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Integrating 5E Model with Planned-Incidental Grammar Teaching Approach to enhance grammar competency of eighth-grade Odia medium school students, in a time-sensitive manner

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Abstract

Prompted by the challenges faced by teachers in balancing grammar and content in English classes, coupled with the poor English proficiency of rural Odia medium school students, the study aimed to devise an intervention that could balance content and grammar, thereby enhancing the grammar competency and content comprehension of eighth-grade students. Based on quasi-experimental research with a pretest-posttest nonequivalent group design, two groups were assigned treatment conditions: the 5E Model with Planned-Incidental Grammar Teaching Approach (experimental group) and the traditional Grammar Translation Method (control group) during class instructions. Data were collected from 100 school students, with 52 in the experimental group and 48 in the control group, using pretest and posttest assessments. The mixed ANOVA test results revealed significantly higher posttest scores in the experimental group compared to the control group, highlighting the positive impact of the intervention on students' grammar proficiency. The *t*-test for the comprehension test suggested comparable levels of comprehension in both groups, indicating the efficiency of the new pedagogical strategy in seamlessly integrating grammar instruction into regular classroom teaching, optimizing instructional time and ensuring balance between content and grammar, making it particularly valuable for educators facing time constraints. This study underscores the need for professional development opportunities to enhance teachers' pedagogical skills and knowledge. Further research is warranted to explore the intervention's impact on various language skills and assess its applicability in diverse contexts, contributing to a broader understanding of its implications.

Keywords: 5E Model, Eighth-grade students, Odia medium school students, Planned-incidental grammar teaching approach

Introduction

Status of english in vernacular government schools in Odisha

The significance of English language education cannot be overstated, as it is widely recognized as the dominant universal language in both academia and professional communication (Salomone, 2022). Despite India having a substantial English-speaking population, estimated between 50 to 125 million individuals, making it the second-largest English-speaking group globally (Mukherjee & Bernaisch, 2020), the quality of English education and English teaching in many parts of the country remains subpar. This deficiency in English education becomes particularly evident due to a notable correlation between geographical location, social class, caste, and religion, and the accessibility of quality English education and exposure (Borooah, 2012; Desai & Kulkarni, 2008). The education quality in vernacular government schools, barring a few schools in a few states, is also believed to be inferior to that of private schools across the country (Kingdon, 2020). The poor quality of education in vernacular government schools is not only reflected in English language teaching but also in general when compared to private schools (Kingdon, 2020; Ohara, 2012). In the context of Odisha, a similar picture exists that is further verified by Pratham's Annual Status of Education Report of 2022 (ASER Centre, 2022). The report suggests that only 22.9% of class V vernacular government school students could read English sentences, as opposed to 68% of class V private school students. Furthermore, only 46.9% of class VIII vernacular government school students could read English sentences, a mere jump from 44.3% in 2016. Another study by Mohanty (2017) suggests that students graduating from vernacular government schools encounter difficulties in comprehending technical terminology and concepts used in various science subjects, because of the lack of good English skills.

There are multiple factors contributing to the inadequate proficiency in the English language among vernacular government school students in Odisha. First is the delayed introduction of English language and grammar at school. English as a formal subject is introduced in class III, where students learn the alphabet and number system. As students graduate to higher classes, they are gradually introduced to English poems and stories. However, the formal rules of English grammar are typically introduced at a later stage, specifically in class IX, when students are provided with their first grammar textbook. Second is the lack of/limited English proficiency among teachers. Studies suggest that most secondary school teachers lack specialization in English and do not have the necessary training and expertise to teach the language effectively (Arul Kumar, 2012; Padwad, 2017; Tickoo, 2004). As most teachers have graduated from educational systems with deficient pedagogical approaches/deficient training, they struggle to teach English grammar, pronunciation, and vocabulary effectively, which adversely affects students' learning outcomes. It is a common practice in several vernacular government schools in Odisha to assign the task of teaching English to a teacher with a Bachelor of Education (B.Ed.) degree, regardless of their specialization at graduation/post-graduation level and proficiency in the language. Third is the adoption of the age-old Grammar Translation Method (GTM) by most English language teachers (Nayak, 2019). In Odia medium schools (essentially vernacular government schools where the vernacular language or Odia is the medium of instruction), all curricular activities, including classroom teaching and examinations, are conducted only in Odia, making it the sole

language used for instruction (Pattanaik, 2020). Moreover, teachers have been found to use Odia to teach English, which hinders students' ability to learn English effectively (Nayak, 2019). English teachers emphasize comprehension of the content of English textbooks. They resort to using Odia to explain the meaning of English texts, rather than focusing on developing the students' language skills. Over the years, this approach has impeded students' language development since they have limited exposure to the English language, leading to difficulties in achieving English language proficiency. While the curriculum devised by the Board of Secondary Education (BSE), Odisha, aims to emphasize all four skills, with a particular focus on communication skills to "enable the learner to avail himself of new opportunities in the national and international sphere" (Board of Secondary Education, Odisha (BSE), 2013; Nayak, 2019), the aspect of communication is overlooked in classroom instruction. The teaching-learning process becomes mechanical in the classroom setting, with teachers prioritizing the completion of the course over understanding the students' achievement levels (Nayak, 2019). Fourth is the quality of the English textbooks. Although the textbook series for class III-X, designed by the Department of School and Mass Education, emphasizes listening, speaking, reading, and writing skills, the effectiveness of the teaching materials used is yet to be unequivocally proven. The materials employed in government schools are often insufficient and occasionally fall short of the required standard. The purportedly functional communicative approach associated with the 'Learning English' series of textbooks has not demonstrated a notable improvement among students (Nayak, 2019). Finally, just like any other state in India, teachers in Odisha often have administrative, extracurricular and other government duties (election, surveys, disaster management etc.) that interfere in the effective teaching-learning process (Singhal & Vernekar, 2018). Moreover, there are a lot of holidays and vacations. As a result, teachers do not get enough time to cover the entire syllabus and allocate revision classes, leading teachers to prioritize comprehension of chapters, which leads to gaps in students' language knowledge and skills.

Given the challenges faced by teachers of vernacular government schools in Odisha, as outlined earlier, the authors collaborated to devise a practical solution. Changing government policies related to the English language, curriculum, syllabus, textbooks, teacher appointment, and teacher engagement is a long term and difficult process. However, what is possible is the formulation of a pedagogical approach aimed at effectively teaching English textbook lessons along with grammar within a restricted timeframe and a challenging context. Thus, the authors endeavored to develop a method that would strike a balance between textbook content and language within the specified timeframe.

In a language classroom, focusing on textbook content is essential for providing context, fostering motivation (Fowler, 2022), developing critical thinking and communication skills (Macianskiene, 2016), enhancing cultural awareness (Hossain, 2024; Mearns & Platteel, 2021), expanding vocabulary (Wang, 2023), and integrating language skills, as people learn another language more successfully when they acquire information through it (Richards & Rodgers, 2001). It also ensures students are adequately prepared for examinations, which are based on textbook content, and syllabus completion, which is a priority for many teachers. Similarly, proper grammar knowledge is also important as it, (i) supports reading, writing and speaking skills, (ii) facilitates clear expression of ideas and critical thinking, (iii) develops investigative skills, and (iv) develops a critical

assessment of the manners in which language is utilized in one's daily setting (Hudson & Walmsley, 2005). Additionally, good grammar is required for academic writing and is essential for success in higher education (Bachore, 2022; Bo et al., 2023). Besides, in situations where teachers lack good language skill, especially speaking, they can still effectively teach proper grammar by utilizing appropriate instructional models and referring to quality books.

Balancing content and language

Balancing content and language within the formal education setting has garnered considerable research attention globally. Research on integrating language and content has given rise to two prominent approaches: Content-Based Instruction (CBI) and Content and Language Integrated Learning (CLIL) (Banegas, 2012; Dalton-Puffer & Smit, 2007). CBI is defined as 'an approach to second language teaching in which teaching is organized around the content or information that students will acquire, rather than around a linguistic or other type of syllabus' (Richards & Rodgers, 2001). It is an approach in which language proficiency is achieved by focusing on learning curricular subject-matter through the language to be learnt. (Stryker & Leaver, 1997). The roots of CBI trace back to the Canadian immersion programs in the 1960s, particularly in the context of French immersion projects (Banegas, 2012; Ramos, 2009). Canada's implementation of French immersion throughout schooling aimed to enable English-speaking learners to acquire French by studying various subjects in the French language (Banegas, 2012). The popularity of CBI in countries like Canada and the USA is attributed to the changing demographics of second language student populations due to an influx of non-English-speaking migrants (Dalton-Puffer, 2007). CLIL on the other hand is defined as '... a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language' (Coyle et al., 2010). The term CLIL emerged in Europe in the 1990s and primarily involves teaching content through the medium of English (Dalton-Puffer et al., 2010). It is essential to note that CLIL is not exclusive to English but refers to 'an additional' language other than the first language, including foreign, second or minority languages (Cenoz, 2015). Although CBI and CLIL were developed in different geographical contexts and time periods, they are often referred to as umbrella terms describing approaches to integrating language and content instruction. (Ó Ceallaigh et al., 2017). Despite their distinct origins and intentions, both CBI and CLIL programmes share the same essential properties and are not pedagogically different from each other (Cenoz, 2015). Research on both CBI and CLIL has consistently demonstrated positive outcomes including enhanced language learning, development and usage of language, improved acquisition of subject matter content, and cognitive flexibility (Cammarata & Tedick, 2012; Ceallaigh et al., 2017; Vanichvasin, 2019).

Notwithstanding the benefits of CBI/CLIL, both approaches face a myriad of challenges that impede their seamless implementation. First, these approaches, influenced by social, cultural, political, educational, and contextual factors, result in varied implementations (Ceallaigh et al., 2017; Cenoz, 2015). Cenoz et al. (2014) caution against the assumption that research findings, policy statements, or pedagogical practices that are applicable to one variety would be appropriate for all renditions. What proves effective in one context may not be as fruitful in another, leading to an

insufficient understanding of the approaches' nuances and the absence of consistent practices in their implementation (Ó Ceallaigh et al., 2017). Moreover, the social, cultural, political, educational, and contextual diversities contribute to the complex task of developing tailored approaches for specific CBI/CLIL contexts. Second, balancing content and language in CBI/CLIL classrooms remains a persistent challenge (Cammarata & Tedick, 2012; Ceallaigh et al., 2017; Villabona & Cenoz, 2022; Walenta, 2018). When it comes to pedagogical models/approaches, CBI/CLIL 'offer multiple models and approaches which could be seen as a continuum which goes from a focus on foreign or second language learning, at one end, to a greater interest in curricular instruction through an L2, at the other end' (Banegas, 2012). This results in some classrooms prioritizing content at the expense of language development, while others overly focusing on language, neglecting the depth of content comprehension (Villabona & Cenoz, 2022). The elusive quest for an optimal equilibrium between linguistic and content gains is evident as learners often demonstrate disparities in productive grammar skills compared to their content knowledge, lexical repertoire, and receptive skills (Dalton-Puffer, 2007; Lyster, 2007; Walenta, 2018). While their receptive skills become almost native-like (Swain, 1985), learners are underdeveloped in areas of grammatical accuracy, lexical specificity and variety, complexity, and sociolinguistically appropriate language (Cammarata & Tedick, 2012; Walenta, 2018). Furthermore, the integration of contextualized content, cognition, communication, and culture, adds layers of complexity, underscoring the intricate task of balancing content and language instruction (Coyle, 2002). Third, an additional challenge arises as educators grapple with identifying the precise language required to capture students' attention during content instruction. Despite their heightened awareness of the critical connection between language and content, they face difficulties in identifying which language aspects to focus on, determining how and when to integrate language within content instruction, and deciding on effective follow-up strategies in assessment (Cammarata & Tedick, 2012). Fourth, external challenges further compound the complexities. These external hurdles encompass a shortage of planning and instructional time, limited resources, expectations for comprehensive content coverage, and a conspicuous lack of accountability for language acquisition (Cammarata & Tedick, 2012). These external factors highlight the multifaceted nature of the obstacles faced by educators in their endeavor to integrate content and language seamlessly within educational frameworks. All these challenges hinder the development of a systematic and coherent pedagogy aimed at seamlessly integrating language with content instruction, ultimately impeding the goal of maximizing language learning while maintaining high levels of academic achievement (Ó Ceallaigh et al., 2017; Walenta, 2018).

Thus, considering the challenges related to teaching English in vernacular government schools in Odisha, and problems associated with integrating content and language, the present study proposes and tests a new pedagogical/instructional approach to efficiently teach eighth-grade Odia medium school students English textbook lessons along with grammar, within the allocated time frame, without causing any delays. This study specifically aims to examine the effectiveness of the proposed intervention in enhancing the comprehension of English textbook lessons and improving grammar competency among eighth-grade students.

Theoretical framework

5E instructional model

Developed by the Biological Sciences Curriculum Study in 1987, the 5E instructional model incorporates elements of previous educational models, such as the Atkin and Karplus Learning Cycle or the Science Curriculum Improvement Study Learning Cycle, and shares similar stages in the instructional process (Bybee, 2015; Bybee et al., 2006). Based on the constructivist theory of learning, the model has five stages: Engagement/Engage, Exploration/Explore, Explanation/Explain, Elaboration/Elaborate, and Evaluation/Evaluate. During the Engagement/Engage stage, students' interest is piqued, and connections are made between their pre-existing knowledge base and the new ideas that will be presented in the lesson or unit. The Exploration/Explore stage involves presenting the content and helping learners to be aware of/investigate concepts, processes/procedures, facts, and/or principles. The Explanation/Explain stage is focused on improving students' understanding of the concepts, processes/procedures, facts, and/or principles through explanations that guide them towards a deeper understanding. The Elaboration/Elaborate stage involves constructing new learning by helping students apply new learning. Finally, the Evaluation/Evaluate stage assesses students' learning to ensure that they have achieved the desired learning outcomes.

Numerous research studies have presented compelling evidence suggesting that the 5E instructional model results in improved comprehension of scientific concepts and models, a sustained reduction in the prevalence of incorrect beliefs, enhanced academic performance in science, increased student enthusiasm, motivation, and confidence in science subjects and scientific careers, positive attitudes toward science subjects, and improvements in their scientific knowledge and perceptions (Grau et al., 2021; Ruiz-Martín & Bybee, 2022; Şahin & Baturay, 2016; Tegegne & Kelkay, 2023). In addition to enhancing comprehension and understanding of scientific concepts and models, in other words content, the 5E instructional model has also been found to result in significant improvement in students' grammar (Jendeya, 2015; Naguib, 2019; Yonan et al., 2022), in other words language. This dual efficacy of the 5E model served as a foundation for the intervention for this study. Also, the limited adoption of the 5E model in English language teaching (ELT) (Jeter et al., 2019; Naguib, 2019; Vafaeikia et al., 2023) necessitated further exploration.

Methods of teaching grammar

While there is a common opinion on what grammar is and its definition, the nature of its instruction and teaching is multifold (Schurz & Coumel, 2023). The teaching of grammar in ELT has been a topic of great controversy and debate over the years (Ellis, 2006; Ur, 2011), with varying opinions on whether grammar should be taught, what grammar should be taught, and how and when it should be taught (Ellis, 2006). Unfortunately, despite extensive research on these questions, there is no definitive solution (Ellis, 2006), which leaves teachers with the responsibility of developing their own teaching methods. Although there is a common ground in ELT, actual grammar teaching practices are likely to vary widely across teachers, school types, educational levels, and countries. These teaching practices/methods, as articulated by Schurz and Coumel (2023), can be categorized as (i) focus on meaning,

form and forms, (ii) implicit vs. explicit, and (iii) inductive vs. deductive instruction. While focus on meaning aims at using grammar in meaningful contexts without awareness of form, focus on forms aims at teaching grammar rules/features explicitly. Whereas, focus on form combines meaningful input with grammar forms/rules/features. Implicit instruction on the other hand involves learning grammar through exposure to language without being aware of the process, while explicit instruction involves teaching grammar rules directly involving rule-based explanation. Inductive instruction involves discovering grammar rules through examples, while deductive instruction involves teaching grammar rules first and then applying them to examples. However, it is important to note that these categories are not always mutually exclusive and overlap in certain aspects. Overlapping in grammar teaching arises from the interplay between incidental and planned approaches to instruction. For example, focus on meaning, focus on form, and implicit instructions can be incidental, whereas the others are planned. Incidental approaches involve learners “picking up” a grammatical feature while their primary focus is on some other aspect of language—either message, content or any other feature of language that is taught directly (Shintani, 2015). In contrast, planned approaches involve teachers employing systematic steps to explicitly teach grammatical features and rules. Regardless of the approach adopted for English language teaching, the effectiveness of different approaches in foreign language teaching also remains a controversial matter (Graus & Coppen, 2016). Therefore, a ‘planned-incidental’ approach within the intervention was opted to capitalize on the advantages inherent in both the approaches.

The intervention

The intervention proposed in this study integrates the 5E Model with ‘planned-incidental’ grammar teaching approach to efficiently teach eighth-grade Odia medium school students English textbook lessons along with grammar, within the allocated time frame, without causing any delays. This strategic amalgamation not only addresses the challenges related to systematic and coherent pedagogy concerning the integration of language with content instruction to maximize language learning but also serves as a blueprint for teachers who face constraints in planning and instructional time. Moreover, the intervention caters to the needs of teachers who encounter difficulty in identifying what language to focus on, and figuring out how and when to integrate that language in the context of content instruction. By aligning with the proposed approach, these teachers can benefit from a more structured and effective method, enhancing their instructional capabilities and providing a more conducive learning environment for the students. The incorporation of the 5E Model and ‘planned-incidental’ grammar teaching approach offers a comprehensive solution to the multifaceted challenges faced by both teachers and students in the specified educational context. The intervention has three phases (Fig. 1), (i) the pre-instructional/preparatory phase, (ii) the instructional phase, and (iii) the post-instructional phase.

Pre-instructional/preparatory phase

The pre-instructional/preparatory phase constitutes a crucial stage for teachers, serving as the foundation for the subsequent intervention. In this initial phase, teachers engage in the following key activities:

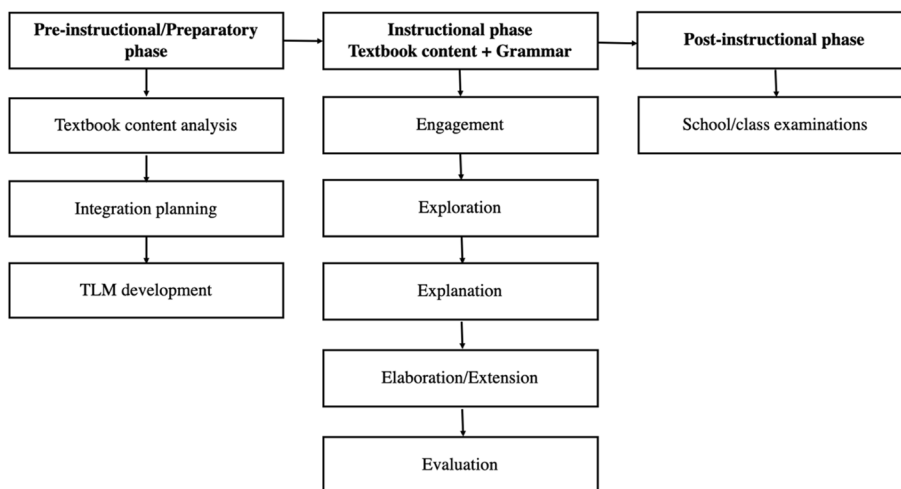


Fig. 1 Phases of intervention

- a. **Textbook Analysis:** Teachers meticulously read and analyze the textbook chapters and exercises, aiming to discern the grammar structures and elements embedded within the content/textbook lessons and exercises. This critical step involves the identification of ‘what’ (grammar structures based on students’ proficiency and academic needs) needs to be imparted concerning the textbook lessons. By delving into the intricacies of the content, educators lay the groundwork for a targeted and effective grammar integration strategy.
- b. **Integration Planning:** Within this phase, teachers strategize and plan the seamless integration of grammar lessons into the framework of the textbook lessons. Addressing the ‘how’ and ‘when’ of grammar instruction, this strategic planning involves the meticulous development of lesson plans. Educators outline the grammar rules and examples to be elucidated in conjunction with the corresponding textbook lessons. This thoughtful planning ensures a cohesive and synchronized delivery of content, optimizing the integration of grammar into the overall instructional approach.
- c. **Teaching Learning Materials (TLM) Development:** Recognizing the significance of supportive resources, teachers, during the pre-instructional phase, dedicate efforts to develop TLMs. These materials serve as valuable aids in facilitating textbook lessons and grammar learning. Through the creation of targeted resources, such as worksheets, substitution tables, visual aids, and supplementary materials, teachers enhance the comprehensibility and engagement levels of grammar instruction, fostering a more effective learning experience for students.

Instructional phase

Once everything is planned, the lessons are delivered in five stages, as illustrated in Table 1.

Table 1 The instructional phase blueprint

Instruction	Phases	Timeframe (45 min)	Activities
Textbook lesson + ‘planned-incidental’ grammar teaching	Engagement	3	<ul style="list-style-type: none"> • Motivating • Introducing the lesson topic or theme • Activating students’ prior knowledge/Recapitulation
	Exploration	12	<ul style="list-style-type: none"> • Presenting the content • Highlighting grammar rules/structures occurring in chapters • Loud/silent reading
	Explanation	10	<ul style="list-style-type: none"> • Explanations of the content • Explanation of identified grammar rules/structures, using content, and contextual examples, with the help of TLMs
	Elaboration/Extension	10	<ul style="list-style-type: none"> • Providing opportunities for students to apply the language skills they have learned to real-life situations or scenarios • Giving exercises/tasks that require students to use the language in context
	Evaluation	5	<ul style="list-style-type: none"> • Giving students quizzes, tests, or other forms of comprehension and language assessment • Feedback
	Buffer time	5	<ul style="list-style-type: none"> • Attendance, class management, etc

Post-instructional phase

In the post-instructional phase, students undergo a comprehensive evaluation through mid-term examinations, providing a platform for assessing their grasp of integrated English content and grammar. This phase culminates with final school examinations, offering a broader assessment of the students’ language proficiency and the effectiveness of the intervention. In this paper, we discuss only the first two phases.

Method

Research design and procedure

This study followed a quasi-experimental research with a pretest–posttest non-equivalent group design (see Fig. 2) (Mertens, 2015). The independent variable of the study was pedagogical/instructional approach employed in class VIII English classrooms. The dependent variable of the study was students’ grammar test scores at pretest and posttest. The selection of groups for the study involved a deliberate and thorough process. At the outset, potential schools were identified and their respective principals were approached. They were informed about the study, and upon their consent, class VIII English teachers of the schools were requested to participate in the experiment. However, it was quite difficult to find teachers who were willing to participate. After scouting many schools, the authors could identify a teacher (T1) who agreed to participate, but only after ensuring that anonymity would be maintained. T1’s class became our experimental group. To ensure that the

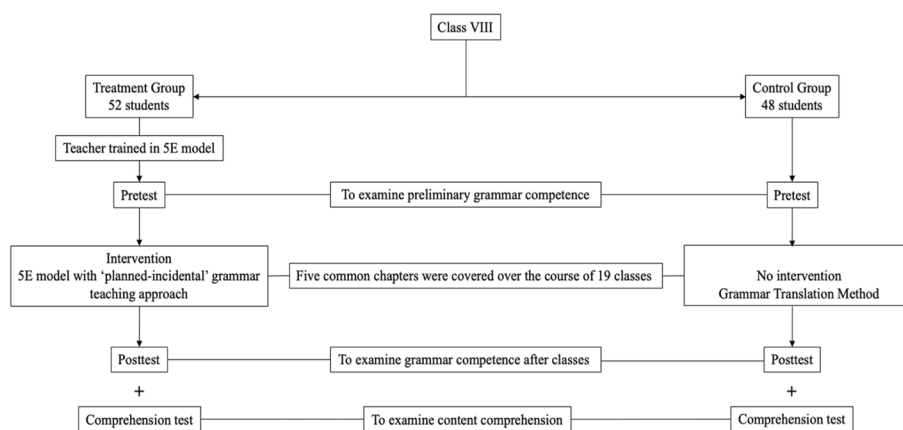


Fig. 2 Research design and procedure

study could make a valid comparison, permission was sought from another principal and English teacher (T2) to conduct pretest and posttest in class VIII. In this case, T2 was unaware of the intervention, but the principal was informed about it. T2’s class became our control group. The intervention period and the chapters to be taught by both teachers during this period were determined after discussions with both of them. The selection of chapters was based on the school’s academic calendar and the schedule provided by the BSE, Odisha. Subsequently, five common chapters scheduled to be taught were finalized.

T1 underwent training on the 5E Model with a ‘planned-incidental’ grammar teaching approach for a week to ensure that she would be able to adhere to the intervention’s instructional design, stages and requirements. T1 was also requested to scan the chapters and identify grammar incidences and topics that she would like to discuss in the class during the intervention period. Furthermore, she was asked to create and share a lesson plan (Table 2) that reflected the chapters and grammar topics, and the number of classes each chapter/grammar topic would cover. Content and grammar were taught in five stages (illustrated in Fig. 1). The instructional approach involved a bilingual pedagogical strategy, wherein content was presented in English and subsequently elucidated in both English and Odia languages, aiming to enhance comprehension among learners. Similarly, grammar rules and structures found in the chapters were highlighted and explained (in both English and Odia) through content, contextual examples, and explicit rules, supported by TLMs. In contrast, T2 did not undergo any training. When enquired about her usual pedagogical practices and the approach she intended to use for teaching the five chapters, T2 mentioned the GTM, which is commonly used across Odisha. All chapters were taught using the translation method, with a focus on content. In instances where grammar exercises were present in the chapter’s exercise section, grammar was taught using explicit rules. TLMs were occasionally used to teach content, but no TLMs were incorporated into the grammar teaching process. The intervention commenced with a pretest, spanned over 19 days of instructional classes, and culminated with a posttest and a comprehension examination.

Table 2 Lesson plan of T1

Sl. No	Chapter title	Incidences of grammar	Grammar taught	Classes	Part of textbook assignment	Total classes	
1	Mongoose	<ul style="list-style-type: none"> • Mongooses like to hunt together • without getting hurt themselves • they travel in groups of about twenty to look for beetles 	<ul style="list-style-type: none"> • Noun + Regular vs irregular plural noun 	1	No	3	
			<ul style="list-style-type: none"> • Pronoun (pos- sessive, reflexive, demonstrative, interrogative, rela- tive and indefinite) • Person 	2	No		
2	The riddle master	<ul style="list-style-type: none"> • Every evening children sit round Budhu • He has gone to herd the alligator • Budhu Hadam came out of his room • They were getting ready for the test • All the boys, who had been listening attentively, laughed at once • Is it an animal? • He is very good at riddles • Is it a thing used by a businessman? 	<ul style="list-style-type: none"> • Simple present 	3	No	6	
			<ul style="list-style-type: none"> • Present per- fect + Past perfect • Simple past 				
			<ul style="list-style-type: none"> • Past continu- ous + Present con- tinuous 				
			<ul style="list-style-type: none"> • Past perfect con- tinuous + Present perfect continuous 				
			<ul style="list-style-type: none"> • Question forma- tion 	1	Yes		
		<ul style="list-style-type: none"> • Preposition (time, place, direction, and position) 	2	Yes			
3	A slave's riddle	<ul style="list-style-type: none"> • His master's chil- dren liked him very much • He was also a very good singer • Jim was really very happy • Read paragraph-4 silently 	<ul style="list-style-type: none"> • Adverb (man- ner, time, place, frequency and degree) 	3	No	3	
4	Math magic	<ul style="list-style-type: none"> • The three persons were quarrelling because they could not divide • I can count them correctly • He was happy too. But the happiest man was the young math-man 	<ul style="list-style-type: none"> • Modals (ability, permission/request, advice and possibil- ity/deduction) 	2	No	4	
			<ul style="list-style-type: none"> • Adjective and Degrees of adjec- tive + Regular vs irregular adjectives 	2	No		
5	Six wise men	<ul style="list-style-type: none"> • Look! One of us is missing • He gave a rap on the second man's head and counted • Let's make sure 	<ul style="list-style-type: none"> • Interjection 	1	No	3	
			<ul style="list-style-type: none"> • Apostrophe 	1	No		
			<ul style="list-style-type: none"> • Contractions 	1	No		

Participants

In this study, the experimental group consisted of 52 students and the control group consisted of 48 students. All the students in the experimental and control groups were between the ages of 13–14 years. They were from a similar socio-economic and cultural background as they all came from Odia rural families of farmers and agricultural/migrant laborers, with virtually no difference in their access to resources, or other learning opportunities. Also, all of them had access to similar learning environments and resources. Regarding the proficiency level of students in both groups, in alignment with the objectives outlined by the BSE Odisha, and following preliminary interactions, it was determined that the students can be classified at the A1 level. As far as teachers in the study are concerned, in both T1 and T2 had a B.A. and B.Ed. qualification. T1 was 35 years old, while T2 was 38 years old. Both teachers were female, and had seven to ten years of teaching experience. All these made sure that both the groups were as similar as possible, ensuring minimal confounding variables, except for the treatment that was administered to the experimental group.

Ethical considerations

Due permissions were taken from principals and teachers regarding the experiment and anonymity of the stakeholders (schools' names, students' names and teachers' names). All were assured that the results would be kept confidential and used for research purposes only.

Measures

This study measured two aspects, i.e., (i) the comprehension of English textbook lessons/content, and (ii) and conscious knowledge of grammar. Pretest and posttest were employed to measure grammar proficiency before and after intervention. Both the tests were prepared by a Central Board of Secondary Education (CBSE) English teacher (T3) with over 15 years of teaching experience, by referring to English Grammar in Use (Murphy, 2019) and Oxford English Grammar Course (Swan & Walter, 2011) to ensure reliability and content validity. Each test included 30 fill-in-the-blank and multiple-choice questions, with each question carrying one mark. As T3 was aware of the intervention, T3 ensured that the questions aligned with the grammar structures found in the textbook chapters. The questions were randomized on the basis of set A, B, C, and D to avoid any potential order effects. To check the reliability of both the tests, pilot tests were conducted with CBSE class VIII students. With Cronbach's alpha greater than 0.80, both pretest and posttest displayed a high level of internal consistency. The face validity of both tests was confirmed by two different CBSE English teachers with over 15 years of teaching experience. These two teachers were not involved in the study in any way and offered an independent evaluation of the questions. Participants were not given any prior information about the tests to ensure that their responses were based solely on their knowledge and not influenced by any outside factors. Both tests had a 30-min time limit, providing enough time for participants to complete the questions without feeling rushed. Similarly, in order to evaluate the efficacy of content teaching and the level of comprehension achieved by the students, a comprehension test was prepared and

Table 3 Descriptive statistics

Test	Group	n	Full mark	Min. score	Max. score	M	SD
Pretest	Experimental	52	30	4	16	9.90	2.90
	Control	48	30	5	15	10.12	2.29
Posttest	Experimental	52	30	16	29	22.38	3.36
	Control	48	30	8	18	12.20	2.46
Comprehension	Experimental	52	15	12	15	13.88	.87
	Control	48	15	12	15	13.64	.97

Table 4 Results of mixed ANOVA

Source	df	F	η_p^2
Between subjects			
Treatment	1	79.44***	.44
Error 1	98		
Within subjects			
Time	1	15892.38***	.99
Time*Treatment	1	8099.79***	.98
Error 2	98		

*** $p < .001$

administered by the researchers. The test comprised a total of 15 objective-type questions, with three questions randomly selected from each of the five chapters’ assignment.

Data analysis

Descriptive statistics were calculated for the pretest, posttest and comprehension test scores of both the groups. A 2 × 2 mixed analysis of variance (ANOVA) was employed to investigate the effect of the proposed intervention on students’ grammar learning. The treatment condition was the between-subjects factor with two levels, 5E Model with ‘planned-incidental’ grammar teaching approach and GTM. Time was the within-subjects factor with two levels, pretest and posttest. This mixed ANOVA focused on both the changes in the students’ scores for the experimental and the control groups, and the difference between the students’ pretest and posttest scores in the experimental and the control conditions. Gliner et al. (2017) suggests the use of a mixed ANOVA, as it provides the most information in the pretest–posttest nonequivalent group design. Additionally, an independent *t*-test was employed to investigate whether there was a statistically significant difference in the mean scores of the comprehension test for the two groups at the end of the study.

Results

Results and associated tables in the following section are presented in the sequence of various analyses conducted in the study. Table 3 presents the descriptive statistics and Table 4 presents the results of the mixed between-within subjects ANOVA.

The between-within subjects mixed ANOVA employed to investigate the effectiveness of the two pedagogical approaches on students’ grammar learning suggested that, the main effect of the treatment/pedagogical approach was found to be statistically

significant ($F(1, 98)=79.44, p<0.001, \eta_p^2=0.44$), indicating a substantial overall difference between the effectiveness of the two pedagogical approaches. Similarly, the main effect of time was found to be statistically significant ($F(1, 98)=15892.38, p<0.001, \eta_p^2=0.99$), indicating that the students' scores significantly differed overall from pretest to posttest. However, a statistically significant interaction was found between time and pedagogical approach ($F(1, 98)=8099.79, p<0.001, \eta_p^2=0.98$), suggesting that the changes seen in the students' test scores from pretest to posttest were different for the 5E Model with 'planned-incidental' grammar teaching approach and GTM conditions. Thus, simple main effects and the interaction graph were examined instead of main effects.

To follow up on the significant interaction found between the pedagogical approaches and time, simple main effects analyses were conducted. The analysis of the simple effect of pedagogical approaches investigated whether or not there was a statistically significant difference between students' pretest and posttest scores when taught using the 5E Model with 'planned-incidental' grammar teaching approach compared to GTM. The analysis revealed no statistically significant difference in students' pretest scores between the group taught using the 5E Model with the 'planned-incidental' grammar teaching approach and the GTM group ($F(1, 98)=0.17, p=0.67$). However, their posttest scores were found to be statistically significantly different ($F(1, 98)=293.10, p<0.001, \eta_p^2=0.74$).

The analysis of the simple effect of time aimed to ascertain whether there existed a statistically significant difference in the students' test scores between pretest and posttest within each treatment condition. The analysis showed that in the 5E Model with 'planned-incidental' grammar teaching approach condition, there was a statistically significant increase in the students' test scores from pretest ($M=9.90, SD=2.90$) to posttest ($M=22.38, SD=3.36$); ($F(1, 51)=19,689.50, p<0.001, \eta_p^2=0.97$). Similarly, in the GTM condition, there was a statistically significant increase in the students' test scores from pretest ($M=10.12, SD=2.29$) to posttest ($M=12.20, SD=2.46$); ($F(1, 47)=839.28, p<0.001, \eta_p^2=0.94$). Despite that, the interaction graph (Fig. 3) illustrated that while

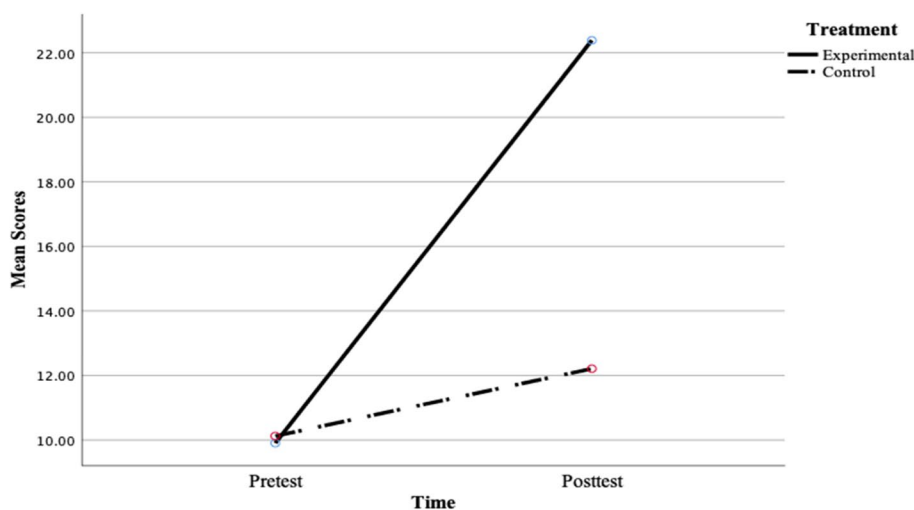


Fig. 3 Interaction graph

the students' test scores increased from pretest to posttest in both the conditions, the increase was more pronounced in the 5E Model with 'planned-incidental' grammar teaching approach group compared to the GTM group, suggesting the effectiveness of the proposed intervention in enhancing grammar efficiency of students. It is worth noting that the observed increase in posttest scores among the control group students can be attributed to the presence of grammar exercises on question formation and prepositions in one of the chapter's exercise sections, which the students had practiced.

The independent *t*-test employed to investigate whether there was a statistically significant difference in the mean scores of the comprehension test for the two groups revealed no significant difference between the scores of the control ($M=13.64$, $SD=0.97$) and experimental ($M=13.88$, $SD=0.87$) groups $t(98)=1.28$, $p=0.20$. Students in both groups demonstrated a comparable level of comprehension. This meant that the intervention did not impede the teaching process of the content and comprehension of the students. It also meant that the intervention could be effectively incorporated into regular classroom instruction to not only teach the prescribed content but also grammar occurring within the texts, thereby striking a balance between content and language. This approach also has the potential to optimize the use of instructional time while concurrently improving students' language skills.

The findings of this study align with prior research exploring the impacts of the 5E model on both content and conceptual learning (Grau et al., 2021; Tegegne & Kelkay, 2023). Additionally, the observed results coincide with existing literature on grammar learning, as reported in studies by Jendeya (2015), Naguib (2019), and Yonan et al. (2022). These consistencies substantiate the theoretical underpinnings supporting the efficacy of the 5E model in addressing both content and grammar domains in educational settings. Furthermore, our integrated 'planned-incidental' approach to teaching grammar finds theoretical support in existing literature, which advocates that a combined approach to grammar instruction may yield benefits for both educators and students (Eide, 2022). This alignment is substantiated by studies indicating that the effective acquisition of English grammar is optimized when multiple instructional approaches are integrated (Alenexi, 2019; Bahraman & Movahed, 2021; Giorgou, 2018; Nešić & Hamidović, 2015; Pawlak, 2021; Zheng, 2015).

Discussions and conclusion

What happens inside a foreign language classroom is inevitably shaped and constrained by needs of instructions (Baker, 2008) and contextual influences (Hu, 2005). These include, curricula, school facilities, teaching force, language policy, economic, social, and cultural factors (Baker, 2008; Hu, 2005; Schurz & Coumel, 2023). Considering the context and needs discussed earlier (see *Status of English in vernacular government schools in Odisha*), it was essential to formulate an intervention that could address the challenges faced by both students and teachers. This research on the integrating 5E Model with planned-incidental grammar teaching revealed that it can effectively address multiple issues. First is the balance between content and language, which many language teachers deem crucial yet difficult to achieve (Cammarata & Tedick, 2012; Cammarata et al., 2016; Reynolds-Young & Hood, 2014; Villabona & Cenoz, 2022). In the Exploration stage, teachers can effectively highlight sentences and grammar rules/structures

occurring in the textbook chapters. Subsequently, in the Explanation and Elaboration stages teachers can teach textbook content and grammar simultaneously, resulting in a balanced teaching-learning experience. While incidental grammar teaching can be used to teach grammar by “picking up” a grammatical feature occurring in textbook chapters, planned grammar teaching can be used to teach practical application of grammatical rules/structures, using explicit grammar rules and examples drawn from chapters’ sentences/phrases and everyday language usage. Second is daily evaluation and feedback that promote grammatical accuracy (Frantzen, 1995). The Evaluation stage provides a platform for assessing students’ comprehension of textbook lessons and application of grammatical rules/structures, and providing required feedback.

The results of this study have several implications for both research and practice. First, this research is particularly relevant for educators who face time constraints but still want to prioritize language/grammar teaching. This integrated approach presents an effective pedagogical strategy for educators to seamlessly integrate grammar instruction into textbook lessons, without compromising the prescribed content, and without necessitating additional time for teaching grammar separately and causing delays. Second, the findings highlight the importance of teacher training in implementing the 5E model and planned-incidental grammar teaching approach. The successful implementation of the intervention relied on the teacher’s (T1) understanding of the approach, her willingness and her ability to design and deliver language/grammar-focused lessons. This underscores the need for professional development opportunities for teachers to enhance their pedagogical skills and knowledge. Third, this study expands the repertoire of instructional strategies available to teachers and contributes to the ongoing discussions on effective balanced (content and language) teaching methodologies.

This study is not free from limitations. Firstly, the study utilizes a quasi-experimental design, which has inherent limitations in terms of controlling for confounding variables. Future research could consider employing a randomized controlled trial design to strengthen the validity of the findings. Secondly, the study was conducted in a specific socio-economic and cultural context, limiting the generalizability of the results. Replication studies in different settings and with diverse student populations would provide a more comprehensive understanding of the effectiveness of the integrated approach. Thirdly, the study was conducted with a relatively small sample size, which could limit the generalizability of the findings. Future research should be conducted to replicate the findings of the study with a larger sample size and in a variety of settings. Lastly, this research employed the 5E model in a linear sequence, failing to explore the potential effects of different sequences of the approach that involves bouncing back and forth between different stages, which remain unknown. Regarding future research, the effects of the intervention on other aspects of students’ language skills, including their speaking and writing skills can be investigated.

In conclusion, the integration of the 5E model with a ‘planned-incidental’ grammar teaching approach proved to be effective in balancing language and content, and enhancing the grammar competency of eighth-grade Odia medium school students in a time-sensitive manner. The findings support the value of integrating grammar instruction into regular classroom instruction without compromising on the main course content. The research contributes to the existing body of knowledge on effective grammar

teaching methodologies and highlights the importance of teacher training in implementing innovative instructional approaches. This study also necessitates additional research to investigate the broader impact of the intervention on various language skills and to assess its applicability in diverse contexts.

Authors' contributions

Conceptualization: RRB, AKA. Data Collection: CSR, TS, AKA. Data Analysis: RRB, AKA, RK. Manuscript Writing: RRB, CSR, TS, AKA, SA, RK. Review and Editing: RRB, AKA. Teacher Training: AKA, SA, RK.

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Availability of data and materials

The authors confirm that the data supporting the findings of this study are available within the article and can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All procedures performed in this study were in accordance with the ethical standards of Fakir Mohan University, Balasore, Odisha, comparable with other accepted ethical standards. This study was approved by the ethics committee of Fakir Mohan University, Balasore, Odisha. Due consent was obtained from all participating teachers and principals. All were assured that their identity will be kept confidential, and the data will be used in an aggregate manner for the research purpose only. No names, address or other identifying information were used in data analysis and dissemination of findings.

Consent for publication

Consent was obtained from all participating teachers and principals.

Competing interests

The authors declare no competing interests.

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References

- Alenxi, S. M. (2019). Exploring explicit and implicit grammar teaching. *International Journal of Applied Linguistics and English Literature*, 8(1), 104–106.
- Arul Kumar, T. S. (2012). Teaching English to the 'Disadvantaged' (TED): Towards a socio-cultural perspective. In Francis Peter (Ed.), *Indian Voices in ELT* (pp. 125–130). New Delhi: Viva Books Private Limited.
- ASER Centre. (2022). *Annual status of education reports 2022, Odisha rural*. Pratham Education Foundation, New Delhi. Retrieved March 3, 2023 from, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://img.asercentre.org/docs/ASER%202022%20report%20pdfs/State%20pages/6%20paggers_English/odisha_19.pdf
- Bachore, M. M. (2022). English language literacy skills and academic achievement of urban and rural secondary schools: the case of high and low achievers. *Education Research International*, 2022, 2315426.
- Bahraman, M., & Movahed, R. (2021). The efficacy of two teaching methods on minimizing the grammatical errors in translating persian sentences into english. *Critical Literary Studies*, 3(2), 191–210.
- Baker, W. (2008). A critical examination of ELT in Thailand: the role of cultural awareness. *RELC Journal*, 39(1), 131–146.
- Banegas, D. L. (2012). Integrating content and language in English language teaching in secondary education: models, benefits, and challenges. *Studies in Second Language Learning and Teaching*, 2(1), 111–136.
- Bo, W. V., Fu, M., & Lim, W. Y. (2023). Revisiting English language proficiency and its impact on the academic performance of domestic university students in Singapore. *Language Testing*, 40(1), 133–152.
- Board of Secondary Education (BSE), (2013). *Courses of study for class IX*. Cuttack, Odisha.
- Borooh, V. K. (2012). Social identity and educational attainment: the role of caste and religion in explaining differences between children in India. *Journal of Development Studies*, 48(7), 887–903.
- Bybee, R. W. (2015). *The BSCS 5E instructional model: creating teachable moments*. NSTA Press.
- Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: origins and effectiveness. *Colorado Springs Co: BSCS*, 5, 88–98.
- Cammarata, L., & Tedick, D. J. (2012). Balancing content and language in instruction: the experience of immersion teachers. *The Modern Language Journal*, 96(2), 251–269.
- Cammarata, L., Tedick, D. J., & Osborn, T. A. (2016). Content-based instruction and curricular reforms: Issues and goals. In L. Cammarata (Ed.), *Content-based foreign language teaching: curriculum and pedagogy for developing advanced thinking and literacy skills* (pp. 1–21). New York: Routledge.
- Cenoz, J. (2015). Content-based instruction and content and language integrated learning: the same or different? *Language, Culture and Curriculum*, 28(1), 8–24.

- Cenoz, J., Genesee, F., & Gorter, D. (2014). Critical analysis of CLIL: taking stock and looking forward. *Applied Linguistics*, 35(3), 243–262.
- Coyle, D. (2002). Against all odds: lesson from content and language integrated learning in english secondary schools. In W. C. Daniel & G. M. Jones (Eds.), *Education and society in plurilingual contexts* (pp. 37–55). Brussels: Brussels University Press.
- Coyle, D., Hood, P., & Marsh, D. (2010). *CLIL: content and language integrated learning*. Cambridge: Cambridge University Press.
- Dalton-Puffer, C. (2007). *Discourse in content and language integrated learning (CLIL) Classrooms*. Philadelphia: John Benjamins.
- Dalton-Puffer, C., Nikula, T., & Smit, U. (2010). Language use and language learning in CLIL: current findings and contentious issues. In C. Dalton-Puffer, T. Nikula, & U. Smit (Eds.), *Language use and language learning in CLIL classrooms* (pp. 279–291). Amsterdam: John Benjamins.
- Dalton-Puffer, C., & Smit, U. (2007). Introduction. In C. Dalton-Puffer & U. Smit (Eds.), *Empirical perspectives on CLIL classroom discourse* (pp. 7–23). Wien: Peter Lang.
- Desai, S., & Kulkarni, V. (2008). Changing educational inequalities in India in the context of affirmative action. *Demography*, 45, 245–270.
- Eide, K. (2022). *Effects of a Combined Approach to Grammar Instruction in a Foreign Language Classroom*. [Unpublished master's dissertation thesis]. Northwestern College, Iowa.
- Ellis, R. (2006). Current issues in the teaching of grammar: an SLA perspective. *TESOL Quarterly*, 40(1), 83–107.
- Fowler, S. (2022). Motivating speaking in the world language classroom and beyond. *NECTFL Review*, 89, 95–102.
- Frantzen, D. (1995). The effects of grammar supplementation on written accuracy in an intermediate Spanish content course. *The Modern Language Journal*, 79(3), 329–344.
- Giorgou, S. T. (2018). *The effects of deductive, inductive and a combination of both types of grammar instruction in pre-sessional classes in higher education*. [Unpublished PhD dissertation thesis]. University of Bedfordshire.
- Gliner, J. A., Morgan, G. A., & Leech, N. L. (2017). *Research methods in applied settings: an integrated approach to design and analysis* (3rd ed.). New York, NY: Routledge.
- Grau, F. G. I., Valls, C., Piqué, N., & Ruiz-Martín, H. (2021). The long-term effects of introducing the 5E model of instruction on students' conceptual learning. *International Journal of Science Education*, 43(9), 1441–1458.
- Graus, J., & Coppen, P. A. (2016). Student teacher beliefs on grammar instruction. *Language Teaching Research*, 20(5), 571–599.
- Hossain, K. I. (2024). Reviewing the role of culture in English language learning: challenges and opportunities for educators. *Social Sciences & Humanities Open*, 9, 100781.
- Hu, G. (2005). Contextual influences on instructional practices: a Chinese case for an ecological approach to ELT. *Tesol Quarterly*, 39(4), 635–660.
- Hudson, R., & Walmsley, J. (2005). The English patient: english grammar and teaching in the twentieth century. *Journal of Linguistics*, 41(3), 593–622.
- Jendeya, M. (2015). *The Impact of 5E Model on Developing Tenth Graders' English Grammar Learning and their Attitudes towards English*. [Unpublished master's dissertation thesis]. Faculty of Education, Islamic University, Gaza.
- Jeter, G., Baber, J., Heddy, B., Wilson, S., Williams, L., Atkinson, L., Dean, S., & Gam, G. (2019). Students at the center: Insights and implications of authentic, 5E instruction in high school English language arts. *Frontiers in Education*, 4(91), <https://doi.org/10.3389/educ.2019.00091>.
- Kingdon, G. G. (2020). The private schooling phenomenon in India: a review. *The Journal of Development Studies*, 56(10), 1795–1817.
- Lyster, R. (2007). *Learning and teaching languages through content. A counterbalanced approach*. Amsterdam: John Benjamins.
- Macianskiene, N. (2016). Development of transversal skills in content and language integrated learning classes. *European Scientific Journal*, 12(1), 129–122.
- Mearns, T., & Platteel, T. (2021). Exploring teacher support for a content and language integrated modern languages curriculum. *Language, Culture and Curriculum*, 34(3), 207–223.
- Mertens, D. M. (2015). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods* (4th ed.). Thousand Oaks: Sage.
- Mohanty, S. (2017). An assessment of the English language needs of tribal youth in urban Odisha and identifying the barriers experienced in their language learning. *British Council India, Understanding learners-researching learners' needs*, 1, 20–34.
- Mukherjee, J., & Bernaisch, T. (2020). The development of the English language in India. In A. Kirkpatrick (Ed.) *The Routledge handbook of world Englishes* (pp. 165–177). New York: Routledge.
- Murphy, R. (2019). *English grammar in use book with answers: a self-study reference and practice book for intermediate learners of english*. Cambridge: Cambridge University Press.
- Naguib, S. M. N. (2019). Using the 5 E's instructional model to enhance english grammar learning of secondary stage students. *Mağallaḥ Dirāsāt Fi Al-Manāhiġ Wa Ṭuruq Al-Tadrīs*, 244(244), 115–152.
- Nayak, R. (2019). *Teaching English to Rural High-School Students in India: Identifying and Addressing the Challenges* [Unpublished doctoral dissertation thesis]. National Institute of Technology Rourkela.
- Nešić, I. D., & Hamidović, K. Č. (2015). Teaching English grammar: efficiency of inductive and deductive approaches students' perceptions. *Zbornik Radova Filozofskog Fakulteta u Prištini*, 45–3, 189–205.
- Ó Ceallaigh, T. J., NiMhurchú, S., & NiChróinín, D. (2017). Balancing content and language in CLIL: the experiences of teachers and learners. *Journal of Immersion and Content-Based Language Education*, 5(1), 58–86.
- Ohara, Y. (2012). Examining the legitimacy of unrecognised low-fee private schools in India: comparing different perspectives. *Compare: A Journal of Comparative and International Education*, 42(1), 69–90.
- Padwad, A. (2017). Towards understanding Rural ELT. In Francis Peter (Ed.), *Indian Voices in ELT* (pp. 117–125). New Delhi: Viva Books Private Limited.

- Pattanaik, J. K. (2020). Tribal children in Odisha and their right to education in the home language. *South Asia Research*, 40(2), 163–180.
- Pawlak, M. (2021). Teaching foreign language grammar: new solutions, old problems. *Foreign Language Annals*, 54(4), 881–896.
- Ramos, F. (2009). Una propuesta de AICLE para el trabajo con textos en segundos idiomas. *Porta Linguarum*, 12, 169–182.
- Reynolds-Young, D., & Hood, S. (2014). balancing content & language in the english language development classroom. *ORTESOL Journal*, 31, 33–43.
- Richards, J., & Rodgers, T. S. (2001). *Approaches and methods in language teaching* (2nd ed.). Cambridge: Cambridge University Press.
- Ruiz-Martín, H., & Bybee, R. W. (2022). The cognitive principles of learning underlying the 5E Model of Instruction. *International Journal of STEM Education*, 9(1), 21.
- Şahin, S. M., & Baturay, M. H. (2016). The effect of 5E-learning model supported with WebQuest media on students' achievement and satisfaction. *E-Learning and Digital Media*, 13(3–4), 158–175.
- Salomone, R. (2022). *The rise of English: Global politics and the power of language*. New York: Oxford University Press.
- Schurz, A., & Coumel, M. (2023). Grammar teaching in ELT: A cross-national comparison of teacher-reported practices. *Language Teaching Research*, 27(5), 1167–1192.
- Shintani, N. (2015). The incidental grammar acquisition in focus on form and focus on forms instruction for young beginner learners. *Tesol Quarterly*, 49(1), 115–140.
- Singhal, K., & Vernekar, N. (2018). *Administrative Duties Are Stealing Valuable Time from Government School Teachers*. The Wire. <https://thewire.in/education/non-teaching-duties-government-school-teachers-india>
- Stryker, S., & Leaver, B. (Eds.). (1997). *Content-based instruction in foreign language education: models and methods*. Washington, DC: Georgetown University Press.
- Swain, M. (1985). Communicative competence: some roles of comprehensible input and comprehensible output in its development. In S. Gass & C. Madden (Eds.), *Input in second language acquisition* (pp. 235–253). Rowley, MA: Newbury House.
- Swan, M., & Walter, Catherine. (2011). *Oxford english grammar course intermediate*. Oxford: Oxford University Press.
- Tegegne, T. A., & Kelkay, A. D. (2023). Comparative study of using 5E learning cycle and the traditional teaching method in chemistry to improve student understanding of water concept: the case of primary school. *Cogent Education*, 10(1), 2199634.
- Tickoo, M. L. (2004). *ELT in India*. New Delhi: Orient Longman.
- Ur, P. (2011). Grammar teaching: Research theory, and practice. In E. Hinkel (Ed.), *Handbook of research in second language teaching and learning Volume II* (pp. 507–522). Abingdon: Routledge.
- Vafaeikia, M., Marandi, S., & Siyyari, M. (2023). Exploring the role of 5E-based online activities in english language students' critical thinking and creativity. *Issues in Language Teaching*, 12(1), 1–31.
- Vanichvasin, P. (2019). Effects of content-based instruction on english language performance of thai undergraduate students in a non-english program. *English Language Teaching*, 12(8), 20–29.
- Villabona, N., & Cenoz, J. (2022). The integration of content and language in CLIL: a challenge for content-driven and language-driven teachers. *Language, Culture and Curriculum*, 35(1), 36–50.
- Walenta, M. (2018). Balancing linguistic and extra-linguistic gains in CLIL: a case for content-based structured input. *International Journal of Bilingual Education and Bilingualism*, 21(5), 578–590.
- Wang, C. W. (2023). Incidental vocabulary learning in a content and language integrated learning setting. In B. L. Reynolds (Ed.), *Vocabulary learning in the wild* (pp. 105–139). Singapore: Springer.
- Yonan, R. F., Mahmood, L. Z., & Hamid, R. (2022). The effect of using 5e strategy on developing university students' achievement in transformational grammar. *Journal of Language and Linguistic Studies*, 18(4), 1390–1399.
- Zheng, L. (2015). Explicit grammar and implicit grammar teaching for English major students in university. *Sino-US English Teaching*, 12(8), 556–560.

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