comprehension strategies create powerful synergies in today's education. By innovating curricula strategically employing technology nurturing supportive environments for learning it becomes more meaningful for students while equipping them with the skills they need to face future challenges ("The Use Of Modern Electronic Gadgets In Educational Process Of University", 2019; Cui et al., 2023; Garrad & Nolan, 2022).

Deep Learning Implementation in Indonesian Education

Deep Learning approaches in Indonesian education are the antithesis of the conventional teaching paradigm. The traditional approach is largely based on rote memorization and mastery of content through lectures and repetition, with high test scores as the final outcome. Deep Learning approaches emphasize conceptual understanding and competency development critical thinking, creativity, communication, and collaboration (4C skills). Students become the center point of learning through project-based methodologies, problem-based learning, and collaborative discussions. Teachers transform from being knowledge holders to facilitators guiding students toward discovering knowledge by themselves through exploration and reflection. Unlike passive rigidly structured traditional methods, Deep Learning creates flexible learning environments that strategically utilize technology to bridge content with real-world scenarios increasing intrinsic motivation among students.

OPEN ACCESS

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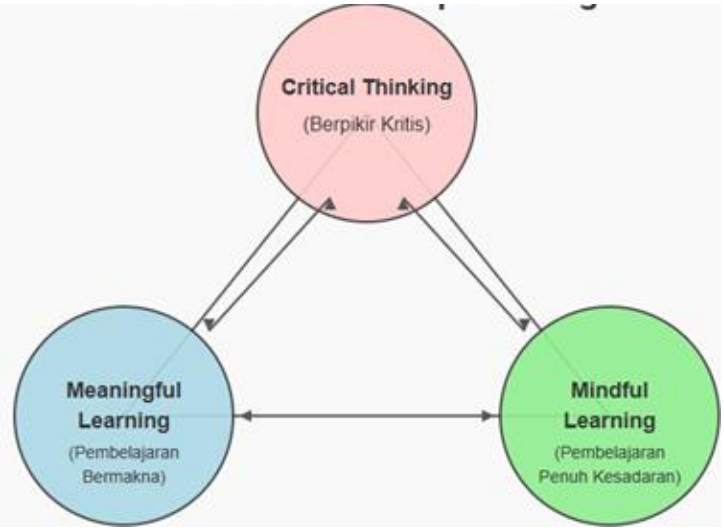
Assessment practices in Deep Learning reflect diversity through projects, portfolios, and self-reflection rather than solely depending on written examinations for assessment. Recent regulations have mandated such approaches within the National Curriculum via Ministry of Education Culture Research and Technology Regulation No 13 of 2025 covering early childhood to senior high school levels plus Ministry Regulation No 53 of 2023 covering higher education up until its Independent Learning-Independent Campus (MBKM) program. In early childhood education levels, Deep Learning is actualized through meaningful play-based learning supporting holistic child development. Elementary education employs thematic projects to bridge academic concepts with daily life experiences via Pancasila Student Profile Strengthening Projects (P5). Junior high school students analyze complex problems through interdisciplinary projects while senior high school emphasizes more research-based learning developing critical and creative thinking skills concerning global issues. Higher education applies Direct Experience Learning whereby students are involved in internships or industrial practice so that they may be prepared for real professional working environments. Therefore deep learning lays a very strategic foundation in the independent curriculum by producing generations that have knowledge as well as the skills to apply it in various situations.

Core Principles of Deep Learning

Deep Learning encompasses three interrelated principles: Meaningful Learning, Mindful Learning, and Critical Thinking. These principles serve as the foundation for developing deeper understanding, reflective awareness, and analytical capacity among learners. Together, they transform learning from a process of memorizing information into one of constructing knowledge through reflection and application. Meaningful Learning connects academic content directly to students' lived experiences and everyday realities. Learning becomes purposeful when students can relate new information to what they already know and encounter in their daily lives. For instance, students studying economics learn not by memorizing definitions but by understanding personal financial management or analyzing local market dynamics. When learning has clear relevance and produces visible impact, students are naturally more motivated to engage and participate actively. Mindful Learning requires conscious awareness throughout the learning process. It emphasizes deliberate focus, self-reflection, and awareness of one's own thinking patterns.

Rather than absorbing information passively, students are encouraged to question assumptions, identify personal biases, and draw lessons from mistakes through reflective practice. After completing group projects, for example, students evaluate effective



strategies and pinpoint areas needing improvement. This reflective engagement fosters independence and adaptability, helping students manage their own learning processes more effectively. Critical Thinking equips students with the ability to analyze, evaluate, and synthesize information to make sound decisions and solve problems. Deep Learning encourages students to assess the validity of information, seek supporting evidence, and connect new knowledge with prior understanding. In history learning, for example, students move beyond memorizing dates to analyzing historical causes and their implications for present-day society. Such analytical engagement helps students form reasoned judgments and apply knowledge in complex situations. These three principles work synergistically to create authentic learning experiences in which students not only acquire knowledge but also understand and apply it across diverse contexts. The integration of Meaningful Learning, Mindful Learning, and Critical Thinking

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aligns closely with the goals of Indonesia's Independent Curriculum, particularly in supporting the development of the Pancasila Student Profile—a vision of learners who are independent, reflective, critical, and socially responsible.

Figure 1. Main Elements of Deep Learning

Integration of Critical Thinking and Joyful Learning

The integration of Critical Thinking and Joyful Learning within the framework of Deep Learning represents an innovative approach to achieving holistic and meaningful education. Each of these approaches contributes distinct but complementary dimensions to the learning process. Deep Learning promotes profound understanding through inquiry, reflection, and conceptual connection; Critical Thinking develops analytical reasoning, evaluation, and evidence-based judgment; and Joyful Learning fosters emotional engagement and intrinsic motivation through enjoyable, student-centered experiences. When combined, these three elements create learning environments that are intellectually rigorous, emotionally supportive, and intrinsically rewarding. Deep Learning models have been shown to enhance both cognitive depth and emotional engagement by providing opportunities for continuous feedback and active participation (Filius *et al*., 2018). Empirical evidence from En-Yun *et al*. (2022) highlights a strong correlation between students' engagement in deep learning activities and the level of emotional support they receive from teachers.

Such support not only sustains student motivation but also strengthens their critical thinking skills, enabling them to engage in deeper reflection and more reasoned analysis. Emotional scaffolding, therefore, becomes a key mechanism linking Deep Learning with Critical Thinking development. Joyful Learning further enhances this process by creating positive educational experiences that improve learning outcomes and participation. As Kustyarini (2020) notes, active learning models that emphasize enjoyment and student engagement lead to more favorable academic results. When learners perceive educational activities as enjoyable and purposeful, they are more willing to explore challenging material, thereby deepening comprehension. Consequently, Joyful Learning serves not as a superficial addition to Deep Learning, but as a vital psychological catalyst that maintains enthusiasm and persistence during complex cognitive tasks. In practical implementation, educational models such as project-based and problem-based learning naturally integrate these three dimensions. These methods encourage students to think critically while participating in enjoyable, collaborative problem-solving experiences.

Although research directly linking Joyful Learning and Critical Thinking to measurable Deep Learning outcomes remains limited (Pan *et al*., 2023), emerging studies suggest that engaging, emotionally stimulating environments significantly promote deeper cognitive engagement and sustained learning (Putilova *et al*., 2023). Achieving high-quality educational outcomes therefore requires harmonizing cognitive and affective dimensions of learning. Integrating Critical Thinking and Joyful Learning within Deep Learning frameworks not only strengthens student understanding but also fosters satisfaction, creativity, and intrinsic motivation. As Kaushik (2023) and Ma and Ju (2023) argue, educational experiences that are both intellectually demanding and emotionally enriching cultivate learners who are reflective, confident, and resilient—qualities essential for success in today's complex world.

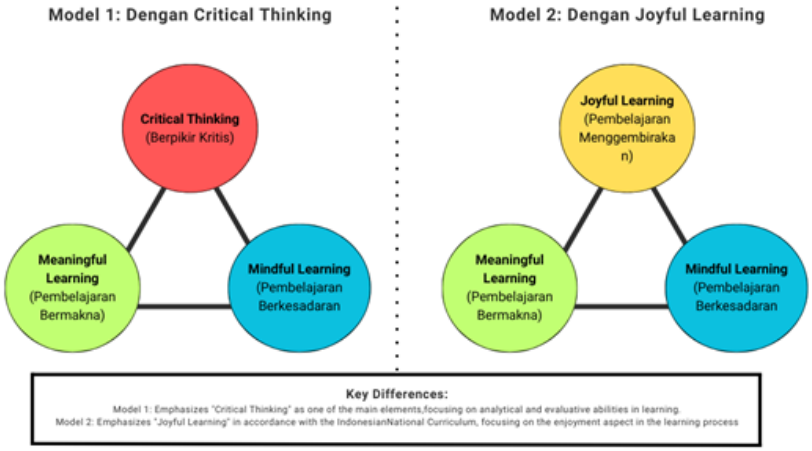

Figure 2. Deep Learning with "Critical Thinking" and "Joyful Learning" Approaches

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

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International Journal Education and Computer Studies (IJECS)

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Methodology

Curriculum development focused on Deep Learning approaches has proven effective in enhancing student comprehension. Modern educational settings emphasize reflective learning experiences while prioritizing social interactions between students and between students and teachers. Koster and Vermunt demonstrate that student-to-student interactions during project work and problem-based learning sessions create collaborative dialogue that promotes reflective learning within curriculum frameworks (Koster & Vermunt, 2020). Such systematic approaches that integrate curriculum aspects holistically prove more effective in stimulating reflective learning processes. Curriculum implementation designed to support deep learning plays a crucial role in facilitating independent learning strategies. McGleenon and Morison discuss how Virtual Learning Environments (VLE) enable educators to provide customized resources for students to use before attending classes, improving their preparation and engagement in learning (McGleenon & Morison, 2021). Students can better prepare themselves before classroom instruction, which remains essential for Deep Learning approaches.

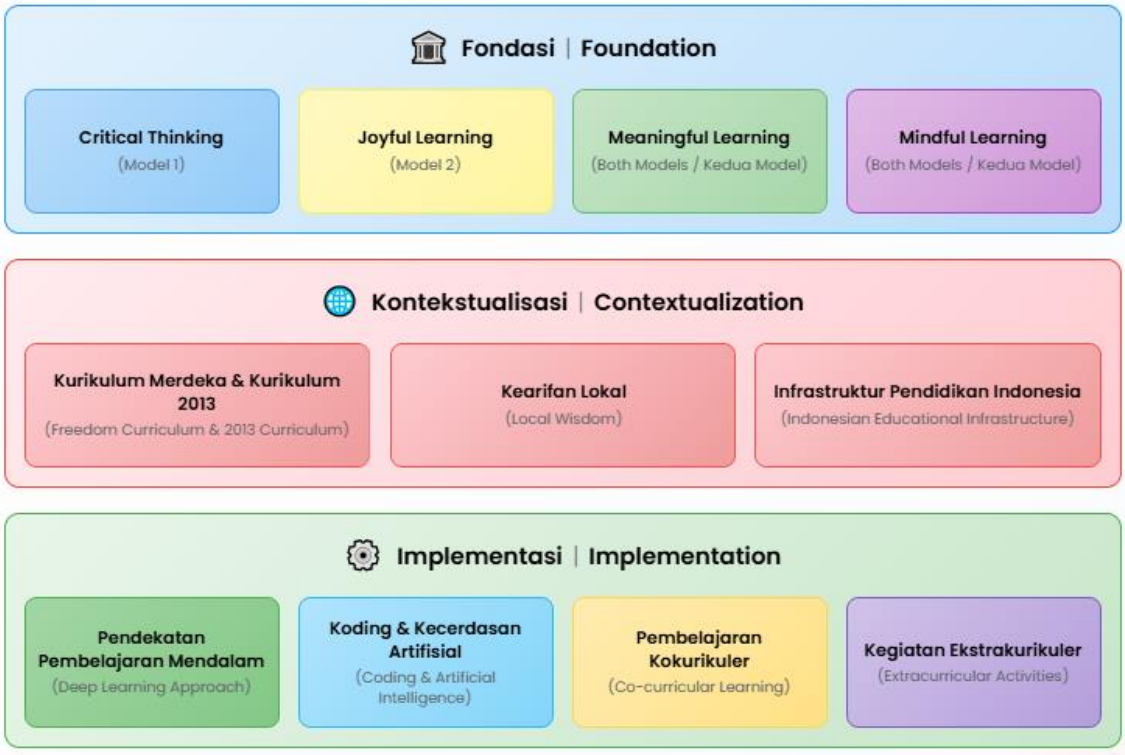

Figure 3. Deep Learning in Indonesian Context (Based on Ministry of Education Regulation No. 13/2025)

Research by Rabi et al. shows that deep learning strategies can produce superior academic performance, particularly when implemented through application-based approaches (Rabi et al., 2024). Such approaches focus on connecting theory with practice, enabling students not only to understand concepts but also apply them in real situations. Regarding student comprehension, Dolmans et al. emphasize the importance of innovative teaching methods to facilitate deep approaches while reducing surface approaches. They identify that curricula prioritizing problem-based learning help students engage more actively with subject matter, thereby improving their overall understanding (Dolmans et al., 2015). Dynamic and interactive learning environments enhance students' ability to apply their knowledge effectively.

Curriculum development methodology supporting Deep Learning approaches focuses on creating holistic and interactive learning experiences. By facilitating social interactions, implementing technology effectively, and using application-based approaches, education can be formulated to significantly improve student understanding (Koster & Vermunt, 2020; McGleenon & Morison, 2021; Rabi et al., 2024; Dolmans et al., 2015). The study employs a descriptive qualitative approach focusing on document analysis and literature review. The methodology was selected to develop Deep Learning implementation strategies suitable for educational settings in Pinrang Regency without requiring primary data collection in the field. Research objects include national curriculum

OPEN ACCESS

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documents (Independent Curriculum and 2013 Curriculum), educational policy documents from Pinrang Regency, literature on Deep Learning approaches in education, and literature on local wisdom of South Sulawesi, specifically Pinrang Regency.

Data collection techniques involve document study through analysis of national curriculum documents, regional educational policy documents, and educational profile documents of Pinrang Regency. Literature review encompasses Deep Learning approach literature, regional curriculum implementation studies, South Sulawesi local wisdom research, and innovative learning strategy publications. Data analysis methods comprise content analysis for identifying curriculum aspects that can be integrated with Deep Learning approaches and relevant local wisdom, comparative analysis for comparing Deep Learning approaches with conventional learning practices and national curriculum frameworks, and synthesis analysis for developing implementation strategies based on document and literature analysis results. The research conceptual framework builds upon four main pillars: Deep Learning conceptual foundation incorporating critical thinking, joyful learning, meaningful learning, and mindful learning; national curriculum contextualization ensuring alignment with existing educational policies and standards; strategic school-level implementation providing practical application strategies for educational institutions; and educator capacity development through professional development programs for teachers and educational staff.

Through such methodological approach, the research produces practical implementation strategies specifically designed for Pinrang Regency's educational landscape. The framework ensures that Deep Learning principles can be effectively integrated within existing educational structures while respecting local cultural values and educational needs. The methodology provides a systematic foundation for analyzing how Deep Learning approaches can be adapted and implemented within Indonesia's educational system, particularly in regional settings where local wisdom and cultural values play significant roles in shaping educational practices. The research design allows for thorough examination of how theoretical Deep Learning principles can be translated into practical strategies that work within the unique educational environment of Pinrang Regency.

Results and Discussion

Results

Research findings reveal that implementing Deep Learning approaches in Pinrang Regency requires strategic frameworks across five primary areas. Establishing conceptual foundations involves critical thinking development through integration of locally-relevant questioning techniques and problem-based learning addressing real issues within Pinrang communities. Joyful learning implementation benefits from incorporating traditional Bugis games and utilizing local arts as educational media. Meaningful learning emerges through community-based project work and material adaptation using examples from daily life in Pinrang. Mindful learning application draws upon cultural values of "sipakainge" (mutual reminding) to enhance metacognitive awareness.National curriculum adaptation occurs through mapping learning achievements with Pinrang Regency's local characteristics and developing learning modules that blend deep learning principles with regional content. Local wisdom integration begins with systematic documentation of Pinrang's cultural knowledge relevant to education and weaving Bugis cultural values throughout learning experiences.

Educational infrastructure adjustments require low-tech high-impact approaches and optimization of regional resources as learning materials. Practical application includes classroom-based deep learning through local phenomena as learning foundations and scaffolding techniques acknowledging students' existing knowledge. Coding and artificial intelligence integration happens through unplugged computational thinking activities and simple technology utilization. Integrated co-curricular learning develops through thematic projects based on regional potential and educational expeditions to learning sites within Pinrang. Extracurricular strengthening involves developing clubs based on local strengths and community service projects. Educator capacity building focuses on training for adapting national curriculum to local conditions and workshops for developing situational teaching materials. Ongoing teacher support manifests through creating local learning resource collections and collaboration networks with community leaders. Evaluation and sustainability require developing situational success indicators and systematic documentation of learning practice evolution. Program continuity ensures through strategy alignment with regional education programs and advocacy for supportive policies.

Conceptual foundation establishment for Deep Learning in Pinrang Regency encompasses strategies for four primary areas. Critical thinking cultivation through integration of locally-relevant questioning approaches, situational problem-based learning addressing genuine Pinrang issues, discussion techniques adapted to Bugis cultural communication patterns, and analysis of local wisdom such as "sipakatau" (humanizing others). Joyful learning implementation through traditional Bugis game integration, local

OPEN ACCESS

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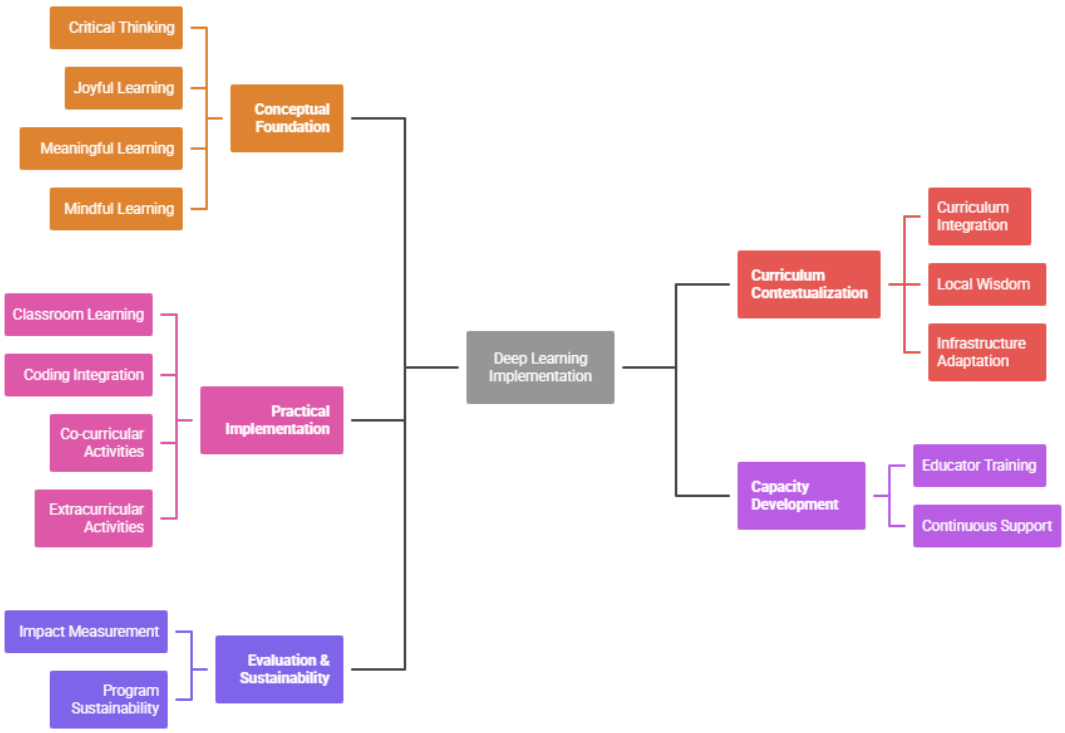
arts utilization like "pakacaping", Pinrang's natural environment as outdoor laboratory, and Bugis folktales as learning medium. Meaningful learning development through community-based project work related to Pinrang community needs, learning material adaptation with relevant examples from local life, traditional knowledge integration with modern scientific understanding, and intergenerational learning involving community leaders. Mindful learning application through reflection practices based on "sipakainge" values, mindfulness techniques aligned with local values, situational reflection journals, and reflective dialogue respecting Bugis cultural communication patterns.

National curriculum adaptation occurs through three primary approaches. Independent Curriculum and 2013 Curriculum integration through mapping learning achievements with Pinrang Regency local characteristics, developing learning modules integrating Deep Learning principles with regional content, adapting teaching projects for Pinrang conditions relevance, and developing authentic assessments based on local situations. Local wisdom adaptation through systematic documentation of Pinrang local wisdom relevant to learning, developing learning content based on Bugis culture, utilizing regional languages as learning resources, and student cultural documentation projects. Educational infrastructure adjustment through low-tech high-impact approaches independent of advanced technology, optimizing local resource use as learning media, inter-school resource sharing systems, and community-based learning utilizing public facilities as learning space extensions.

Practical application encompasses four primary areas. Deep classroom learning through local phenomena as learning foundations, scaffolding techniques considering students' prior knowledge, collaborative learning with local patterns like "assitulung-tulungeng" (mutual assistance), and guided discovery utilizing school surroundings. Coding and artificial intelligence integration through unplugged computational thinking activities, simple technology utilization for basic coding learning, technology learning adaptation to Pinrang local needs, and technology ethics discussions within local frameworks. Integrated co-curricular learning through thematic projects based on local potential, learning expeditions to educational locations in Pinrang, collaboration with local institutions, and integrated learning festivals. Extracurricular strengthening with club development based on Pinrang local potential, community service projects connecting learning with community needs, competitions based on local wisdom, and mentoring programs connecting students with local practitioners.

Educator capacity building occurs through two primary approaches. Training and professional development through national curriculum adaptation training for Pinrang local conditions, workshops for developing situational teaching materials, district-based teacher learning communities, and teacher mentoring programs. Ongoing support through local learning resource repository development, teacher-community collaboration networks, best practice sharing forums, and teacher innovation recognition programs. Evaluation and sustainability include two primary areas. Impact measurement through situational indicator development, systematic documentation of learning practice changes, multi-dimensional impact assessment, and model school case studies. Program sustainability through regional program integration, supportive policy development, multi-stakeholder involvement, and ongoing monitoring systems.



OPEN ACCESS

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Figure 4. Deep Learning Implementation Strategy Framework in Pinrang Regency

Discussion

The strategy for establishing the conceptual foundation of Deep Learning in Pinrang Regency has illustrated how pedagogical concepts can be harmoniously integrated with local wisdom. The study by Wathon (2024) concerning the alignment between the Independent Curriculum and the principles of Deep Learning has validated that local adaptation is essential for effective implementation. Locality-based questions allow students to enhance their critical thinking skills through problem analysis in their surroundings, while traditional Bugis games integrated into joyful learning provide an engaging experience as well as support cultural preservation. Culturally responsive pedagogy that takes students' learning styles and cultural backgrounds into account is necessary for creative-thinking skill development according to Palupi et al. (2020). The integration of "sipakainge" values into mindful learning practices is an example of how traditional wisdom can improve metacognitive awareness, as Dolmans et al. (2015) argue that deep learning approaches should be based on students' existing knowledge frameworks and cultural understanding.

The strategy for conceptual foundations addresses a basic problem in educational reform by transforming abstract thinking skills into culturally meaningful practices. Using “sipakatau” (humanizing others) as a framework for critical thinking analysis goes beyond cultural accommodation; it creates authentic learning experiences connecting students to their cultural heritage while developing higher-order cognitive skills. Traditional Bugis games such as “pakacaping” serve two purposes: maintaining cultural continuity and developing cognitive skills through play-based learning, which aligns with Vygotsky's (1978) research on the zone of proximal development supporting the idea that cultural tools and practices can act as scaffolding for higher-order thinking skills. Utilizing Pinrang's natural environment as an outdoor laboratory creates authentic learning experiences linking students to their geographical and ecological heritage, supporting Sobel's research (2004) demonstrating that place-based education increases student engagement and academic achievement while fostering environmental stewardship. Intergenerational learning with community leaders marks a significant shift away from traditional classroom-centered education by building reciprocal learning relationships that enhance social cohesion and result in better educational outcomes. Kaplan et al.'s research (2017) on intergenerational programs indicates such approaches benefit both students and community members, while practicing "sipakainge" in mindful learning applications changes reflection from an individual cognitive process into a communal practice of mutual accountability and support.

Bugis folktales are a medium for learning as well as being part of the narrative pedagogy study by Bruner (1991) which argues that stories assist in understanding, recollecting, and developing cultural identity; thus creating several avenues to acquire knowledge and transmit culture. National curriculum adaptation struggles with the challenge of merging national standard requirements with local needs and potentials through systematic approaches that respect both educational quality and cultural relevance. According to Fritz et al. (2019), effective curriculum development in diverse educational settings requires systematic adaptation strategies that honor both national standards and local realities while documentation of Pinrang local wisdom as a learning development foundation strengthens students' cultural identity and enriches the learning process. The strategy for adapting the curriculum recognizes the fact that standardized national curricula frequently overlook regional specificities and cultural diversity which necessitate sophisticated approaches to curriculum localization beyond superficial cultural references to substantive pedagogical integration. An analysis by OK and Kaya (2024) on curriculum learning outcomes underscores the importance of culturally responsive educational frameworks that recognize traditional practices as legitimate educational content and also create resources for future curriculum development.

Local wisdom documentation has several functions: it helps keep cultural knowledge alive; it makes traditional practices valid educational content; and it also helps create resources for future curriculum development. The systematic approach to documenting Pinrang local wisdom relevant to learning addresses concerns raised by indigenous education scholars about the marginalization of traditional knowledge in formal education systems, as Smith (2012) argues for the inclusion of indigenous knowledge in formal curricula. The use of regional languages as learning resources supports multilingual education research by Cummins (2000) showing that mother tongue instruction enhances cognitive development and academic achievement while student cultural documentation projects create authentic assessment opportunities validating diverse ways of knowing and demonstrating knowledge. Adjusting the educational infrastructure using low-tech high-impact approaches proves that pedagogical innovation does not require high technology but rather the ingenuity in utilizing existing resources. Kabanova and Vetrova (2019) stated that effectively integrating educational technology requires knowledge about what local infrastructure can support and what resources are available, while Cui et al. (2023) found that modern educational technology’s effectiveness depends more on how well it is pedagogically designed than on its sophistication.

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 218-233

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5508

The low-tech high-impact approach also questions some assumptions about the role of technology in educational quality since Cuban's (2001) study of computers in education revealed that technology does not by itself improve learning outcomes—what makes a difference is pedagogical design and teacher capacity. The strategy for optimizing local resource use as learning media transforms potential disadvantages into advantages by creating authentic learning experiences that connect students to their immediate environment while simultaneously building collaborative networks among educational institutions. Inter-school resource sharing systems address resource scarcity while building collaborative networks among educational institutions as Hopkins and Reynolds' (2001) research on school networks demonstrates that collaboration among schools can improve educational outcomes particularly in resource-constrained environments. Community-based learning utilizing public facilities as extensions of the learning space expands educational opportunities beyond traditional classroom boundaries, which aligns with Mahoney et al.'s (2009) research on expanded learning time and community schools showing improved student outcomes through extended learning opportunities and community partnerships.

Implementation in the field requires the creativity and flexibility of teachers in realizing the principles of Deep Learning into real classroom practices, approaches that recognize the prior knowledge and culture of students. The use of local phenomena as the basis for learning increases relevance and engagement for students while scaffolding techniques that take into account students' prior knowledge acknowledge that learning is built on existing cognitive structures and cultural knowledge. The collaborative learning approach using local patterns such as 'assitulung-tulungeng' (mutual assistance) transforms classroom dynamics from competition to cooperation in line with Johnson and Johnson's research (2009) about collaborative learning which states that cooperative learning improves academic and social outcomes. Unplugged computational thinking activities show digital literacy can develop even if there are limitations in technological infrastructure because Ramlee et al. (2019) proved that the cultivation of mathematical higher-order thinking skills can be adapted to various technological contexts supporting the viability of low-tech approaches in Deep Learning implementation.

Unplugged computational thinking activities is an innovative approach to digital literacy education without requiring advanced technology infrastructure as Bell et al.'s research (2009) on computer science unplugged proves that basic computational concepts can be taught through hands-on activities without computers. The adaptation of technology learning to Pinrang local needs ensures that digital literacy education remains relevant to students' lived experiences and future opportunities while technology ethics discussions within local frameworks help students understand the social and cultural implications of technological advancement. Thematic projects based on local potential create authentic learning experiences that connect academic content with real-world applications while learning expeditions to educational locations in Pinrang transform the entire region into a learning laboratory. Field trips to educational sites provide authentic learning experiences in real-world settings. Such experiences enhance student engagement, understanding, and retention, as noted by Behrendt and Franklin (2014) in their review of field-based experiential learning pedagogy. Collaborations with local institutions foster mutually beneficial partnerships between schools and community organizations, leveraging shared support and resources while expanding opportunities for learning beyond traditional classroom boundaries.

Community service initiatives align educational outcomes with local community needs and address the critique of education being disconnected from social realities. Eyler and Giles (1999) found that service-learning experiences that integrate academic curricula with community service enhance student engagement, civic responsibility, and academic performance. Local wisdom-based competitions and student mentorship programs connecting learners with local experts offer authentic assessment opportunities while fostering the intergenerational transmission of cultural knowledge. Educator capacity building is crucial in the success of Deep Learning implementation through professional development approaches that address local educational challenges and cultural specificities. Aslam et al. (2020) emphasized the need for teacher education programs to be responsive to local educational challenges and cultural specificities while local learning resource repositories and collaboration networks with community leaders create supporting ecosystems enabling teachers to continuously develop their practices.

The strategy for educator capacity building acknowledges that teachers are the primary change agents in education, and their professional development should be sustained and contextually relevant through district-based teacher learning communities that create professional networks supporting peer learning and collaboration. DuFour and Eaker's (1998) research on professional learning communities indicates that collaborative professional development is more effective than isolated training programs while teacher mentoring programs establish structured support systems for professional growth that preserve institutional knowledge. Structured teacher mentoring programs help keep knowledge within an organization as they support professional growth. Ingersoll and Strong (2011) found that effective mentoring increases retention, satisfaction with one's job, and the quality of instruction. Developing a local repository of learning resources will help solve the problem of accessing culturally relevant educational materials while simultaneously building institutional capacity for ongoing curriculum development. This leads to sustainable systems for educational improvement.

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 218-233

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5508

Teacher-community collaboration networks mark a major shift away from the traditional models of professional development for teachers that focus mainly on improving pedagogical skills because they include community leaders and local practitioners in teacher development. It is understood that effective education involves culturally local knowledge, values, and practices. The research by Henderson and Mapp (2002) about partnerships between communities and schools indicates that such partnerships enhance student outcomes while strengthening the social capital of the community through mutual engagement and shared responsibility for educational success. Best practice sharing forums create opportunities for teachers to learn from each other's experiences and innovations, as Cochran-Smith and Lytle's (2009) research on teacher learning emphasizes the importance of practitioner inquiry and collaborative reflection in professional development. Teacher innovation recognition programs acknowledge and celebrate creative approaches to educational challenges while encouraging continued experimentation and improvement creating cultures of innovation that support continuous professional growth and educational advancement. Evaluation and sustainability strategies address the challenge of assessing educational impact in culturally diverse contexts where standardized assessments may not fully capture the range of learning outcomes. Long et al. (2024) argue that educational content matching using advanced models requires systematic evaluation frameworks that can respond to local educational needs and cultural specificities, while situational indicator development asserts that success metrics must be aligned with local values, goals, and circumstances. Gay's (2010) study on culturally responsive assessment underscores the necessity for evaluation approaches that validate different ways of knowing and demonstrating knowledge.

Systematic documentation of changes in learning practices builds institutional memory and allows for continuous improvement through multi-dimensional impact assessment recognizing educational interventions have effects beyond academic achievement including social, cultural, and community outcomes. Model school case studies offer tangible evidence of successful implementation as well as identifying factors contributing to success or failure creating learning opportunities for other schools and educational systems. Program sustainability through regional program integration makes Deep Learning implementation part of a broader educational ecosystem rather than an isolated initiative as Fullan's (2007) research on educational change emphasizes sustainable reform requires systemic approaches addressing multiple levels within any given educational system Supportive policy development creates enabling environments for innovation while multi-stakeholder involvement ensures broad-based support for educational change through collaborative governance approaches engaging diverse community stakeholders in planning and implementation Ongoing monitoring systems provide feedback loops enabling adaptive management plus continuous improvement as Patton's (2008) research emphasizes utilization-focused evaluation providing actionable information for program improvement Integration from the start of monitoring with evaluation into program design ensures learning adaptation during implementation creating responsive systems able to change under new conditions emerging needs but still keep their eyes on core goals and outcomes.

The Framework for the Deep Learning Implementation Strategy in Pinrang Regency is a systemic model that places Deep Learning as the conceptual core and integration point for all domains through coordinated action across multiple interconnected areas. It shows how contemporary pedagogical approaches can be adapted by taking into account local wisdom, infrastructure availability, and educator capacity since collaboration and ethics in educational design must consider local cultural values and community participation, as noted by Biem and Morrison (2023). The framework takes a systemic approach because educational change involves coordinated action across multiple domains with Deep Learning serving as the conceptual core to ensure that all activities remain focused on enhancing student learning while supporting domains provide infrastructure, capacity, and sustainability mechanisms for success. The hierarchical yet interdependent arrangement of domains reflects complexity in educational systems wherein changes in one area affect others creating synergistic effects that enhance overall impact when all domains function effectively. Conceptual Foundation provides philosophical and pedagogical grounding to every activity while Curriculum Adaptation translates these principles into concrete educational content and approaches that respect both national standards as well as local cultural values. Practical Implementation brings this adaptation into actual classroom practice through teacher creativity and community engagement;

Capacity Building ensures educators have knowledge and skills for its effective implementation by means of ongoing professional development support systems. Evaluation and Sustainability give feedback mechanisms plus long-term planning needed for continuous improvement plus program continuation creating adaptive systems able to respond to changing conditions but still keep up quality plus relevance culturally. The interdependent nature of these domains means weakness in any one area can bring down the whole initiative while strength in all areas brings about synergistic effects enhancing overall impact through coordinated action plus shared commitment to excellence in education. The strategy framework is a roadmap for educational transformation, which honors diversity and recognizes the importance of cultural relevance in meaningful learning. It supports broader goals of educational reform in Indonesia as outlined by recent policy developments from Kementerian Pendidikan Dasar dan Menengah (2025). This approach illustrates high-quality education that can be achieved through culturally responsive practices respecting local wisdom and national standards while preparing students for global citizenship via balanced ways integrating local knowledge with universal educational principles. The framework's emphasis on cultural responsiveness directly addresses long-standing issues regarding the cultural appropriateness of education practices in diverse societies by bringing local wisdom, languages, and

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 218-233
International Journal Education and Computer Studies (IJECS)
DOI: https://doi.org/10.35870/ijecs.v5i3.5508

practices into formal education; validating traditional knowledge while improving its transmission to younger generations through systematic and sustainable methods.The practical orientation of the framework makes sure that theoretical principles are translated into concrete actions that can be executed by teachers and schools with different levels of resources and capacities. The emphasis on low-tech high-impact approaches also makes the framework accessible to schools in resource-constrained settings. The focus on building educator capacity makes sure that implementation remains sustainable over time through professional development systems which build local expertise and create supportive networks for ongoing improvement and innovation. This framework contributes to Indonesia's educational reform efforts by proving that Deep Learning principles can be successfully adapted to diverse local conditions without compromising pedagogical rigor or educational quality through systematic approaches balancing national standards with local needs and cultural diversity. This systematic approach to implementation offers a model that can be adapted elsewhere under similar challenges of educational reform in culturally diverse settings creating opportunities for knowledge sharing as well as collaborative learning across different educational contexts while maintaining respect for specificities and valuing cultural contexts.

Conclusion

Implementing Deep Learning approaches within the National Curriculum in Pinrang Regency requires strategic frameworks that are systematic, culturally responsive, and sustainable. The research has produced a strategic framework encompassing five primary domains: conceptual foundation development, national curriculum adaptation, practical implementation, educator capacity building, and evaluation with sustainability measures. These strategies were designed considering local characteristics of Pinrang Regency, including Buginese cultural wisdom, agriculture and fisheries-based economic potential, and existing educational infrastructure conditions. Research objectives have been achieved through developing conceptual foundation strategies for Deep Learning relevant to Pinrang Regency through integration of "sipakainge" and "sipakatau" values in learning practices. National curriculum adaptation strategies were successfully developed considering local wisdom and educational infrastructure conditions through low-tech high-impact approaches that optimize local resources.

Practical implementation strategies at school level were formulated by utilizing local phenomena as learning foundations and integrating collaborative patterns of "assitulung-tulungeng" in pedagogical practices. Educator capacity building strategies were designed through district-based learning community approaches and teacher-community collaboration networks. Evaluation and sustainability strategies were developed with situational indicators appropriate to local conditions and continuous monitoring systems. Successful Deep Learning implementation in Pinrang Regency depends on the ability to balance national curriculum demands with local needs and potential through mapping learning achievements with Pinrang Regency's local characteristics. Integrating local wisdom in learning practices requires systematic documentation of local knowledge relevant to education and developing learning content based on Buginese culture. Resource optimization occurs through creative approaches in utilizing public facilities as learning space extensions and inter-school resource sharing systems.

Sustainable educator capacity building requires training programs for national curriculum adaptation according to Pinrang local conditions and workshops for developing situational teaching materials. The research provides significant value in bridging gaps between contemporary pedagogical frameworks and regional educational realities through developing implementation models that can be adapted for other regional situations. The resulting strategic framework demonstrates that Deep Learning principles can be successfully adapted to diverse local conditions while maintaining pedagogical rigor and educational quality. Through adaptive and locally responsive implementation strategies, Deep Learning approaches can serve as catalysts for improving educational quality in Pinrang Regency while preserving local wisdom values in modern educational settings. The Deep Learning implementation strategic framework in Pinrang Regency shows that meaningful educational transformation requires systemic approaches integrating pedagogical innovation with local wisdom, building educator capacity sustainably, and creating evaluation systems responsive to local needs.

The model can serve as reference for other regions in implementing Deep Learning approaches that are culturally responsive and sustainable, supporting national educational quality improvement efforts through appreciation of Indonesia's local cultural diversity and richness. Educational transformation in Pinrang Regency through Deep Learning implementation represents more than curriculum modification—it embodies a paradigm shift toward learning that honors students' cultural heritage while preparing them for global citizenship. The strategic framework developed recognizes that effective education must be rooted in students'

OPEN ACCESS

E-ISSN 2776-3277, P-ISSN 2776-4729

Volume 5 (3), November 2025, 218-233

International Journal Education and Computer Studies (IJECS)

DOI: https://doi.org/10.35870/ijecs.v5i3.5508

lived experiences and cultural knowledge while meeting rigorous academic standards. Through systematic integration of Buginese cultural values, local economic potential, and available resources, the framework creates authentic learning experiences that engage students meaningfully while building essential 21st-century skills.

The research findings reveal that successful educational reform in diverse cultural settings requires moving beyond one-size-fits-all approaches toward adaptive strategies that respond to local conditions, needs, and opportunities. The framework's emphasis on low-tech high-impact solutions demonstrates that educational innovation depends more on pedagogical creativity than technological sophistication, making quality education accessible even in resource-constrained environments. Through community partnerships, intergenerational learning, and cultural documentation projects, the framework creates sustainable systems for knowledge preservation and transmission while enhancing educational outcomes. The strategic framework's potential for replication in other Indonesian regions lies in its systematic approach to balancing national standards with local distinctiveness. By providing concrete strategies for curriculum adaptation, teacher development, and community engagement, the framework offers practical guidance for educational leaders seeking to implement culturally responsive Deep Learning approaches. The model's success will ultimately be measured not only by improved academic outcomes but also by its ability to strengthen cultural identity, community cohesion, and students' sense of place and purpose in their local and global communities.

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E-ISSN 2776-3277, P-ISSN 2776-4729

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