

## Impact of a Multimodal Cognitive Enhancement Programme on the Learning Outcome of Upper Primary Students

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### Abstract

This research paper examines the impact of a Multimodal Cognitive Enhancement Programme (MCEP) on the learning outcomes of upper primary students. Situated at the developmental stage where children transition from concrete operational to formal reasoning, the study evaluates whether multimodal strategies—integrating visual, auditory, kinaesthetic, and experiential methods—enhance attention, memory, reasoning, creativity, and engagement compared to traditional monomodal instruction. A mixed-method, pragmatic design combining quantitative measures with qualitative insights was employed. Results indicate significant cognitive and motivational benefits, highlighting implications for policy, pedagogy, and alignment with NEP 2020.

### Keywords

Multimodal learning; Cognitive development; Upper primary students; Student engagement; NEP 2020; Educational innovation

### 1. Introduction

This research investigates the effects of a Multimodal Cognitive Enhancement Programme (MCEP) on the educational results of upper primary children. Traditional monomodal instruction often does not address the varied learning requirements of pupils, while multimodal solutions amalgamate visual, auditory, kinaesthetic, and experiential components to improve cognitive results, including attention, memory, reasoning, and creativity. This chapter talks about the study's background, research challenge, goals, objectives, hypotheses, and importance. The search for better methods to teach and learn has always been at the heart of educational innovation. Conventional classroom methodologies, mostly reliant on rote memorisation and lecture-centric approaches, often do not sufficiently engage pupils or cultivate their higher-order cognitive skills. For adolescents in upper primary school, who are at a very important time in their cognitive, social, and emotional development, these kinds of limits might hurt their academic advancement and general learning. At this point, students go from concrete operational thinking to more abstract reasoning. This requires strategies that spark curiosity, creativity, and a better understanding.

#### 1.1 Background of the Study

Students in upper primary school (ages 9 to 12) are at a very important period of development when they start to learn how to think abstractly and in higher-order ways. But rote-based approaches are still the most common way to teach, which frequently makes students lose interest and learn just superficially. Multimodal techniques engage several senses, fostering enhanced understanding and ongoing motivation.

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### Impact of Multimodal Cognitive Enhancement Programme on the Learning Outcome of Upper Primary Student

*Malti Gaur & Dr. Kirti Thakre*

## 1.2 Research Problem

Even though there is more and more proof throughout the world that multimodal learning works, Indian schools still don't use it in a systematic way very often. The issue examined in this research is whether a structured MCEP may markedly improve cognitive and motivational results in comparison to traditional teaching methods.

## 1.3 Aim & Objectives

**Aim:** To create, put into action, and test the efficacy of a Multimodal Cognitive Enhancement Program for pupils in upper primary school.

**Objectives:**

1. To assess the impact of multimodal methods on attention and concentration.
2. To evaluate the effect on memory retention and retrieval.
3. To look at how multimodal activities help people learn how to think and solve problems.
4. To look at how multimodal learning affects creativity and new ideas.
5. To find out how the program affected engagement and motivation.

## 2. Literature Review

### 2.1 Theoretical Foundations

### 2.2 Multimodal Learning & Cognitive Development

### 2.3 Research Gaps

Multimodal cognitive improvement utilises many complimentary learning theories. Piaget's perspective on the upper primary years (about ages 9–12) as a shift from concrete processes to early formal thinking designates this time as optimal for activities that enhance categorisation, inference, and hypothesis testing. Vygotsky's sociocultural theory underscores scaffolding and the Zone of Proximal Development, endorsing collaborative, tool-mediated activities (discussion, manipulatives, digital media) that define multimodal teaching. Gardner's Multiple Intelligences concept validates several representational modalities (visual-spatial, verbal, bodily-kinesthetic, musical) as concurrent pathways to comprehension. From an information-processing perspective, Dual Coding (verbal and nonverbal codes) and Cognitive Load Theory (the management of internal and external load) elucidate the rationale for the enhancement of encoding, retention, and transfer via the integration of words, pictures, and actions.

These traditions together suggest that a well-structured multimodal curriculum should enhance attention, memory, reasoning, creativity, and engagement—fundamental objectives in upper primary education. Piaget's cognitive development theory, Vygotsky's sociocultural theory, and Gardner's notion of multiple intelligences serve as the theoretical underpinnings for multimodal methods. Mayer's multimodal learning theory posits that processing information via numerous channels lowers cognitive burden and enhances retention. Empirical research substantiates these advantages; yet, deficiencies persist in the examination of upper primary children within Indian settings.

## 3. Methodology

This study employs a pragmatic research perspective, highlighting the need of integrating methodologies to address practical issues. The cognitive development of children is a multifaceted phenomenon that cannot be comprehensively comprehended via a single paradigm. Quantitative methods provide us hard data on how well children are learning, while qualitative methods give us a

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## Impact of Multimodal Cognitive Enhancement Programme on the Learning Outcome of Upper Primary Student

*Malti Gaur & Dr. Kirti Thakre*

deeper look at how students and instructors live their lives. Pragmatism therefore validates the amalgamation of both methodologies to equilibrate objectivity with contextual comprehension.

The research uses an inductive-deductive hybrid methodology. Inductively, patterns are examined via classroom observations, teacher interviews, and student reflections to provide novel insights on the impact of multimodal methods on engagement and creativity. Hypotheses created from known theories, like Piaget's constructivism, Vygotsky's sociocultural theory, Mayer's multimodal learning, and Gardner's multiple intelligences, are empirically evaluated using structured instruments and statistical methodologies. This combination makes sure that both theory-testing and theory-building happen. It also uses data and theme coding to provide qualitative insights. Informed permission, voluntary involvement, and secrecy were all part of the ethical rules.

#### 4. Findings & Analysis

The study on the Impact of a Multimodal Cognitive Enhancement Programme (MCEP) on the Learning Outcomes of Upper Primary Students makes an important contribution to the discourse on educational innovation and cognitive development. The research situates itself at a crucial developmental stage, where students aged 9–12 years transition from concrete operational to early formal reasoning. Traditional rote-based and monomodal instruction has long been criticized for limiting engagement and higher-order thinking. By introducing multimodal methods that integrate visual, auditory, kinaesthetic, and experiential approaches, the study aims to test whether structured pedagogical innovation can significantly improve attention, memory, reasoning, creativity, and engagement.

The significance of this study lies in its attempt to bridge gaps between theory and practice. While global research acknowledges the benefits of multimodal learning, Indian schools have been slow to institutionalize such practices. By situating the research within the Indian educational landscape, this thesis not only validates theoretical frameworks like Piaget's constructivism, Vygotsky's sociocultural theory, and Gardner's multiple intelligences, but also adds empirical weight to the relevance of Mayer's multimodal learning principles in primary classrooms.

The findings provide compelling evidence that MCEP positively influences attention, memory retention, reasoning, creativity, and engagement in upper primary classrooms. Attention and concentration improved significantly among students exposed to multimodal methods, validating the assumption that diversified sensory input maintains focus and reduces cognitive fatigue. Memory retention and retrieval showed measurable gains, with students recalling lessons more effectively when information was presented through a combination of text, visuals, and interactive activities.

Reasoning and problem-solving abilities were also enhanced. Multimodal tasks encouraged categorization, inference, and hypothesis testing, helping students transition into higher-order cognitive processes. Creativity, while benefiting from multimodal approaches, exhibited varied outcomes across individuals, suggesting that contextual factors like classroom culture and prior exposure to open-ended activities may mediate the impact.

Engagement and motivation were among the most notable findings. Students reported enjoying multimodal lessons more than traditional lectures, and teachers observed heightened participation and enthusiasm. This aligns with global evidence suggesting that learner-centered methods foster intrinsic motivation. However, the research also documented practical challenges such as resource scarcity, teacher workload, and difficulties in managing group activities. These challenges underscore that innovation requires systemic support for teachers and schools to sustain multimodal practices effectively.

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### Impact of Multimodal Cognitive Enhancement Programme on the Learning Outcome of Upper Primary Student

*Malti Gaur & Dr. Kirti Thakre*

## 5. Discussion

### Theoretical Implications

The findings reinforce multiple theoretical perspectives:

**Piaget's Theory of Cognitive Development** – The transition to formal operational thinking is facilitated by tasks that demand abstraction, categorization, and reasoning. MCEP demonstrated effectiveness in bridging this developmental shift.

**Vygotsky's Sociocultural Theory** – Scaffolding and collaborative learning were evident in multimodal group activities, where peer-to-peer interaction enhanced both comprehension and socio-emotional growth. The Zone of Proximal Development (ZPD) was particularly visible in contexts where weaker students benefited from shared multimodal resources and peer assistance.

**Gardner's Multiple Intelligences** – The program validated the need to design lessons that address diverse intelligences, including linguistic, spatial, kinaesthetic, and musical. Multimodal methods allowed students with different dominant intelligences to access knowledge equitably.

**Mayer's Cognitive Theory of Multimedia Learning and Cognitive Load Theory** – By distributing information across multiple channels, multimodal teaching reduced overload and improved retention. Students processed information more effectively when verbal and visual codes were integrated, corroborating Dual Coding Theory.

Collectively, these implications demonstrate that multimodal approaches are not supplementary but integral to facilitating deeper learning.

### Methodological Contributions

The research employed a pragmatic, mixed-method approach, combining quantitative measures with qualitative insights. Quantitative data provided objective evidence of improvements in cognitive and motivational outcomes, while qualitative interviews and reflections enriched understanding of lived classroom experiences. The inductive-deductive hybrid methodology was a methodological strength, as it simultaneously tested established theories and generated new insights from contextual observations.

Ethical rigor was also evident. Voluntary participation, informed consent, and confidentiality protocols strengthened the study's credibility. Importantly, the triangulation of methods reinforced validity, highlighting the utility of pragmatic frameworks in educational research.

### Practical and Pedagogical Implications

The findings have significant implications for curriculum reform, teacher training, and classroom practice. First, MCEP illustrates that multimodal interventions are not luxuries but essential pedagogical strategies. By improving attention and memory, multimodal methods directly contribute to academic performance, while increased engagement fosters long-term motivation for learning.

Second, the research supports alignment with India's National Education Policy (NEP 2020), which emphasizes competency-based learning, creativity, and holistic development. Multimodal strategies directly operationalize NEP's vision by promoting active, learner-centered classrooms.

Third, for practical implementation, schools must provide resources, professional development, and institutional support for teachers. Teacher training should include modules on designing multimodal lessons, managing dynamic classroom environments, and integrating technology. Without this systemic backing, teachers may experience workload stress, limiting sustainability.

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## Impact of Multimodal Cognitive Enhancement Programme on the Learning Outcome of Upper Primary Student

*Malti Gaur & Dr. Kirti Thakre*

Finally, the findings have relevance for educational technology (EdTech) developers. Digital platforms that combine text, visuals, interactivity, and gamified learning align closely with MCEP principles. Thus, the research opens avenues for collaborative innovation between educators and EdTech providers.

### **Contribution to Literature**

This study addresses significant gaps in literature. It systematically evaluates a comprehensive multimodal program rather than isolated interventions, thereby offering a holistic perspective. It also focuses specifically on upper primary students in India, an underexplored demographic in multimodal research. By connecting MCEP to NEP 2020, the study situates global theories within local educational reforms, making its contribution contextually relevant and practically actionable.

The research also advances literature by linking multimodal learning to 21st-century skills such as problem-solving, creativity, and engagement. This positions multimodal pedagogy as a critical enabler of education for future-ready learners.

### **Future Research Directions**

Future studies should adopt longitudinal designs to measure sustained cognitive and motivational effects over time. Comparative research across urban and rural schools would enhance understanding of contextual differences. Exploring the integration of technology-based multimodal interventions, including interactive apps and gamification, would expand the scope of findings.

Another promising avenue is to analyze the teacher experience more systematically, as workload and resource challenges emerged as recurring themes. Finally, further investigation into the relationship between multimodal strategies and creativity could yield deeper insights into how pedagogy fosters innovative thinking.

### **Conclusion**

The findings of this study provide robust evidence that multimodal cognitive enhancement significantly improves the learning outcomes of upper primary students, especially in terms of attention, memory, reasoning, and engagement. Creativity also benefits, albeit modestly. By validating key educational theories and employing a pragmatic, mixed-method design, the research bridges theoretical ideals with practical realities.

The study makes a persuasive case for institutionalizing multimodal pedagogy within mainstream education. Its contribution extends beyond cognitive gains, highlighting the importance of learner engagement, motivation, and holistic development. Aligning seamlessly with NEP 2020, the findings underscore that multimodal teaching is not an experimental innovation but a necessary evolution for preparing students to thrive in dynamic, knowledge-driven societies.

Ultimately, this research demonstrates that education must move beyond rote memorization and lecture-driven classrooms towards inclusive, student-centered, and multimodal approaches that cultivate both cognitive excellence and lifelong learning dispositions.

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### **7. Limitations & Future Research**

Despite strong findings, the study acknowledges limitations. The sample size was limited to selected schools, which may restrict generalizability across diverse socio-economic contexts. The short-term design did not assess long-term impacts of MCEP on academic achievement and retention. Classroom constraints—such as limited resources and challenges with group dynamics—may have influenced outcomes. These limitations indicate that further research with larger, longitudinal samples is necessary to validate findings.

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