

Enhancing English Achievement and Long-Term Retention Through Concept Mapping: A Multi-Site Longitudinal Study of Secondary Students in Keralam, India

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ABSTRACT:

Persistent gaps in secondary English education in Keralam are linked to teacher-centred practices that limit active engagement with literary texts. This study examined whether structured concept mapping (COM) improves English achievement, attitudes, and retention compared to conventional instruction (CON) and whether the effects vary by school location. Participants included 160 Class IX students from two government schools in Malappuram District, India (rural Vettilappara and urban Areekode) assigned by class to COM or CON (80 each) and 40 secondary English teachers. Over seven weeks, COM students engaged in a five-step concept mapping process, while CON students received lecture–discussion instruction. We measured achievement using a validated English Language Achievement Test (ELAT) at baseline, post-test, and 3- and 6-month follow-up. Baseline ELAT scores were comparable. COM students achieved significantly higher post-test scores than CON students (37.35 vs. 31.43; $p < .001$), with advantages sustained at 3 and 6 months post-intervention. The COM also demonstrated superior retention of learning gains. COM students reported more positive attitudes, and the teachers' attitudes improved following orientation. The findings suggest that concept mapping enhances durable literary comprehension in rural and urban settings.

Keywords: English language achievement, secondary education, instructional strategy, teacher attitude, visual learning, long-term retention

Introduction

The persistent discrepancy between the objectives of English language instruction and

the actual learning outcomes remains a critical concern for secondary education across India, particularly in regions where English serves as a secondary medium of instruction (Hazaymeh &

Alomery, 2022; Ta & Razali, 2023). In Keralam, despite high literacy rates and a well-structured SCERT curriculum, secondary students frequently demonstrate fragmented comprehension of English literary texts. They often retain only the fundamental content and struggle to synthesise themes, establish intertextual connections, or articulate critical analyses. This disparity is especially pronounced when comparing rural and urban educational environments, where variations in access to teaching resources and opportunities for extracurricular English activities lead to divergent learning trajectories among students with comparable potential (Manzon, 2021). Teaching English as a second or foreign language (L2/ESL/EFL) to secondary school students remains a formidable challenge in contemporary language education, necessitating evidence-based instructional strategies to replace traditional methodologies (Han, 2025).

In government secondary schools in Keralam, the predominant instructional method is the traditional chalk-and-talk approach. This method is characterised by a teacher-led sequence that includes reading, explaining, note-taking, and responding to textbook questions. While procedurally straightforward, this approach confines students to passive roles, thereby limiting opportunities for self-directed learning, meaningful schema development, and comprehensive engagement with the text (Chen & Hwang, 2020). Research consistently shows that passive teaching leads to superficial learning that is easily forgotten, particularly with literary texts that require simultaneous processing of narrative, thematic, symbolic, and linguistic elements (Dolmans et al., 2016; Sharma & Sharma, 2025). Consequently, the inherent limitations of teacher-centred pedagogy have intensified the search for learner-centred instructional strategies that can bridge the gap between surface-level memorisation and deep, meaningful understanding (Bremner et al., 2022).

Concept mapping, initially developed by Novak and Gowin (1984) within the framework of Ausubel's (1968) theory of meaningful learning, presents a distinct alternative to conventional passive teaching methods. By prompting students to express their conceptual understanding through a network of labelled propositions with nodes interconnected by directional phrases, concept mapping

transforms comprehension from passive reception into an active process of knowledge construction (Novak, 2010). The resultant artefact, the concept map, functions as a learning tool, assessment method, and communication medium, rendering the learner's cognitive organisation visible, open to discussion, and amenable to revision (Sunday et al., 2025; Uygun and Demir, 2026). This approach is grounded in the idea that meaningful learning occurs when learners deliberately link new information to existing cognitive structures, enhancing long-term retention and conceptual clarity while reducing language anxiety (Bryce and Blown, 2023).

In English language and EFL/ESL education, concept mapping is widely used to strengthen critical skills such as reading comprehension, writing, vocabulary retention, and grammar acquisition. Research suggests that concept maps serve as pre-reading organisers, in-reading instructional aids, and post-reading reflective tools, particularly for secondary EFL students (Su and Zou, 2024). A comprehensive meta-analysis of 68 studies conducted between 2006 and 2024 corroborated the significant positive impact of concept mapping on L2 learning, with collaborative approaches proving more effective than individual ones, and productive skills such as writing and speaking deriving the greatest benefits (Han, 2025). Quasi-experimental studies at the secondary level, including those by Manzon (2021) and Kassem (2017), found statistically significant differences in average achievement scores between students taught with concept mapping and those receiving traditional instruction, further substantiating the educational value of this strategy.

Although a substantial body of international research exists in fields such as science, mathematics, health education, and English as a Foreign Language (EFL), the application of concept mapping in secondary-level English literary education in India remains underexplored. Indian research has largely focused on science subjects at the higher secondary or collegiate level, with few studies using the comprehensive multi-site longitudinal designs needed to assess both the magnitude and persistence of instructional impacts across diverse educational settings (Singh and Rahman, 2023; Sharma and Sharma, 2025). Educational disparities between rural and urban regions in

Keralam further exacerbate this issue, as unequal access to English-medium resources and trained educators leads to unequal achievement outcomes that single-site studies cannot adequately capture (Scaria, 2009; Rasheed, 2014; Vakkom Moulavi Foundation Trust, 2024).

This study investigates whether a structured concept mapping (COM) intervention embedded in teaching “Half a Day” by Naguib Mahfouz (SCERT Class IX, Unit I) can improve English language achievement and student attitudes among Class IX learners in Malappuram District, Keralam. It also examines the effect of a three-day COM orientation programme on secondary English teachers’ attitudes toward concept mapping. By integrating the intervention into two government secondary schools located in rural and urban settings and tracking outcomes over time, this study provides practical evidence for the wider adoption of concept mapping in Indian secondary English education. This study addressed the following research questions:

- RQ1: To what extent does the implementation of concept mapping as an instructional strategy enhance English language achievement among Class IX students compared to traditional teaching methods, as evaluated immediately after the intervention?
- RQ2: Are the differences in achievement and attitude between groups influenced by the location of the school (rural versus urban)?
- RQ3: What is the direction and magnitude of the relationship between post-intervention achievement and attitude scores?
- RQ4: To what extent does a structured three-day concept mapping orientation program affect the attitudes of secondary English teachers across the cognitive, affective, behavioural, and perceived-barriers dimensions?

2. Literature Review

2.1 Theoretical Foundations of Concept Mapping

Concept mapping is grounded in Ausubel’s (1968) assimilation theory, which posits that meaningful learning occurs when new information is anchored to and integrated with pre-existing knowledge structures, a process Ausubel termed cognitive subsumption. Novak

and Gowin (1984) operationalised this principle by developing concept maps as external representations of the propositional structure of knowledge, wherein nodes represent concepts and labelled arcs denote relational assertions connecting them. This architecture directly reflects the semantic network model of long-term memory (Collins & Quillian, 1969), ensuring that map construction engages encoding processes associated with durable retention and transferable understanding.

Vygotsky’s (1978) sociocultural theory provides a complementary framework for this study. When students co-construct maps in pairs or compare individual maps during class discussions, the zone of proximal development is activated. In this context, peers and teachers scaffold each other’s conceptual organisation beyond what individual, unaided cognition can achieve. In the present study, the 5-step instructional model integrates individual map construction with whole-class presentation and feedback phases, drawing on both Ausubelian subsumption and Vygotskian scaffolding.

2.2 Concept Mapping and Language Learning

Recent research increasingly suggests that concept mapping significantly enhances various language learning outcomes, such as vocabulary acquisition (Bahr & Dansereau, 2001), reading comprehension (Nesbit & Adesope, 2006), and written compositions (Goodnough & Woods, 2002). A meta-analysis by Nesbit and Adesope (2006), which reviewed 55 studies, identified an overall mean effect size of $d = 0.82$ for concept mapping compared to traditional text study, with particularly notable effects on recall and transfer tasks. The current study assessed these specific outcomes using the English Language Achievement Test.

For learners of English as a Second Language (ESL) and English as a Foreign Language (EFL), concept mapping presents a significant advantage; the visual-spatial framework reduces the cognitive load associated with processing text in a non-native language, thereby freeing working memory resources for more advanced comprehension processes (Feng et al., 2023). This is particularly relevant in Keralam SCERT Class IX, where students encounter complex literary texts, such as allegories, multilayered symbols, and temporal shifts that require simultaneous linguistic and literary processing.

2.3 Concept Mapping in Secondary English: A Gap in Indian Research

Research on implementing concept mapping in English education in Indian secondary schools remains limited. Previous studies (Sundararajan et al., 2018; Wong et al., 2021) have primarily focused on scientific disciplines, employed small convenience samples from single locations, and reported findings without longitudinal follow-up or psychometric validation of the instruments used. This study makes four significant contributions to the field: (1) it employs a larger, stratified multi-site sample; (2) it utilises a validated multi-component instrument that assesses both achievement and attitude; (3) it incorporates parallel teacher-component measurement; and (4) it includes a six-month follow-up phase.

2.4 Teacher Attitudes and Instructional Innovation Adoption

Rogers (2003) diffusion of innovations framework suggests that attitudinal change, specifically modifications in perceived relative advantage, compatibility, and trialability, is a crucial precursor to the adoption of instructional innovations. Teachers' attitudes toward a new pedagogy indicate both the fidelity of implementation and the innovation's sustainability beyond the training period. This study examines teacher attitudes across four operationally distinct dimensions: cognitive (knowledge and understanding), affective (emotional orientation), behavioural (intention and readiness to use), and barriers (perceived obstacles), providing a multidimensional assessment of the orientation program's impact.

3. Method

3.1 Research Design

A stratified, multi-site, quasi-experimental, parallel group design with repeated measures at four time points (baseline, immediate post-test, three-month follow-up, and six-month follow-up) was employed (Campbell and Stanley, 1963). Stratification was based on school location (rural vs. urban), with intact Class IX sections at each site allocated to either COM or conventional instruction (CON), yielding four groups of $n = 40$ each.

Because ethical and administrative constraints precluded random reassignment of individual students within intact classes, the study used a non-equivalent control group design. To

mitigate threats to internal validity, the study assessed baseline equivalence on ELAT and attitude scores, entered the pre-test ELAT as a covariate in ANCOVA models, and explicitly modelled school location as a stratification factor and an interaction term.

3.2 Participants

3.2.1 Students

Participants in this study comprised 160 Class IX students aged 13–15 years from two government high schools in Malappuram District, Kerala, India. One school was situated in a rural area (Government High School, Vettilappara), and the other was in an urban area (Government High School, Areekode). Each institution contributed 80 students, who were divided into Concept Mapping (COM) and Control (CON) groups (40 students each), resulting in COM: $n = 80$ and CON: $n = 80$; rural: $n = 80$ and urban: $n = 80$. The sample included 93 females (58.1%) and 67 males (41.9%), with sex distributions comparable across the COM (48 females, 32 males) and CON (45 females, 35 males) groups. The mean age of the participants was 13.98 years ($SD \pm 0.70$), and the average attendance during the intervention was 89.86% ($SD \pm 6.03$), with negligible differences between the COM and CON groups. The inclusion criteria required enrolment in Class IX during the 2024–2025 academic year, at least 80% attendance during the intervention, completion of both pre- and post-tests, and no prior formal training in concept mapping. The sample size was determined a priori using G*Power 3.1 (Faul et al., 2007), assuming a medium effect size of $d=0.50$, an alpha level of $\alpha=.05$, and a desired power of $1-\beta=.80$, which indicated that 34 participants per group were required; this number was increased to 40 per group to allow for an anticipated 20% attrition rate, yielding a total planned sample of $n=160$.

3.2.2 Teachers

Forty secondary English teachers, comprising 20 from rural areas and 20 from urban areas, participated in the TAS and open-ended questionnaire components. The sex distribution was 21 males (52.5%) and 19 females (47.5%). The mean total teaching experience was approximately 12.6 years ($SD \pm 6.46$), while the mean experience in teaching English was approximately 10.7 years ($SD \pm 6.56$). Participants' academic qualifications ranged

from a Bachelor of Arts to a Doctor of Philosophy, with 70% holding a Bachelor of Education and 30% holding a Master of Education. Familiarity with concept mapping was limited: 57.5% of participants had heard of it, 20% had used it at least once, and 5% had received formal training.

3.3 Instruments

3.3.1 English Language Achievement Test (ELAT)

The ELAT was a researcher-developed, content-validated assessment consisting of 50 marks, aligned with the SCERT (Keralam) Class IX unit “Half a Day” by Naguib Mahfouz. It included multiple-choice, fill-in-the-blank, matching, short-answer, and extended-response items, all mapped to Bloom’s taxonomy. We piloted the items with a separate Class IX sample and revised those with extreme difficulty indices or poor discrimination. The same test was administered as a pre-test, post-test, and during Week 18/Week 30 follow-ups, with a seven-week interval between the pre-test and post-test assessments. No feedback on the correct answers was provided between the administrations.

Content validity was ascertained through an expert review by three specialists in English education. The instrument underwent pilot testing with 30 ninth-grade students from a school in Malappuram that was not involved in the study. Items with difficulty indices below 0.20 or above 0.80 and discrimination indices below 0.30 were subsequently revised. The same instrument functioned as both the pre- and post-test, administered with a seven-week interval and without disclosing answers between administrations, in accordance with the standard parallel-measurement convention in educational research.

3.3.1 Student Attitude Scale

The 24-item Likert-type Attitude Scale comprised four subscales: attitude towards English literature, attitude towards the teaching method, attitude towards concept mapping (applicable only to COM students), and general academic motivation, along with three open-ended prompts. Participants rated items on a scale of 1 (strongly disagree) to 5 (strongly agree). Negative items were reverse-coded, and the subscale scores were aggregated. The maximum total score was 120 for COM

students (four subscales) and 90 for CON students (three subscales).

3.3.2 Teacher Attitude Scale (TAS)

The TAS is a 20-item Likert-scale instrument designed to evaluate four subscales: Cognitive, Affective, Behavioural, and Barriers, each comprising five items (with a maximum score of 25 per subscale and a total range of 20–100). Teachers completed the TAS both before and after the orientation, enabling the calculation of within-person gains for each subscale and the overall score.

3.3.3 Teacher Open-Ended Attitude Questionnaire

Educators also completed a 20-item open-ended questionnaire on their attitudes toward technology integration and concept mapping. The questionnaire encompassed perceptions, emotions, perceived benefits, barriers, suggestions, behavioural intentions, and future outlook. Responses were anonymised using identification codes (T01–T40) and linked to demographic data through a separate key.

3.4 Intervention

3.4.1 Concept mapping instruction (COM group)

Over seven weeks, with five 45-minute sessions each week, the COM lessons adhered to a structured five-step model: (1) focus question, (2) concept identification, (3) concept map construction, (4) presentation and discussion, and (5) reflection and consolidation. Students, either individually or in pairs, constructed maps centred on “Half a Day,” linking themes, life phases, characters, symbols, literary techniques, and authorial messages using labelled arrows. The selected maps were presented and critiqued, culminating in the collaborative construction of a class map.

3.4.2 Conventional instruction (CON group)

The control group (CON) received instruction through a conventional lecture-discussion-question format. This included a teacher introduction, teacher-led reading and explanation, notes on the blackboard, textbook exercises, and a verbal summary without visual organisers or student-constructed maps. Both groups received identical instructional time (5 periods $\times$ 45 minutes $\times$ 7 weeks; total = 26.25 hours) and used the same text, ensuring equal

exposure.

3.4.3 Teacher Orientation Programme

Before the student intervention, 20 teachers assigned to COM participated in a three-day residential workshop focused on concept mapping. This workshop integrated theoretical instruction (Novak and Gowin, 1984), demonstration lessons, practical mapping exercises, collaborative lesson planning, mock teaching, and training on fidelity checklists. Teachers who scored below 70% on a post-training competency assessment received additional coaching before implementing the COM lessons.

3.5 Procedure

The study was conducted over five phases spanning approximately eight months: Phase 0 (Weeks 1–2) involved research approval, permissions, pilot testing, and teacher orientation; Phase 1 (Week 3) consisted of student pre-tests (ELAT and attitudes); Phase 2 (Weeks 4–10) entailed the COM/CON instructional intervention; Phase 3 (Week 11) included student post-tests and the teacher TAS post-test; and Phase 4 (Weeks 18 and 30) comprised follow-up ELAT assessments at three and six months after the intervention. The researcher and a trained assistant administered all tests in classrooms using a standardised script. Weekly observations employing a fidelity checklist identified any lessons with implementation fidelity below 80% for exclusion from the analysis.

3.6 Data analysis

Data were analysed using SPSS 25 and R, with all tests two-tailed and a significance level of $\alpha = .05$. Descriptive statistics, including the means and standard deviations, were calculated for all variables and demographic indicators. We evaluated baseline equivalence using independent-samples t-tests on pre-test ELAT scores and by examining the distributions of age, gender, attendance, and location across the COM and CON groups.

- For RQ1, paired-samples t-tests were employed to evaluate pre-post ELAT gains within each group, while independent-samples t-tests were used to compare post-test ELAT scores between groups. We calculated Cohen's d for all comparisons to determine effect sizes. We conducted an Analysis of Covariance

(ANCOVA) with post-test ELAT as the dependent variable, pre-test ELAT as a covariate, and Method (COM vs CON), Location (rural vs urban), and the Method $\times$ Location interaction as fixed factors. This approach adjusted for baseline differences and reflected the quasi-experimental design. We analysed longitudinal retention at Week 18 and Week 30 using paired-samples t-tests (comparing post-test to follow-up within groups) and independent-samples t-tests (comparing COM to CON at each follow-up). Retention rates were calculated as the percentage of post-test gains that were maintained over time.

- For RQ2, a two-way ANOVA was conducted with Method and Location as factors to analyse the main effects and interactions on the post-test ELAT scores.
- For RQ3, composite post-test student attitude scores were calculated, incorporating the concept-mapping subscale specific to COM students. We then computed Pearson correlations between post-test ELAT scores and attitude totals for the full sample and separately for the COM and CON groups.
- For RQ4, paired-samples t-tests were conducted to evaluate pre-post changes in the TAS subscales and total scores, with within-person Cohen's d effect sizes calculated. We explored relationships between TAS gains and teacher demographics (location, gender, experience, age) descriptively and, where appropriate, through t-tests and correlations. We analysed teacher open-ended responses thematically using inductive coding to identify recurring themes related to perceived benefits, barriers, equity issues, and intentions for future use.

4. Results

4.1 Pre-Test Equivalence and Demographic Comparability

As shown in Table 1, the COM and CON groups were balanced on key demographic variables and pre-test achievement. Pre-test ELAT means did not differ significantly (COM: $M = 25.22$, $SD \approx 6.44$; CON: $M = 24.58$, $SD \approx 5.28$; $t(158) \approx 0.69$, $p \approx .49$, $d \approx 0.11$), indicating baseline equivalence in terms of achievement. Age and attendance were also similar across the groups, and the gender distributions differed only trivially.

Table 1. Student demographic profile by instructional method

Characteristic	COM (n = 80)	CON (n = 80)	Total (N = 160)
Age (years), M (SD)	13.98 (0.69)	13.98 (0.71)	13.98 (0.70)
Gender, n (%) – Female	48 (60.0)	45 (56.3)	93 (58.1)
Gender, n (%) – Male	32 (40.0)	35 (43.7)	67 (41.9)
Attendance %, M (SD)	89.68 (6.29)	90.04 (5.79)	89.86 (6.03)
Location – Rural, n	40	40	80
Location – Urban, n	40	40	80

4.2 Immediate Effects of Concept Mapping on Achievement and Attitudes

4.2.1 Student Achievement

Both groups exhibited statistically significant pre–post ELAT gains; however, the gains were substantially larger in the COM group (Table 2). COM students improved from $M = 25.22$ in the pre-test to $M = 37.35$ in the post-test (gain = 12.13; $t(79) \approx -29.91$, $p < .001$, $d \approx 3.34$), whereas CON students improved from $M = 24.58$ to $M = 31.43$ (gain = 6.85; $t(79) \approx -18.08$, $p < .001$, $d \approx 2.02$).

Table 2. ELAT descriptive statistics over time by instructional method

Time point	Group	n	Mean ELAT	SD
Pre-test	COM	80	25.22	6.44
	CON	80	24.58	5.28
Post-test	COM	80	37.35	6.65
	CON	80	31.43	6.16
Week 18	COM	80	36.50	6.56
	CON	80	30.02	5.95
Week 30	COM	80	35.84	6.48
	CON	80	29.25	5.78

At post-test, COM students significantly outperformed CON students ($M = 37.35$ vs 31.43 ; $t(158) \approx 5.84$, $p < .001$, $d \approx 0.92$), confirming a large between-group effect (Table 3; Figure 1). ANCOVA results demonstrated that the method remained a strong predictor of post-test ELAT after controlling for pre-test scores ($F(1,155) \approx 92.58$, $p < .001$), while Location and the Method $\times$ Location interaction were non-significant.

Table 3. Within- and between-group ELAT comparisons (pre–post)

Comparison	Group	n	Mean difference	t (df)	p	d
Pre $\rightarrow$ Post (within)	COM	80	+12.13	-29.91	< .001	3.34
Pre $\rightarrow$ Post (within)	CON	80	+6.85	-18.08	< .001	2.02
Post-test COM vs CON	COM–CON	160	+5.92	5.84	< .001	0.92

Positive mean differences reflect improvement; d = Cohen's d .

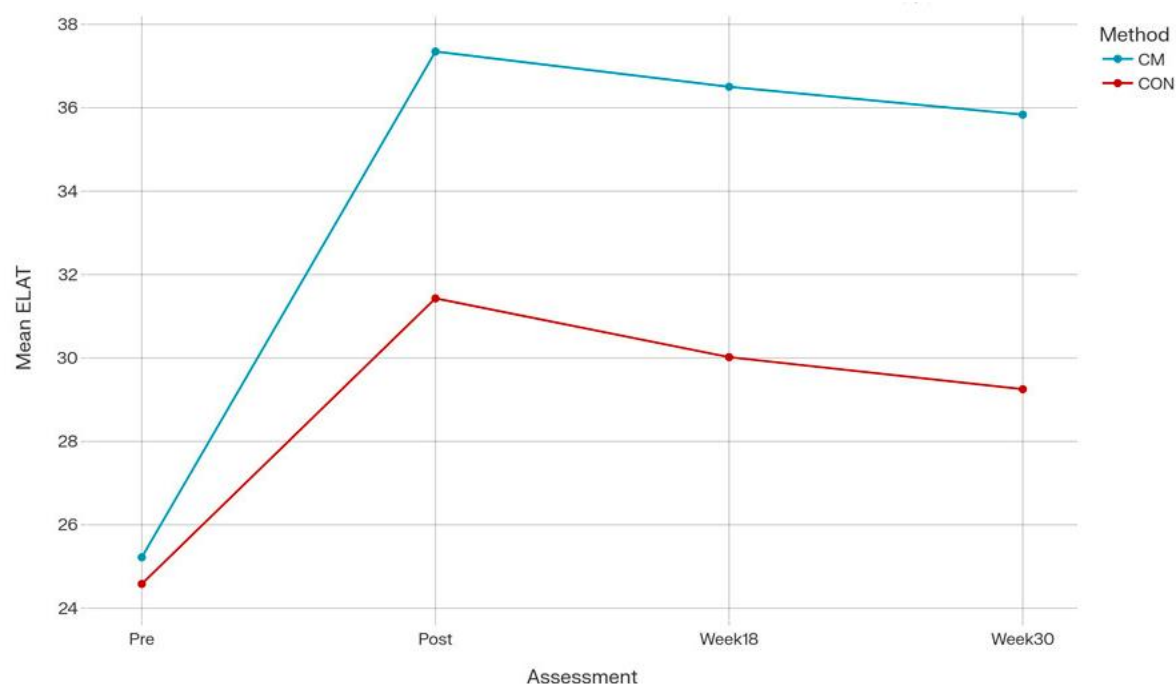


Figure 1. Post-test ELAT and follow-up scores by instructional method. A line graph with four time points (Pre-test, Post-test, Week 18, Week 30) on the x-axis and mean ELAT scores on the y-axis, with separate lines for COM and CON showing higher and more sustained performance for COM at all post-baseline time points.

4.3 Student Attitudes

Post-intervention attitude totals (including the concept-mapping subscale for COM students) were much higher in the COM group ($M \approx 86.99$, $SD \approx 8.57$) than in the CON group ($M \approx 56.91$, $SD \approx 8.08$; $t(158) \approx 22.84$, $p < .001$, $d \approx 3.61$; Table 4). These very large differences

suggest that COM promoted more positive attitudes towards English, the instructional method, and learning more broadly, although part of the magnitude reflects the additional COM-specific subscale available only to COM students.

Table 4. Post-test student attitudes by instructional method

Outcome	Group	n	Mean	SD	t (df)	p	d
Post-test attitude	COM	80	86.99	8.57	22.84	< .001	3.61
total*	CON	80	56.91	8.08			

*Total includes the concept-mapping subscale for COM students only.

4.4 Three- and six-month retention

At Week 18, COM students scored $M \approx 36.50$ ($SD \approx 6.56$) and CON students scored $M \approx 30.02$ ($SD \approx 5.95$); at Week 30, COM students scored $M \approx 35.84$ ($SD \approx 6.48$) and CON students scored $M \approx 29.25$ ($SD \approx 5.78$). Between-group differences remained statistically significant at both follow-ups, with large effect sizes ($d \approx 1.04$ and 1.07 , respectively; Table 2).

Within the COM group, ELAT scores declined modestly but significantly from post-test to Weeks 18 and 30 ($t(79) \approx 11.83$ and 19.13 , both $p < .001$; $d \approx 0.13$ and 0.23), indicating modest forgetting but substantial retention. The COM group preserved approximately 93.0% of post-test gains at Week 18 and 87.6% at Week 30, whereas the CON group retained only about 79.4% and 68.2% of their gains at the same time points.

4.5 Method $\times$ Location Effects

Two-way ANOVA on post-test ELAT showed a significant main effect of Method ($F(1,156) \approx 33.87$, $p < .001$), but neither the location main effect ($F(1,156) \approx 0.51$, $p \approx .48$), nor the method

$\times$ location interaction ($F(1,156) \approx 0.42$, $p \approx .52$) was significant (Table 5). The ANCOVA confirmed this pattern after adjusting for pre-test ELAT; the method remained highly significant, whereas location and the interaction remained nonsignificant (Table 6).

Table 5. Two-Way ANOVA of Method and Location Effects on Post-Test ELAT

Source	df	SS	F	p
Method (COM vs CON)	1	1401.26	33.87	< .001
Location (Rural vs Urban)	1	21.10	0.51	.48
Method $\times$ Location	1	17.49	0.42	.52
Error	156	6454.74		

Table 6. ANCOVA of Method and Location Effects on Post-Test ELAT Controlling for Pre-Test Scores

Source	df	SS	F	p
Pre-test ELAT (covariate)	1	4554.83	371.60	< .001
Method	1	1134.86	92.58	< .001
Location	1	0.00	0.00	.99
Method $\times$ Location	1	6.80	0.55	.46
Error	155	1899.91		

These results indicate COM's superiority over conventional instruction across rural and urban schools, supporting the interpretation that COM is a contextually robust strategy within this district.

4.6 Relationships between Achievement and Attitudes

The overall correlation between post-test ELAT and post-test attitude totals was moderate and statistically significant ($r \approx .36$, $p < .001$), suggesting that, across the entire sample, higher achievement co-occurred with more positive attitudes (Table 7). However, within the COM and CON groups, the correlations were small and nonsignificant (COM: $r \approx .06$, $p \approx .61$; CON: $r \approx -.10$, $p \approx .36$).

Table 7. Pearson correlations between post-test ELAT and attitudes

Group	n	r	p	Interpretation
Overall	160	0.36	< .001	Moderate positive, significant
COM only	80	0.06	.61	Negligible, non-significant
CON only	80	-0.10	.36	Negligible, non-significant

This discrepancy illustrates Simpson's paradox, in which the aggregate correlation largely reflects systematic between-group differences (COM vs CON) in both achievement and

attitude, rather than a consistent individual-level relationship within either group. Consequently, caution is warranted when interpreting attitudes as mediators of achievement gains without

sophisticated modelling and improved psychometrics.

4.7 Teacher Attitudes towards Concept Mapping

4.7.1 TAS Quantitative Results

The TAS results showed large, statistically significant pre–post improvements across all subscales and in the total score (Tables 8 and 9; Figure 2). The mean total TAS increased from 64.40 (SD $\approx$ 2.42) to 76.08 (SD $\approx$ 3.38), a gain of 11.68 points; the corresponding paired-samples t-test yielded $t(39) \approx -23.45$, $p < .001$, $d \approx 3.71$.

Table 8. TAS descriptive statistics (pre- and post-training)

Subscale	Time	n	Mean	SD
Cognitive	Pre	40	15.93	1.44
	Post	40	18.75	1.94
Affective	Pre	40	16.18	1.60
	Post	40	19.35	1.69
Behavioural	Pre	40	16.25	1.45
	Post	40	19.20	1.65
Barriers	Pre	40	16.05	1.54
	Post	40	18.78	1.94
Total	Pre	40	64.40	2.42
	Post	40	76.08	3.38

Table 9. TAS pre–post comparisons and effect sizes

Outcome	Mean gain	t (df = 39)	p	d
Cognitive	2.83	-11.78	< .001	1.86
Affective	3.17	-11.01	< .001	1.74
Behavioural	2.95	-15.06	< .001	2.38
Barriers	2.73	-11.89	< .001	1.88
Total	11.68	-23.45	< .001	3.71

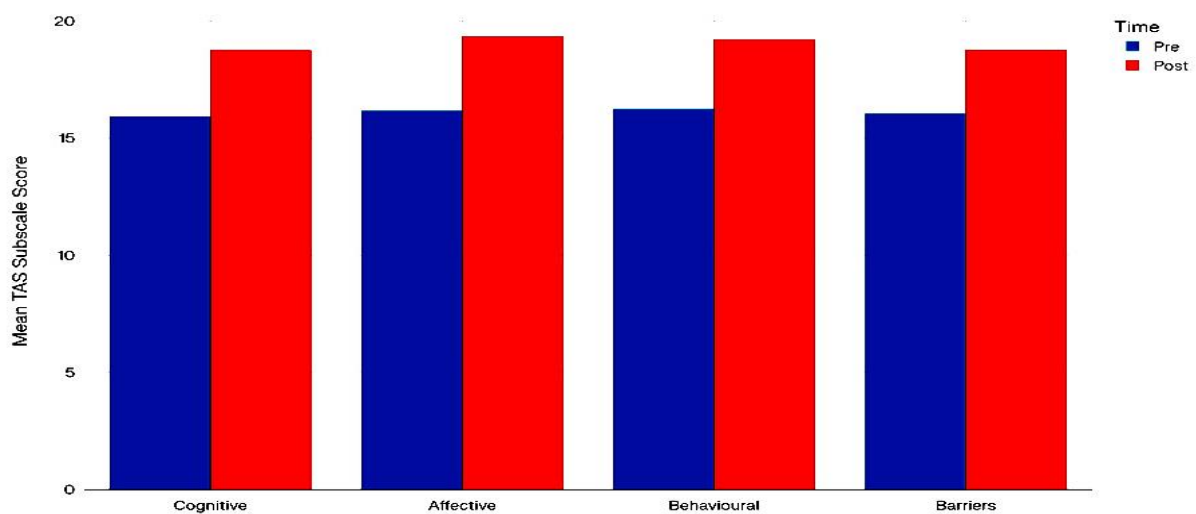


Figure 2. Teacher Attitude Scale subscale scores before and after concept mapping. A clustered bar chart

showing the mean pre- and post-training TAS scores for the cognitive, affective, behavioural, and barriers subscales, illustrating large gains across all four dimensions.

Subscale gains were similarly substantial, cognitive (gain ≈ 2.83 ; $t(39) \approx -11.78$, $p < .001$, $d \approx 1.86$), affective (gain ≈ 3.17 ; $t(39) \approx -11.01$, $p < .001$, $d \approx 1.74$), behavioural (gain ≈ 2.95 ; $t(39) \approx -15.06$, $p < .001$, $d \approx 2.38$), and barriers (gain ≈ 2.73 ; $t(39) \approx -11.89$, $p < .001$, $d \approx 1.88$).

Exploratory analyses of the TAS gain scores by location, age, and teaching experience revealed no systematic differences. A small gender effect favouring male teachers was observed but should be interpreted cautiously, given the sample size and absence of prior hypotheses.

4.7.2 Qualitative Themes

Thematic analysis of open-ended responses generated four major themes: (1) perceived pedagogical benefits (enhanced engagement, clearer explanation of complex concepts, support for higher-order thinking); (2) structural and infrastructural barriers (unreliable internet, inadequate hardware, limited preparation time, and inconsistent institutional support); (3) equity and ethical concerns (digital divides, data privacy, cyberbullying, and academic integrity in technology-mediated tasks); and (4) professional growth and future intentions (increased confidence, desire for further training, and intentions to integrate COM more systematically). These themes complement the quantitative TAS findings by highlighting both enthusiasm for COM and the systemic conditions required for sustainable adoption.

5. Discussion

5.1 Main findings

The study provides convergent evidence that concept mapping, implemented through a structured five-step model, substantially improves secondary students' English achievement relative to conventional instruction and that these gains are largely retained over a six-month period. COM also fostered markedly more positive student attitudes and produced large improvements in teachers' cognitive, affective, and behavioural orientations toward COM while reducing perceived barriers.

Critically, school location did not moderate COM's advantages, suggesting the method is robust across rural and urban government

schools operating under similar curricular conditions. The finding that the overall achievement-attitude correlation is primarily compositional underscores the importance of separating between-group from within-group effects when interpreting attitudinal data.

5.2 Concept Mapping as a Catalyst for Meaningful Learning

COM's superior immediate and long-term achievement outcomes align with theoretical accounts that emphasise meaningful learning, schema construction, and deep processing. By requiring students to externalise relationships among characters, events, themes, symbols, and narrative techniques in "Half a Day," COM likely encouraged integrative understanding and facilitated transfer beyond rote recall.

From a cognitive load perspective, visual mapping may reduce the burden of tracking multiple textual elements simultaneously in L2 contexts, allowing learners to allocate more resources to inference, evaluation, and critical interpretation. The collaborative phases of COM lessons, presentation, critique, and co-construction of class maps further leverage peer scaffolding and discursive negotiation, consistent with the sociocultural views of learning.

5.3 Rural-Urban Equity and System-Level Considerations

The absence of method $\times$ location interactions indicates that COM is effective in both rural and urban contexts, an important finding given documented disparities in English achievement linked to resource and exposure gaps. Because COM can be implemented with basic materials (paper, board, markers) and does not require sophisticated technology, it is particularly appealing to government schools with constrained infrastructure.

At the same time, teacher narratives highlight that when COM is coupled with technology (e.g., digital mapping tools, online resources), infrastructure inequities and connectivity issues can become salient barriers. Policy-level efforts to promote COM should therefore be coupled with targeted investments in infrastructure, professional development, and support

structures, with particular attention to rural schools and students with limited access to devices and home connectivity.

5.4 Teacher Development and Sustainable Innovation

The large TAS gains and rich qualitative accounts attest to the impact of a relatively brief, practice-oriented orientation programme on teachers' readiness to adopt COM. The combination of theory, modelling, hands-on practice, collaborative planning, and fidelity monitoring appears to have given teachers both conceptual understanding and practical tools for classroom implementation.

However, sustained adoption will depend on ongoing institutional support, time for collaborative planning, integrating COM into schemes of work and assessments, and alignment with accountability structures. Without such systemic reinforcement, teachers may revert to familiar lecture-based methods, especially under high-stakes examination pressure.

6. Implications

6.1 Classroom Practice

English teachers can use COM to help students grapple with complex literary texts by scaffolding concept identification, encouraging multiple map drafts, and using map comparisons to stimulate discussion of interpretation and evidence. Teachers may begin with teacher-constructed maps, progress to guided co-construction, and ultimately encourage independent or small-group mapping, with explicit attention to clear, concise linking phrases and map organisation.

6.2 Teacher Education and Professional Development

Pre-service and in-service programmes should include COM as part of broader training in learner-centred pedagogy, visual tools, and assessment for learning, giving teachers time to develop and trial COM-based lessons aligned with their syllabus. Addressing perceived barriers, time, assessment alignment, and infrastructural constraints within training can increase the likelihood that positive attitudes will translate into sustainable practice.

6.3 Policy and System-Level Implications

The evidence supports integrating COM into SCERT guidelines, teacher handbooks, and curricular support materials for secondary English, including textbook tasks that prompt mapping, and rubrics for evaluating maps. System-level support might include exemplar lesson plans, low-bandwidth or offline digital mapping tools adapted to local infrastructure, and targeted resource allocation to rural schools.

7. Limitations and Directions for Future Research

Although the quasi-experimental design was strengthened by stratification, baseline checks, and ANCOVA, it cannot fully eliminate selection biases; replication with random assignment of intact classes or additional sites would further reinforce causal claims. The focus on a single text and district limits generalizability; future studies should examine COM across genres, grades, and regions.

Psychometric analyses indicated that the Student Attitude Scale's subscales behaved more as independent dimensions than as indicators of a single latent construct, and Cronbach's alpha values were low or unstable, suggesting the need for instrument refinement and factor-analytic validation in larger samples. Future work should also explore the differential effects of individual versus collaborative mapping, digital versus paper-based mapping, and more complex mediation models that examine how motivational and contextual factors shape COM outcomes.

Teacher samples were limited to English teachers in government schools; comparative studies involving other subjects, private schools, and cross-regional samples would deepen the understanding of the contextual moderators of COM adoption.

8. Conclusion

This stratified, multi-site, quasi-experimental study demonstrates that concept mapping is a powerful, contextually adaptable strategy for improving English language achievement and long-term retention among secondary students in Keralam, while also enhancing students' attitudes and teachers' readiness to adopt learner-centred pedagogy. The benefits of COM were robust across rural and urban schools and persisted for over six months, positioning it as a promising component of evidence-informed reforms to improve the quality and equity of

English language education in government secondary schools.

By making learners' thinking visible, negotiable, and revisable, COM offers a practical pathway from surface-level recall to a deeper, more durable understanding of complex literary texts, provided system-level supports for teachers and infrastructure are in place.

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Ethics Statement

The study involving human participants was conducted in accordance with the ethical principles of research involving human subjects. We obtained all necessary ethical approvals before the study began.

Conflict of Interest

The authors declare no competing interests or conflicts of interest related to this work.

Author Approval

All authors have read and approved the final version of the manuscript and agree to its submission for publication.

Informed Consent

We obtained written informed consent from all participants included in this study.

Data Availability

The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

References

- Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. Holt, Rinehart & Winston.
- Bahr, G. S., & Dansereau, D. F. (2001). Bilingual knowledge maps (BiK-Maps) in second-language vocabulary learning. *The Journal of Experimental Education*, 70(1), 5–24. doi:10.1080/00220970109599496
- Bremner, N., Sakata, N., & Cameron, L. (2022). The outcomes of learner-centred pedagogy: A systematic review. *International Journal of Educational Development*, 94, 102649. doi:10.1016/j.ijedudev.2022.102649
- Bryce, T. G. K., & Blown, E. J. (2023). Ausubel's meaningful learning revisited. *Current Psychology*. Advance online publication. doi:10.1007/s12144-023-04440-4
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Rand McNally.
- Chen, M.-R. A., & Hwang, G.-J. (2020). Effects of a concept mapping-based flipped learning approach on EFL students' English speaking performance, critical thinking awareness and speaking anxiety. *British Journal of Educational Technology*, 51(3), 817–834. doi:10.1111/bjet.12887
- Collins, A. M., & Quillian, M. R. (1969). Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, 8(2), 240–247. doi:10.1016/S0022-5371(69)80069-1

- Dolmans, D. H. J. M., Loyens, S. M. M., Marcq, H., & Gijbels, D. (2016). Deep and surface learning in problem-based learning: A review of the literature. *Advances in Health Sciences Education*, 21(5), 1087–1112. doi:10.1007/s10459-015-9645-6
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191. doi:10.3758/BF03193146
- Feng, R., Alsager, H. N., Azizi, Z., & Sarabani, L. (2023). Impact of mind-mapping technique on EFL learners' vocabulary recall and retention, learning motivation, and willingness to communicate. *Heliyon*, 9(6), e16560. doi:10.1016/j.heliyon.2023.e16560
- Goodnough, K., & Woods, R. (2002, April). *Student and teacher perceptions of mind mapping: A middle school case study* [Paper presentation]. American Educational Research Association Annual Meeting, New Orleans, LA. Retrieved from <https://eric.ed.gov/?id=ED470970>
- Han, X. (2025). Effects of concept mapping on L2 learning: A meta-analysis of studies from 2006 to 2024. *Asian-Pacific Journal of Second and Foreign Language Education*, 10, 26. doi:10.1186/s40862-025-00331-2
- Hazaymeh, W. A., & Alomery, M. K. (2022). The effectiveness of visual mind mapping strategy for improving English language learners' critical thinking skills and reading ability. *European Journal of Educational Research*, 11(1), 141–150. doi:10.12973/eu-jer.11.1.141
- Kassem, H. M. (2017). The effectiveness of a blended strategy based on concept mapping and text structure in enhancing EFL learners' writing performance. *Journal of Studies in Education*, 7(2), 184–212. doi:10.5296/jse.v7i2.11259
- Manzon, R. P. (2021). The impact of concept mapping as a teaching strategy on students' achievement and interest in English. *EPRA International Journal of Research and Development*, 6(8), 227–232. doi:10.36713/epra8348
- Nesbit, J. C., & Adesope, O. O. (2006). Learning with concept and knowledge maps: A meta-analysis. *Review of Educational Research*, 76(3), 413–448. doi:10.3102/00346543076003413
- Novak, J. D. (2010). Learning, creating, and using knowledge: Concept maps as facilitative tools in schools and corporations. *Journal of E-Learning and Knowledge Society*, 6(3), 21–30.
- Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. Cambridge University Press.
- Rasheed, A. P. (2014). Integrating digital tools in English language teaching: A study on challenges and prospects from Malappuram, Kerala. *International Journal of Applied Research*, 1(1), 693–696.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Scaria, S. (2009). *Looking beyond literacy: Disparities in levels of and access to education in a Kerala village* (Working Paper No. 190). Gujarat Institute of Development Research.
- Sharma, J., & Sharma, R. (2025). Effectiveness of concept mapping on students' academic achievement in biology at the secondary school level. *International Journal of Research - GRANTHAALAYAH*, 13(3), 437–444. doi:10.29121/granthaalayah.v13.i3.2025.6035
- Singh, A., & Rahman, M. S. (2023). Effect of concept mapping approach on scientific attitude and achievement in science among students with learning disability. *School Science*, 61(4), 45–58.
- Su, F., & Zou, D. (2024). A comparative review of technology-assisted and non-technology concept mapping-based language learning. *International Journal of Educational Research Open*, 6, 100319. doi:10.1016/j.ijedro.2024.100319
- Sunday, O. J., Adesope, O. O., Shenghai, D., & Carbonneau, K. (2025). The effects of concept mapping experience, feedback timing, and motivation on students' learning outcomes. *Learning and Motivation*, 92, 102201. doi:10.1016/j.lmot.2025.102201

- Sundararajan, N., Adesope, O., & Cavagnetto, A. (2018). The process of collaborative concept mapping in kindergarten and the effect on critical thinking skills. *Journal of STEM Education: Innovations and Research*, 19(1).
- Ta, N., & Razali, A. B. (2023). Concept mapping for improving reading comprehension in second language education: A systematic review. *International Journal of Learning, Teaching and Educational Research*, 22(8), 287–300. doi:10.26803/ijlter.22.8.16
- Uygun, E., & Demir, B. (2026). A PRISMA-based systematic review of artificial intelligence in English as a foreign and second language education (2023–2025). *Discover Education*. 5, 478. doi:10.1007/s44217-026-01504-y
- Vakkom Moulavi Foundation Trust. (2024). *Separate and unequal?: VMFT report highlights Kerala's education inequality and calls for reforms*. Retrieved from <https://vmft.org/ereports/separate-and-unequal-vmft-report-highlights-keralas-education-inequality-and-calls-for-reforms/>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.
- Wong, R. M., Sundararajan, N., Adesope, O. O., & Nishida, K. R. A. (2021). Static and interactive concept maps for chemistry learning. *Educational Psychology*, 41(2), 206–223. doi:10.1080/01443410.2020.1761299