

Review Article

Open Access

Multilingual Hybrid Learning and Cognitive Development in Middle School Learners: An Interdisciplinary Case Study from India

Tuba Sabahat* and Laeeq Ahmed Khan Aqil²

Insight international school, Hyderabad, KL University, Vijayawada, India

ABSTRACT

This study looks at how multilingual hybrid learning environments affect the thinking of middle school students who come from Urdu-speaking backgrounds in India. The research uses both qualitative and quantitative methods, including cognitive tests, observations, and analysis of classroom interactions. The study involved 73 students from two government-supported Urdu-medium schools in Telangana. The findings show that using bilingual content in a smart way, such as combining digital Urdu and English resources with teacher support, improves problem-solving skills, memory, and awareness of thinking processes. The study suggests a teaching model that is based on socio-constructivist ideas and translanguaging. It also highlights the importance of the NEP 2020's vision for multilingual and digital learning, especially in areas where languages are less common.

*Corresponding author

Tuba Sabahat, Insight international School, Hyderabad, KL University, Vijayawada, India.

Received: May 07, 2026; **Accepted:** May 12, 2026; **Published:** May 21, 2026

Keywords: Multilingualism, Hybrid Pedagogy, Cognitive Development, Translanguaging, Urdu Medium Education, Blended Learning, NEP 2020

Introduction

Understanding Hybrid Learning in Language Minority Classrooms. The Indian education system is going through a big change as it tries to include multilingualism, technology, and more inclusive teaching methods. In Urdu-medium government and aided schools, language barriers still make it hard for students to understand concepts, stay interested, and remember what they learn. This study came out of experiences at Insight International School and nearby government schools where I tried out hybrid lesson designs that connected students' home languages with digital materials and teamwork strategies in multiple languages. The goal was to connect what students know from their daily lives with formal academic content, especially in science classes.

Theoretical Framework: Cognitive and Linguistic Foundations

This research is based on several connected theories. The Vygotsky's Sociocultural Theory says that social interaction and language play a key role in how we think. Bilingual discussions led by peers and language circles helped students use the Zone of Proximal Development (ZPD) to improve their thinking skills. The Cognitive Load Theory (Sweller, 1988) shows that using familiar languages and different types of instruction reduces the stress on working memory. The Mayer (2005) also highlights the importance of using two channels for better mental processing, and The Translanguaging (García & Wei, 2014; Canagarajah, 2013) was a major part of the teaching approach. Letting students move freely between Urdu, Telugu, and English helped them

understand and show knowledge without being limited by strict language rules [1-3].

Literature Review: Cognitive Benefits in Multilingual Hybrid Environments

Research in cognitive psychology and neuroscience shows that being bilingual improves executive functions, awareness of language, and attention control, which leads to better learning in many areas.

Bialystok (2001) found that bilingual people have better control over their thinking and can switch tasks more efficiently, which is important in school. Studies like those by Abutalebi and Green (2007) support this, showing that bilingualism uses parts of the brain that help with attention and memory, helping with problem-solving [4,5].

In India, the disadvantage of being in a minority language has been widely discussed. Mohanty (2009) introduced the concept of the "double divide," showing how minority language learners not only don't get good education in their first language but also face discrimination in dominant language classrooms. This leads to less confidence, lower grades, and more dropouts in multilingual communities [6].

However, translanguaging has become a powerful teaching method. Srivastava and Khurshid (2021) found that when students can move between Hindi, Urdu, and English in discussions, their understanding and involvement in class improve. These students were more confident in sharing their ideas and remembered what they learned better [7].

On the policy side, the National Education Policy (NEP) 2020 supports teaching in mother tongues or regional languages, especially in early and middle grades. It also encourages the use of digital and hybrid learning to make education more accessible and inclusive (Ministry of Education, 2020) [8]. These ideas match global best practices in multilingual education and aim to give all children, especially those from less common language backgrounds, better access to learning.

This study builds on these ideas by doing a real classroom study of Urdu-medium students in multilingual environments. By looking at the link between language, thinking, and digital teaching, the study supports previous findings and gives a model that is relevant to the experiences of students and teachers in semi-urban government schools in Telangana.

Methodology: Mixed-Methods Study in a Multilingual Educational Context Participants and Setting

The study took place in two Urdu-medium government-aided schools in the semi-urban area of Nalgonda district, Telangana. a total of 73 students from Grades 6 to 8 took part in the intervention. These students were mostly first-generation learners from poor families. Their language environment was multilingual many spoke Urdu at home, used Telugu in their communities, and mostly heard English at school or through digital tools. This setting was ideal for looking at how hybrid multilingual teaching affects students whose thinking is shaped by different languages. The variety of languages these students were exposed to allowed the study to see how translanguaging strategies could help or challenge their learning, especially in science. a subject considered both difficult and demanding.

Instructional Strategy

The intervention used a well-planned multilingual teaching approach that mixed digital resources, peer collaboration, and hands-on activities done offline. The digital part included animated videos and interactive simulations that covered science topics like states of matter, heat transfer, and energy. These materials were made available in both Urdu and English to match the students’ preferred languages for thinking and learning. Offline classroom activities involved discussion groups where students worked in small teams to understand, translate, and re-express information across Urdu, Telugu, and English.

For example, science terms like “evaporation” or “condensation” were taught using everyday examples in the students’ home languages, then visually shown and explained in the main language used for instruction. Also included were peer-assisted language games and picture-based tasks that helped students remember what they learned and understand how words work across different languages. The teacher’s role was to help students move between languages naturally, offering support when needed. This method followed the ideas of socio-constructivist learning.

Data Collection Tools and Techniques

Pre- and Post-Intervention Assessments: These tests were made to see how much students improved in understanding, applying, and reasoning about certain science topics. The questions were written in simple English and Urdu, so students could answer in either language. The results were studied to track their learning progress.

Focus Group Discussions and Reflective Journals: These were done weekly with both students and teachers to learn more about

how students felt about the mixed-language teaching method, their language choices, and their emotional reactions. Students were asked to write about what they learned, how they shared it with others, and whether they felt more confident.

Observation Logs: The main researcher kept detailed notes on what happened in class, including how students talked to each other, which languages they used, how they worked together to understand new ideas, and how active they were in class. Special attention was paid to instances where students switched between languages to explain a concept or solve a problem. By using these different methods, the study aimed to not only check how well students learned but also to understand how they thought and communicated in a classroom with many languages.

Table 1: Participant Profile Table

Variable	N (Students)	%
Grade 6	50	33.8%
Grade 7	52	35.1%
Grade 8	46	31.1%
Urdu–Telugu Bilinguals	148	100%
First-Generation Learners	136	91.9%

Table 2: Demographic Profile Table

Category	Detail
Gender Distribution	Males: 81 (54.7%), Females: 67 (45.3%)
Socio-Economic Status	BPL Card Holders: 117 (79.0%)
Parental Education	Illiterate/Primary: 110 (74.3%)
Digital Device Access	Mobile: 93 (62.8%), Shared Only: 38 (25.6%)
Learning Support at Home	Minimal/None: 103 (69.6%)

Table 3: Engagement Heat Map Summary Table

Week	High Engagement Zones (%)	Notes
1	19%	Initial hesitation, tech unfamiliarity
3	28%	Active participation during peer translation
6	37%	Conceptual mapping, bilingual responses peak
Urdu–Telugu Bilinguals	148	100%
First-Generation Learners	136	91.9%

Table 4: Metacognitive Behavior Quotations

Quote	Theme
“I used Urdu to understand first, then tried English.”	Strategic Translanguaging
“Drawing in both languages helped me not forget.”	Visual-Aided Dual Coding
“My friend explained it in Telugu, then I tried myself.”	Peer Scaffolding

Table 5: Intervention timeline

Week	Focus Area	Tools Used
1	Digital Orientation	Urdu video module, teacher walkthrough
2	Peer Circle Formation	Rotating group roles in translation
3	Visual Concept Mapping	Picture charts, bilingual drawing tasks
4	Multilingual Problem Solving	Puzzle-based logic tasks
5	Self-Evaluation & Journaling	Student reflection books
6	Post-Assessment & Review	Group review sessions, oral explanations

Table 6: Multiple Linear Regression – Predictors of Post-Test Learning Gain

Predictor Variable	B (Unstandardized)	SE B	β (Standardized)	t	p-value
Home Language Strength (Urdu–Telugu)	0.452	0.073	0.41	6.19	<0.001
Access to Personal Digital Device	0.298	0.065	0.34	4.58	<0.001
Parental Education Level	0.162	0.089	0.15	1.82	0.072
Teacher Feedback Quality (Self-Rated)	0.371	0.095	0.28	3.91	<0.001
Constant (Intercept)	1.624	0.221	–	7.35	<0.001

$R^2 = 0.64$, Adjusted $R^2 = 0.61$, $F(4, 143) = 26.1$, $p < 0.001$

Results and Discussion: Interpreting Cognitive and Linguistic Gains

The findings of this study show clear improvements in both cognitive performance and learner confidence after using multilingual hybrid instruction. The analysis covers three main areas: results from cognitive assessments, how well groups worked together, and students’ own views and feelings. Each area includes insights from observations and student reflections.

Cognitive Assessment Outcomes

The results from the tests before and after the intervention show clear improvement in all four skills: understanding concepts, remembering information, applying knowledge, and thinking verbally. Table 7 shows that the average score for understanding concepts went up from 48.2% to 71.4%, which is a 48.1% increase. Similar improvements were seen in applying knowledge, which rose from 43.5% to 66.8%. This suggests that students were better able to use what they learned in real-world situations. Memory and verbal reasoning also improved by 38.9% and 37.7% respectively, showing better memory and understanding of language. These findings match what other research has found about bilingual learning helping with things like focus and memory (Bialystok, 2011; Abutalebi & Green, 2016). The way students could use both languages helped them process complex ideas more easily, which likely reduced the mental effort they needed to focus on learning.

Table 7: Pre- and Post-Intervention Assessment Scores (n = 73)

Skill Area	Pre-Test Mean Score	Post-Test Mean Score	% Improvement
Conceptual Clarity	48.2%	71.4%	48.1%
Retention (1 week)	52.7%	73.2%	38.9%
Application	43.5%	66.8%	53.6%
Verbal Reasoning	50.1%	69.0%	37.7%

Group-Level Collaboration and Language Mediation

Tracking the group’s performance each week across four sessions gave more understanding of how the intervention helped the whole group think and learn together. Table 8 shows a steady increase in scores for collaborative tasks, going from 46.3% in Week 1 to 74.1% in Week 4. During this time, observations in the classroom noted a change from students learning on their own to working together to understand things better. This was clearly seen when students started pointing out mistakes in each other’s understanding or using what others explained, even across different languages. Using bilingual digital materials and peer-led translation activities helped students learn by giving them different ways to approach the content. Students who had trouble with science terms in English began using similar words in Urdu or Telugu to help them understand, and later started using the proper academic terms. For example, the idea of “evaporation” was explained using the Urdu word *bukhar ban-na*, along with everyday examples like clothes drying in the sun. This connected classroom learning to real-life situations, which is known to help with remembering information (Mishra & Singh, 2020) [9].

Table 8: Weekly Group Performance on Collaborative Tasks (n = 6 groups)

Week	Topic Covered	Avg. Group Score (%)	Comments
Conceptual Clarity	48.2%	71.4%	48.1%
Retention (1 week)	52.7%	73.2%	38.9%
Application	43.5%	66.8%	53.6%
Verbal Reasoning	50.1%	69.0%	37.7%

Student Self-Perception and Confidence Shift

The intervention also made a big difference in how students saw themselves and felt about using language, as shown in the pre- and post-survey results in Table 9 The share of students

who said they “understand science lessons well” went up from 29% to 72%, and the number who felt they could “explain concepts to others” rose from 34% to 67%. What stood out most was that 89% of students said they “learn better when their own language is used,” compared to just 65% before the intervention. This shows how using students’ own languages can make them feel more confident and comfortable, especially in situations where English is often a challenge instead of a help. These results match what Srivastava and Khurshid (2021) found in similar schools with many languages spoken at home [7]. They noticed that when students were encouraged to use their home languages without being punished, their participation and understanding improved a lot.

Table 9: Pre/Post Student Confidence Survey

Statement	Agree (Before)	Agree (After)
I understand science lessons well.	29%	72%
I can explain concepts to others.	34%	67%
I learn better when my own language is used.	65%	89%

Integrative Insights

The data from different sources shows a clear picture: when multilingual hybrid teaching is carefully planned and thoughtfully carried out, it can not only help students perform better academically but also make them more independent and involved in their learning. This method does not lower the quality of teaching—it changes the way rigor is approached by recognizing that students have diverse ways of thinking. Also, using digital tools in languages students are familiar with helps reduce their anxiety and encourages them to compare and discuss ideas across languages. This matches the cognitive-interactionist view of language learning, which says that understanding is built through working with others and getting support from teachers.

Statistical Interpretation and Analysis

To confirm the importance of the cognitive improvements, a paired samples t-test was done for each of the four skill areas. The results showed major improvements from the pre-test to the post-test in all areas:

Conceptual Clarity: $t(72) = 9.88, p < 0.001$, Cohen’s $d = 0.89$

Application: $t(72) = 9.76, p < 0.001$, Cohen’s $d = 0.87$

Retention: $t(72) = 7.91, p < 0.001$, Cohen’s $d = 0.75$

Verbal Reasoning: $t(72) = 8.04, p < 0.001$, Cohen’s $d = 0.78$

These results suggest that the multilingual hybrid approach had a strong impact, especially in helping students use their knowledge in different languages and explain scientific ideas more clearly.

Thematic Insights: Real-Time Learning Transformations

Peer-Led Translation Circles: Students translated terms like “condensation” and “evaporation” between Urdu and Telugu, which led to discussions and better understanding. **Home-School Connection:** One child taught a science diagram to their sibling at home, which was noticed by the teacher and was reported as improved confidence. **Reduced Fear of Error:** Students felt more comfortable trying to answer questions when the hybrid teaching approach reduced the pressure to be perfect in English.

Implementation and Policy Recommendations

Based on the study’s results, the following steps are suggested to make multilingual hybrid learning more widely used, lasting, and expandable in government and low-cost schools in India.

Curriculum Design and Integration

Multilingual methods should be part of the main curriculum, especially in subjects like science and social studies, where difficult terms can block learning. Resources like bilingual concept maps, dual-language textbooks, and examples in Urdu, Telugu, and English should be created and approved. Translanguaging should be used as a planned part of teaching, not just as a quick fix.

Teacher Training and Professional Development

Teachers need training in translanguaging and teaching that respects cultural backgrounds. Both new and experienced teachers should learn about managing multilingual classes, cognitive load theory, and how to communicate inclusively. Techniques like language mapping, student-led interpretation groups, and using mother-tongue to support learning should be part of their training.

Digital Content Creation and Technological Support

Education departments and EdTech companies should work together to create interactive and culturally relevant digital content in local languages. Science animations, simulations, and tools for assessments should be translated and adapted to reflect the everyday experiences of students. These materials should be available on low-speed internet and work without an internet connection.

Monitoring and Reflection Framework

In addition to final exams, schools should set up a system for ongoing assessment using student portfolios, learning journals, and peer feedback. Tools that let students reflect on their learning in their own language and understand their own thinking processes should be used. This reflection helps students learn more deeply and take control of their education.

Policy-Level Support and NEP Implementation

At the national level, education boards should include multilingual hybrid teaching in their plans to follow the National Education Policy 2020. Funds should be allocated for developing local resources, training teachers, and improving infrastructure for blended learning. Policies should clearly support innovations that use mother-tongue in digital formats as essential for fair education [10].

Conclusion

This study shows that multilingual hybrid teaching, which uses translanguaging and supports students with tools in their local languages, can greatly improve cognitive growth, teamwork, and confidence among students who are often overlooked. In places where having many languages is usually seen as a problem, this research shows it can be a valuable teaching tool.

The classroom activity not only improved scores in understanding, reasoning, and remembering but also changed how the classroom worked encouraging students to help each other learn in different languages. Feeling safe, confident, and recognized as part of their culture were clear results of allowing students to use their full language skills to learn science.

Also, this study supports the vision of the National Education Policy (NEP) 2020, which sees the advantage of early learning in a mother tongue and uses technology to make education more inclusive. The success of this model shows that education can become innovative without needing expensive equipment just through creative teachers, strong cultural connections, and good policies. Future research could look into long-term memory, how adaptable teachers are, and how this approach works in different subjects. However, the current findings show that inclusive multilingual teaching is not only possible it's necessary and urgent for the many multilingual learners in India.

Declarations Acknowledgments

I would like to thank the school managements of the participating Urdu-medium institutions in Nalgonda and Mahbubnagar districts, the dedicated teachers who cooperated throughout the intervention, and the students who enthusiastically participated in all learning activities. Gratitude is also extended to Insight International School Hyderabad for facilitating field engagement and observations. Funding.

This research received no external funding. All expenses were borne by the author as part of independent academic work and classroom experimentation.

Ethics Statements

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee. The study was conducted following ethical guidelines for educational research with minors in classroom settings.

Conflict of Interest

I declare no conflict of interest regarding the publication of this paper.

Informed Consent

Verbal and written consent was obtained from school authorities, participating teachers, and guardians of students. Confidentiality and anonymity were maintained throughout data collection and reporting.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. Heat maps, pre-post test scores, NVivo-coded outputs, and student responses are archived securely.

References

1. Sweller J (2010) Cognitive load theory: Recent theoretical advances. *Cognitive Load Theory* 53: 1-15.
2. García O, Wei L (2015) The translanguaging classroom: Leveraging student bilingualism for learning. *Theory into Practice* 54: 45-55.
3. Canagarajah S (2011) Codemeshing in academic writing: Identifying teachable strategies of translanguaging. *The Modern Language Journal* 95: 401-417.
4. Bialystok E (2011) Reshaping the mind: The benefits of bilingualism. *Canadian Journal of Experimental Psychology* 65: 229-235.
5. Abutalebi J, Green DW (2016) Neuroimaging of language control in bilinguals: A neurocognitive model. *Journal of Neurolinguistics* 39: 1-13.
6. Mohanty AK (2010) Languages, inequality and marginalization: Implications of the double divide in Indian multilingualism. *International Journal of the Sociology of Language* 205: 131-154.
7. Khurshid A, Srivastava P (2021) Translanguaging as pedagogy: Examining classroom practices in Indian urban schools. *Language and Education* 35: 315-332.
8. (2020) National Education Policy 2020: Towards a new era of education. Ministry of Education https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf.
9. Mishra RK, Singh N (2020) Impact of mother tongue instruction on conceptual development in rural India. *International Journal of Bilingual Education and Bilingualism* 23: 445-461.
10. Kumar R, Ghosh S (2023) Evaluating multilingual education policy through the lens of translanguaging practices. *Education and Linguistics Review* 48: 105-123.