Relationship between Using Visuals and Diagrams on Grammar Learning and Multiple Intelligences among EFL Young Learners

Najmeh Hamzehnejadi [1] [*] , Valeh Jalali[2], Rahmatollah Dadvar[3]

[1*]Department of Foreign Languages, Ba.C., Islamic Azad University, Baft, Iran
n.hamzehnejadi@iau.ir
[2]Department of Foreign Languages, Ke.C., Islamic Azad University, Kerman, Iran
Vjalali@iauk.ac.ir
[3]Department of Social Sciences, Ba.C.m, Islamic Azad University, Baft, Iran
rahmatolahdadvar313@gmail.com

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Abstract

Grammar is widely recognized as one of the most abstract and challenging components of language learning, particularly for young EFL learners. Its intangible nature often leads to confusion and disengagement. Absolutely, incorporating visual aids such as sketches and diagrams can significantly enhance the learning experience for EFL (English as a Foreign Language) learners. Visual representations can help, making abstract grammar concepts more concrete and easier to understand. This approach not only reduces the learning burden but also caters to different learning styles and intelligences, making the learning process more engaging and enjoyable for students. By utilizing clear and simple visual methods, educators can effectively convey grammar rules and structures, thereby motivating learners to continue their language learning journey with enthusiasm. This study explores the impact of visual aids—specifically sketches and diagrams—on grammar acquisition and their relationship with multiple intelligences. This study explores the impact of visual aids—specifically sketches and diagrams—on grammar acquisition and their relationship with multiple intelligences. A quasi-experimental design was employed, comparing traditional instruction with a visual-based approach. Findings revealed that learners exposed to visual grammar instruction demonstrated significantly higher gains in grammar proficiency, motivation ($\Delta = 1.12$, $p < 0.001$), and overall intelligence scores ($\Delta = 14.85$, $p < 0.001$). These results suggest that diagrammatic teaching not only enhances grammatical understanding but also supports cognitive and affective development, aligning with theories that emphasize visual scaffolding in abstract learning.

دستور زبان به طور گسترده به عنوان یکی از انتزاعی‌ترین و چالش‌برانگیزترین اجزای یادگیری زبان، به ویژه برای زبان‌آموزان جوان، شناخته می‌شود. ماهیت ناملموس آن اغلب منجر به سردرگمی و عدم مشارکت می‌شود. مسلماً، استفاده از ابزارهای بصری مانند طرح‌ها و نمودارها می‌تواند تجربه یادگیری را برای زبان‌آموزان (انگلیسی به عنوان زبان خارجی) به طور قابل توجهی افزایش دهد. نمایش‌های بصری می‌توانند کمک کنند و مفاهیم انتزاعی دستور زبان را ملموس‌تر و قابل فهم‌تر کنند. این رویکرد نه تنها بار یادگیری را کاهش می‌دهد، بلکه به سبک‌ها و هوش‌های مختلف یادگیری نیز توجه می‌کند و فرآیند یادگیری را برای دانش‌آموزان جذاب‌تر و لذت‌بخش‌تر می‌کند. با استفاده از روش‌های بصری واضح و ساده، مربیان می‌توانند به طور مؤثر قوانین و ساختارهای دستور زبان را منتقل کنند و در نتیجه زبان‌آموزان را برای ادامه سفر یادگیری زبان خود با اشتیاق ترغیب کنند. این مطالعه به بررسی تأثیر ابزارهای بصری - به ویژه طرح‌ها و نمودارها - بر یادگیری دستور زبان و رابطه آنها با هوش‌های چندگانه می‌پردازد. این مطالعه به بررسی تأثیر ابزارهای بصری - به ویژه طرح‌ها و نمودارها - بر یادگیری دستور زبان و رابطه آنها با هوش‌های چندگانه می‌پردازد. یک طرح شبه‌آزمایشی به کار گرفته شد که آموزش سنتی را با رویکرد مبتنی بر تصویر مقایسه می‌کرد. یافته‌ها نشان داد که زبان‌آموزانی که در معرض آموزش تصویری دستور زبان قرار گرفتند، پیشرفت قابل توجهی در مهارت دستور زبان، انگیزه ($\Delta = 1.12$، p $0.001 >$) و نمرات کلی هوش ($\Delta = 14.85$)، ($0.001 >$ p) نشان دادند. این نتایج نشان می‌دهد که آموزش نموداری نه تنها درک دستوری را افزایش می‌دهد، بلکه از رشد شناختی و عاطفی نیز پشتیبانی می‌کند و با نظریه‌هایی که بر داربست بصری در یادگیری انتزاعی تأکید دارند، همسو است.
کلمات کلیدی: یادگیری دستور زبان، نمودارها، زبان‌آموزان، هوش‌های چندگانه، انگیزه

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[1]Corresponding Author's Email:
n.hamzehnejadi@iau.ir

Introduction

Language is a tool used to communicate with each other, making it easier for us to convey ideas, feelings and many other things. Many languages are used in the world to firm up commercial, political and even cultural relations between people in different parts of the world (Salomone, 2022). Since English language used by many people around the word, it is known as interlanguage. It is used in many issues including education, medicine, business, politics and technology. For this reason, the importance of the English language in today's world cannot be underestimated and there is no point in ignoring English as the common language in most parts of the world. English language not only plays a role as a communication tool, but it can make it easier for us to adapt to the different social contexts such as workplace, university…. Therefore, we can understand the necessity and importance of learning English for everyday life.

One of the main and determinant constructive elements of every language is grammar. Undoubtedly, Mastery of the grammar of a language affects mastery of other language skills and it act as a prerequisite for providing acceptable and high tonus language products, speaking and writing (Osafo-Adjei, 2023). Since every language gets form and meaning by being in the structural form of grammar, therefore grammar is a subject that should be studied and examined critically. In order to have a good knowledge of the language, students must be sufficiently familiar with the grammar. Since grammar and structural rules are not tangible and concrete concepts, therefore learning them is considered as a difficult and complicated task for foreign language learners, especially those whose first language is not similar to their second language and the extent of commonalties is limited. The situation is even more problematic and challenging for young learners that the abstract concepts conceived with less ease and flexibility.

Most of the teachers' complaint that whenever they ask students to indicate the subject and verb of sentences, students act unknowingly and they have problem in finding them, hence they have problem in recognition of time of the verb and also subject-verb agreement (Muftah,2023). One of the other problems of students is their inability in discrimination between verb and infinitive. Whenever they are asked why they are selecting infinitives as verb, they say that because they have the same form so they assumed that infinitives can be verbs, even they don't know that each sentence cannot have more than one verb. Most of the students have lack of Knowledge about introductory phrases, appositives, gerunds and although teachers explain these grammatical points for them, but it seems that this information are not perceived successfully by students.

According to Fernandes et al., (2018) metalinguistic devices cater learners with memory-enhancing and learning processes. Pictures and diagrams as saviors come to aid learners, making abstract concepts more tangible and sensible and making the path of learning this complex part of language more bearable and easier. Through drawing, envisaging of ideas and sharing one's visual interpretations/insights with others is actualized. Linking grammatical analysis and explanation to drawing or sketching implies encrypting extremely abstract concepts that have no clear link to visual referents in the form of sketches and diagrams (Myhill, 2018).

Diagramming causes students to slow down, ponder, examine the function of each word in a sentence and detect the place of each word in its proper and legitimized location, and pay attention to details that mainly indicate the determinant role of noticing hypothesis in learning (Phonna, 2022). Some educators argue that this sort of focus on the rules hinders the writing process, diminishes its articulacy, and consistently occupies students mind with the thought of "I might have written something wrong" (Zrekat& Al-Sohbani, 2022). Even so, the point that cannot

be neglected is that learning rules and guidelines of grammar is determinant in creating comprehensive productive language outputs, speaking and writing, the only thing that should be considered is that teaching them in the most simple, direct and clear way (Mystkowska-Wiertelak & Pawlak,2012).

One of the methods that can facilitate grammar learning for students is teaching grammar through visuals, diagrams and charts, and since learning through images is somehow related to visual-spatial intelligence and learning through formulas is related to logical-mathematical intelligence, using the method of multiple intelligences-based instruction can increase the efficiency of both teaching and learning. (Samormob& Phusawisot, 2020). Furthermore, learners who apply their strong fields of intelligences in learning activities can learn a subject that they used to detest, with joy and without pressure.

The problem which this study intended to resolve is that beside many differences between individuals' characteristics that might impact their language learning process, there's often a different neglected component which is "Intelligence ". Although there have been several studies examining the relationship between students' multiple intelligence profile and their ability to learn languages, there is inconsistency between the results of these studies. In terms of grammatical knowledge; For example, some show a significant relationship, some a partial relationship, and some a significant negative relationship between the two variables. To fill this gap, the present study is carried out to investigate the impact of visuals and diagrams in grammar learning of secondary high school students with focusing on multiple intelligences.

Regarding the research purposes, the following hypothesizes were formulated:

H₁: The use of visuals and diagrams in grammar instruction has a statistically significant positive effect on high school students' grammar learning outcomes compared to traditional instruction.

H₂: There is a statistically significant difference among types of multiple intelligences in the extent to which students benefit from grammar instruction using visuals and diagrams, with visual-spatial and logical-mathematical intelligences showing the greatest gains.

Review of Literature

Grammar

Grammar is an inseparable part of every known language in the world. Meanwhile learners' knowledge of grammatical concepts is not correct and deep, they cannot express English sentences logically. To be able to speak a language to some extent and to be able to express what we really want to say, is in great need to have adequate knowledge of grammar. Grammar is like the foundation and base of every sentence, where each word has its own specific place and role, and without grammar and sentence structure, the combination of the words will be chaotic and meaningless. Sentences are not a list of words that set beside each other with no rational organization; certainly, there is no point in trying to take meaning from a jumble of disordered words that do not obey from any consistent structural rules (Siddiqui, 2020). Most language learners find learning grammar nettlesome and boring. Dealing with rules that have no resemblance to the rules of the learner's first language grammar that acquired without formal training, and even they have not a correct and tangible understanding of the rules of their own native language, is a complicated and confusing task. This issue is more difficult and repulsive for young learners that the necessity of learning a bunch of complicated rules and regulations is not clear and sensible (Crovitz & Devereaux, 2019).

According to Morelli (2003), to moderate the difficulties in learning structural rules, students should be taught grammar using different methods and approaches to cater their individual learning styles, and teachers should consider students' attitudes and understandings when making decisions about teaching grammar.

In the study by Effendi et al., (2020) the relationship between the beliefs and practices of primary school teachers in Singapore about teaching strategies in grammar instruction is explored. The results indicated that explicit discussion of grammar rules in the classroom is considered extremely important in helping students to learn English and develop their writing skills.

Diagrams

There are several studies that deal with using visual in teaching and learning grammar (e.g. Antonova et al., 2019; Abdusamatova, 2022; Guo and Feng, 2017; Latham, 2021; Mamaliga, 2020). Diagrams can be suggested and used as an efficient way to help students understand sentence structure and word functions, and to deepen their knowledge of sentences (Royani & Sadiah, 2019). Diagrams are visual representation of sentences that make different grammar concepts, pictorial and while gathered with clear explanations will resulted in truly simplified grammatical points. When drawing a sentence diagram, each word is located in its respective place within the diagram, lines are used to represent which words relate to each other and how.

There are some research results showing that many language learners perceive visual images and diagrams as a prosperous aid in better understanding and remembering grammatical terms, the parts of a sentence, and the basic rules of grammar (Ganikhujaeva, 2021).

Focusing on long, tedious intangible explanations of grammatical points or trying to explain grammar points using English sentences that have no resemblance to the students' mother tongue structure, not only does not help the students' learning, but results in confusion and a mind filled with complex and inconsistent information, and ultimately hatred and rejection of grammar. Teachers through teaching grammar in a structured way and using sentence diagramming in their lessons can resolve these problems (Ellis, 2002; Yang & Sang, 2023). Because of the capability of logical presentation of ideas and the visual nature of the sentence diagrams, students are able to understand grammar, and they eventually will turned into grammar lovers. Through diagrams and charts, students are able to get familiar with the sentence components in a conceptual, concrete and objective way, and finally it becomes possible for them to learn the complex structure of the foreign language (Sewssan & Souibaah, 2023).

Many of the diagrams used are those designed by Alonzo Reed and Brainerd Kellogg. Although some teachers prefer to use modern diagrams instead of Reed diagrams.

Simple sentences in the ReedKellogg system are represented in the following forms:
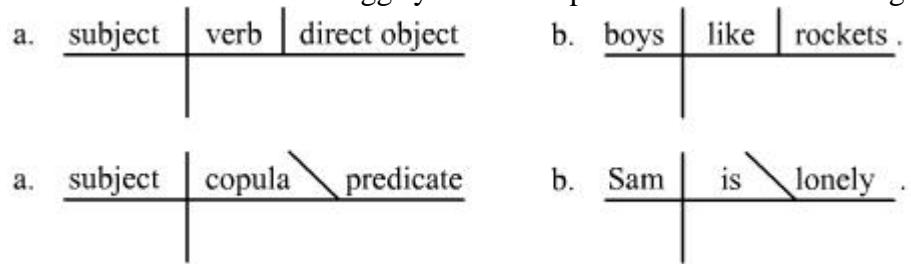
Reed's diagram for simple sentences features a horizontal line called the base, with the first part of the sentence on the left and the following sentence on the right, separated by a vertical line.

The following sentence must contain a verb, which determines the addition of other parts to the sentence.

Subject, predicate, or object modifiers are placed below the baseline:
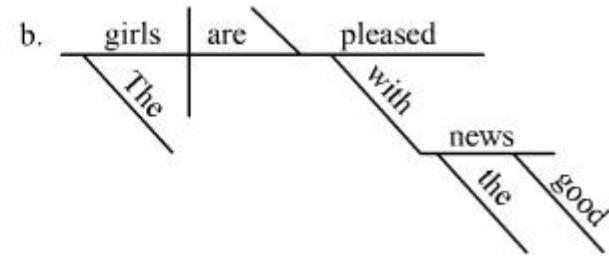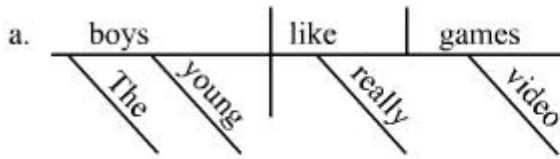
In the diagrams, each identifier, such as an adjective that can include article, as well as adverbs, is placed on slanted lines below the word that identifies it.

a. This tree illustrates constituency.   b. This tree illustrates dependency.
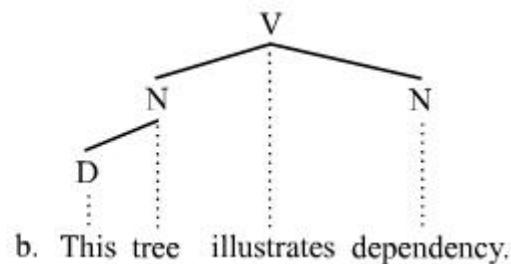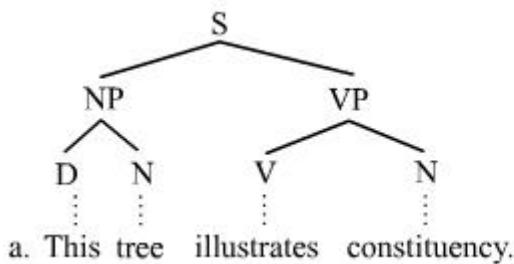
Using Visuals and Diagrams in Teaching Grammar through Deductive Approach
The deductive approach to teaching grammar involves moving from general rules and principles to specific ones. This method has been found to be beneficial in EFL contexts, especially when customized to suit the specific characteristics, cultural background, curriculum framework, and content complexity of the learners (Widodo, 2006; Hmedan & Nafi', 2016). Additionally, introverted learners who prefer clear and direct explanations before delving into grammatical rules and guidelines tend to favor this instructional procedure (Binue, 2022). This approach can provide a structured and systematic learning experience for students, allowing them to build a solid foundation of knowledge before applying specific grammar rules.

Widodo (2006) perceived that the deductive approach to teaching grammar offers several advantages, including being time-saving, easier to process, and presenting concrete examples. It is particularly beneficial for adult learners with developed cognitive and perceptive skills, as it allows them to discern what to expect in the classroom. Furthermore, deductive teaching is preferred when grammatical rules are too difficult or complex for students, as they can learn the rules first and then practice them in communicative tasks once they have a full understanding.

However, even the most perceptive students may find certain grammatical points unclear and perplexing, which can lead to detraction from the learning process. In such cases, simple, clear, and direct methods of conveying teaching material can aid both teachers and students. While many privileges are attributed to the deductive approach, it's essential to acknowledge its potential pitfall

Using Visuals and Diagrams in Teaching Grammar through Inductive Approach
In contrast to the deductive approach, in this approach the specific examples in spoken or written form are presented firstly, from which a general principle or rule can then be derived (Mahdi& Ismail, 2023). Pursuing inductive teaching approach, Learners implicitly get the structural rules

and grammatical points, highlighted and stipulated in teaching materials (Widodo, 2006). Ellis (2006) suggests that through inductive teaching, educators can make complicated grammatical points pellucid and cater students with in depth cognitive learning while accompanied with higher degree of encouragement, engagement and involvement improving personal and interpersonal skills as its result. Thus, inductive reasoning considered an important attainment in this type of instructional method.

In the inductive approach, a problem may potentially arise when learners are unable to understand the forms presented by the teacher due to the unfamiliarity and complexity of sentence samples or learners' lack of metalanguage awareness (Kormos, 2023).in such cases, visual representations are useful to provide context so that learners can comprehend what the teacher is presenting. The use of pictures or illustrations can be a guide for learners to make sense of the rules of specific examples (Buckley& Nerantzi, 2020). Visual representations reinforce and also give weigh to the teacher's explanations and provide a meaningful context for practicing the intended grammatical points. Therefore, learners through visualization and graphs that symbolize their abstract knowledge can easily carry out such rule discovery practice.

Visuals and Diagrams as Consciousness Raising (Cr) Approach to Teaching Grammar
Khezrlou (2022) emphasizes the importance of Consciousness Raising (CR) in teaching students with explicit English language knowledge. While the primary goal of CR is not to directly help students apply grammatical rules correctly, it indirectly influences language learning and authenticates students' understanding of how grammar is constructed (Widodo, 2010). According to Ellis (2002), the aim of CR is to provide learners with a declarative understanding of a specific grammatical feature rather than just procedural knowledge.

In CR, the focus is on the learner's comprehension of particular, abstract grammatical patterns. As a result, the success of consciousness raising (CR) oriented grammar activities and tasks depends on the role of visuals in CR tasks. A teacher can create CR-based assignments using visual mediums or presentations (e.g. g. diagrams, charts, tables, pictures, and texts) (Panarook, 2022).To take benefit of CR-oriented tasks in the teaching process, the teacher can involve any visuals and diagrams designed and introduced by experts. In this way, learners' awareness of the grammatical points is reinforced and consequently, the instructional outcome will be satisfactory.

To leverage the advantages of CR-oriented tasks in the teaching process, teachers can incorporate visuals and diagrams created and introduced by experts. By doing so, learners' comprehension of grammatical points is reinforced, leading to a satisfactory instructional outcome. This approach can enhance the effectiveness of CR-oriented tasks and contribute to a more comprehensive understanding of grammar among students.

In their investigation of the best techniques for teaching English grammar, Antonova et al. (2019) utilized electronic versions with visuals to present grammatical rules, noting that visuals help learners construct relationships between different elements of the rules. Additionally, Wilson and Kam (2013) found that the grammatical structure of English phrases is acquired through nonlinguistic systems, rather than solely being transferred through linguistic systems. Furthermore, a study by Rezaei & Sayadian (2015) aimed to explore the impact of infographics instruction on Iranian EFL learners' grammar learning, with results indicating that infographic instruction was effective in helping EFL learners learn foreign language grammar.

Multiple Intelligences and Teaching Grammar through Visuals and Diagrams
The distinction between traditional views of intelligence and the Multiple Intelligences (MI) theory is a topic of ongoing debate. As Brown (2001) highlighted, traditional intelligence was once narrowly defined as the ability to excel in linguistic and logical-mathematical problems. In contrast, the MI theory, pioneered by Howard Gardner (1983), proposes a learner-centered philosophy that recognizes human intelligence as multifaceted, encompassing dimensions such as linguistic, spatial, and musical abilities. This approach emphasizes the importance of acknowledging and nurturing diverse forms of intelligence in education (Richards & Rodgers, 2001; Mizhir, 2023). Instructional efficacy is informed by cognitive principles, emphasizing optimized load through visual supports like diagrams (Scherer Jr., 2016) and the deep processing mandated by the Involvement Load Hypothesis. Central to differentiated instruction is Gardner's Multiple Intelligences Theory (MIT), which suggests teaching should cater to individual strengths. Specifically, in EFL writing, Shaeghi & Hosseinian (2015) found a positive correlation between overall Multiple Intelligences and the writing quality of female Iranian learners, underscoring the need to integrate activities that support diverse cognitive profiles to enhance complex skills like writing.

Differentiated instruction, central to Gardner's Multiple Intelligences (MI) Theory, mandates catering to diverse strengths like visual/spatial and logical-mathematical intelligence, often through methods like diagrams and graphs. Integrating such engagement principles, a quasi-experimental study by Abdelhamid demonstrated that gamification in Arabic grammar instruction yielded both indirect positive effects on academic achievement and highly favorable student impressions, significantly inspiring struggling learners. This confirms that instructional efficacy relies on combining cognitive approaches (like visual processing) with high-involvement, problem-solving activities to support mastery and retention across various learning profiles.

By incorporating shapes and diagrams into grammar instruction, educators can engage students with different strengths and interests, ultimately enhancing their motivation and understanding of the subject matter. This method can effectively support grammar education by providing a more inclusive and engaging learning experience for all students.

Methodology

Research Design and Participants
This study utilized a quasi-experimental, pre-test/post-test design with two distinct groups: a Traditional Teaching Group (Control) and a Visual and Diagrammatic Teaching Group (Experimental).

The sample consisted of a total of 30 young learners, typically aged 13 to 15 years, randomly assigned to one of the two groups, resulting in 15 participants (n=15) per group. The intervention period for both groups was 24 weeks.

Instruments
Two primary instruments were used for data collection: a language proficiency test and a multiple intelligences questionnaire.

Language Proficiency Test
The Oxford Young Learners' Placement Test was administered to assess the participants' baseline and outcome language proficiency. This standardized test is specifically tailored for young learners and is administered online with automatic marking. The test structure includes 30 questions,

comprising 18 questions focused on core grammar and vocabulary and 12 questions evaluating reading comprehension and language use. The test is adaptive, generally requires approximately 35 minutes to complete, and provides a numerical score indicating the students' English proficiency level according to the Common European Framework of Reference (CEFR), ranging from Pre-Intermediate (A2) to Intermediate (B1).

Multiple Intelligences Scale

The Multiple Intelligences Scale adapted from Candlers (2011) and translated into Persian was used to assess the participants' intellectual profiles. The questionnaire consisted of 24 items rated on a 5-point Likert scale (0 = Not at All to 5 = Very True) to gauge agreement with statements across eight intelligence types, as defined by Gardner's classification: Bodily-Kinesthetic, Linguistic, Intrapersonal, Spatial, Interpersonal, Musical, Naturalistic, and Logical-Mathematical Intelligence. The maximum score for each intelligence area was 15. The internal consistency of the instrument was confirmed by a high Cronbach's alpha of $\alpha = .89$.

Instructional Materials

 The instructional material for the 24-week intervention was based on the Vision 2 textbook. This curriculum covered three main lessons, integrating various language skills. The core grammar content focused on Countable and Uncountable Nouns, Present Perfect, and Conditional Type I. The grammatical points in the textbook are followed by corresponding classification tables and exercises in the accompanying workbook.

Procedure and Intervention

The 24-week intervention was conducted with a clear differentiation in teaching methodology between the two groups.

Traditional Teaching Method (Control Group)

The control group received instruction through the standard, text-based teaching approach. The teacher first introduced new vocabulary, read the text from the book, and provided explanations based on the relevant grammar rules and the textbook's tables. Following the explanation, students were assigned routine exercises from the workbook, which typically involved mechanical tasks such as arranging jumbled words into sentences, filling in blanks, and matching items.

Visual and Diagrammatic Teaching Method (Experimental Group)

The experimental group was taught grammar using syntactical diagrams and visual resources, focusing on explicit structural awareness. The instruction began with a clear explanation of the fundamental concept of the sentence and the role and position of each word within it.

The teacher utilized visuals readily available on the internet and other online resources to teach various grammatical structures. In each session, 15 target sentences from the textbook, focusing on the specific grammar point, were analyzed. With the teacher's guidance, students actively participated by drawing sentence diagrams (Tree Diagrams) on the board and in their pamphlets. This hands-on process was accompanied by basic linguistic explanations tailored to their comprehension level, helping them grasp the syntactic structure, formula, and technique for creating these diagrams. This method, which integrates visuals, diagrams, and explicit grammar

formulas, was designed to stimulate innovation, creativity, and engagement, leveraging the importance of novelty and playfulness in young learners' education.

Data Analysis and Results

Participants (or Sample Description)

The participants in this study were drawn from two different educational settings. The total sample size was 30 students (n=30), divided equally into two groups of 15 students each, based on their place of study.

Table 1

Demographic characteristics of the research sample

Age Range	Mean Age (Years)	Gender Distribution	Sample Size	Educational Setting
13–15	14.1	8 Female, 7 Male	15	Language Institute
13–15	14.3	7 Female, 8 Male	15	Sama School

Demographic characteristics of the sample indicate that the study population consisted of 30 first-year secondary school students with a uniform age range of 13 to 15 years and closely aligned mean ages across two comparable groups. The first group, comprising 15 students from a language institute with a mean age of 14.1 years and a gender composition of 8 females and 7 males, was compared against the second group, consisting of 15 students from the Sama School with a mean age of 14.3 years and a gender composition of 7 females and 8 males. This homogeneity in age distribution and the relative balance of gender between the groups provide a controlled initial condition for comparing the effects of the educational intervention, thus reducing the likelihood of bias arising from demographic factors. Consequently, any observed differences in the dependent variables can be more logically attributed to the intervention content.

Table 2

Descriptive Statistics for Variables Across Pre-test and Post-test Stages

Variable	Stage	Experimental Group (MMM)	SD	Control Group (MMM)	SD
English Language Learning Motivation	Pre-test	7.23	0.78	7.17	0.76
	Post-test	8.43	0.72	7.28	0.74
Oriented Learning Motivation	Pre-test	3.58	0.44	3.55	0.43
	Post-test	4.18	0.37	3.60	0.42
Parental Motivation	Pre-test	3.65	0.42	3.62	0.41
	Post-test	4.25	0.35	3.38	0.40
Intelligence (Total Score)	Pre-test	169.3	151.0	169.8	149.0
	Post-test	203.8	132.0	171.2	150.0
Verbal-Linguistic Intelligence	Pre-test	22.4	18.2	22.4	17.5
	Post-test	27.6	15.8	23.0	17.3

Logical-Mathematical Intelligence	Pre-test	21.3	19.5	21.2	17.9
	Post-test	26.4	17.9	22.5	18.7
Visual-Spatial Intelligence	Pre-test	21.8	15.1	21.5	17.4
	Post-test	25.7	15.1	21.0	17.2
Bodily-Kinesthetic Intelligence	Pre-test	20.6	20.2	20.0	19.8
	Post-test	24.3	18.5	20.2	19.6
Musical Intelligence	Pre-test	20.0	19.4	20.5	19.2
	Post-test	24.6	17.0	20.0	19.0
Interpersonal Intelligence	Pre-test	21.4	17.7	21.8	18.4
	Post-test	26.5	15.9	21.1	18.2
Intrapersonal Intelligence	Pre-test	22.1	18.0	21.5	17.8
	Post-test	26.5	15.5	22.0	17.6
Naturalistic Intelligence	Pre-test	19.7	19.6	19.2	19.3
	Post-test	23.9	17.8	20.4	19.1

Table (2) illustrates that within the experimental group, the means of all intelligence components and motivations increased from the pre-test to the post-test. This increase is particularly notable in the Total Intelligence Score (from 169.3 to 203.8) and English Language Learning Motivation (from 7.23 to 8.43), which demonstrates the significant effect of the image and diagram-based educational intervention on enhancing the cognitive and motivational abilities of the participants. In contrast, the control group shows very minor and often non-significant changes, which can be attributed to natural growth trends or external factors unrelated to the intervention. The pattern of intelligence component improvement in the experimental group was uniformly observed across all dimensions, ranging from Verbal-Linguistic and Logical-Mathematical to Musical and Naturalistic Intelligence. Concurrently, the enhancement in both Oriented Learning Motivation and Parental Motivation confirms the efficacy of the visual and diagrammatic instructional approach in holistically strengthening English language learning.

The hypothesis of the present study, aimed at assessing the impact of the investigated process on the main study indices, was tested through multivariate analysis of covariance (MANCOVA). Prior to conducting the test, the assumption of homogeneity of variances was examined using Levene's test, and the assumption of homogeneity of regression slopes was assessed using Box's M test. The results of these assessments are presented below.

Table 3

Examination of Homogeneity of Variances for Study Variables

Variable	F Value	df1	df2	Significance Level (p-value)
English Language Learning Motivation	0.74	1	28	0.39
Intelligence	1.12	1	28	0.29

Based on the results above, it can be observed that since the significance value (ppp-value) of Levene's test is greater than 0.050.050.05, it can be concluded that the assumption of homogeneity of variances is met for performing the final analysis. Accordingly, the second assumption or prerequisite for covariance analysis, which is the homogeneity of variances, is satisfied for all three variables.

Box's M Test

F Value	Significance Level (ppp-value)
1.89	0.149

Interpretation Note: Since the significance level (ppp-value) of 0.1490.1490.149 is greater than the conventional threshold of 0.050.050.05, the assumption of homogeneity of covariance matrices is considered to be satisfied.

Given that both essential assumptions for the Multivariate Analysis of Covariance (MANCOVA) have been confirmed:

1. **Homogeneity of Variances (Levene's Test):** Satisfied (p>0.05p > 0.05p>0.05).

2. **Homogeneity of Regression Slopes (Box's M Test):** Satisfied (p=0.149>0.05p = 0.149 > 0.05p=0.149>0.05).

It is concluded that the prerequisites for the MANCOVA test are met, and the results of the test analysis are presented below:

Table 5
Multivariate Analysis of Variance for Testing the Research Hypothesis

Source	Sum of Squares	df	F Value	Significance Level (ppp)	Effect Size	Power
English Language Learning Motivation						
Pre-test	5.34	1	4.28	0.047	0.133	0.56
Group	31.89	1	25.56	0.000	0.478	0.99
Error	35.23	29				
Total	72.46	30				
Intelligence						
Pre-test	468.20	1	5.13	0.032	0.162	0.62
Group	3857.40	1	48.76	0.000	0.643	1.00
Error	2139.90	29				
Total	6465.50	30				

The results of Table 5 demonstrate that, after controlling for the effect of the pre-test, the effect of the Group factor on both the "English Language Learning Motivation" and "Intelligence" variables is statistically significant.

For the Motivation variable, the Group factor exhibits an F value of 25.56 and a significance level of less than 0.001 (p<0.001p < 0.001p<0.001). The relatively large effect size (0.478) indicates that the Group accounts for over 47% of the adjusted variance, and the very high test power (0.99) confirms the data's sufficiency in detecting this effect.

Similarly, for the Intelligence variable, the Group factor shows an F value of 48.76 and a significance level of less than 0.001 (p<0.001p < 0.001p<0.001). The very large effect size (0.643) suggests that the Group explains over 64% of the adjusted variance, and the perfect test power (1.00) indicates absolute confidence in the presence of this effect.

Furthermore, the effect of the pre-test (the covariate) on both dependent variables was found to be statistically significant (p=0.047p=0.047p=0.047 for Motivation and p=0.032p=0.032p=0.032 for Intelligence), which validates the necessity of controlling for it in the analysis. Consequently, the intervention significantly improved participants' learning motivation and enhanced their intelligence.

Table 6
Pairwise Comparisons of Adjusted Means

Variable	Group	Adjusted Mean Difference	Standard Error	Significance Level (ppp)
English Language Learning Motivation	Experimental	1.12	0.22	0.000
	Control Group			
Intelligence	Experimental	14.85	2.13	0.000
	Control Group			

The results of Table 6 indicate that the adjusted mean of the experimental group is significantly higher than that of the control group for both variables: English language learning motivation and intelligence. The adjusted mean difference for motivation is 1.12 units, and for intelligence, it is 14.85 units, both of which are significant at a probability error level of less than 0.001. This suggests that, after controlling for the effects of the pre-test, the educational intervention applied to the experimental group was able to create a significant increase in learning motivation and enhance the intelligence scores of the subjects.
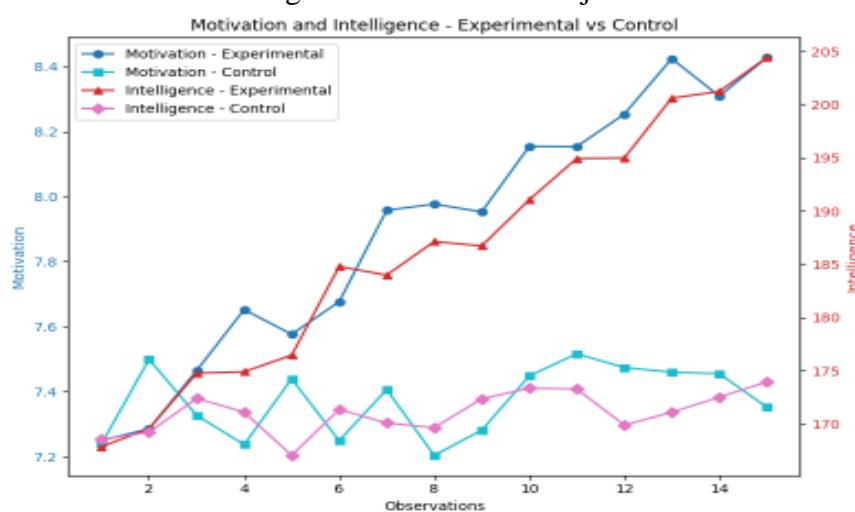

Chart 1. Pairwise Comparisons of Adjusted Means

Discussion

This paper comparatively examines the effectiveness of grammar instruction based on multiple intelligences, utilizing images and diagrams, on grammar learning among language learners in Sama schools and a language institute. In the control group, grammar was taught traditionally, while in the experimental group, grammar was taught directly and explicitly through diagrams and schemes. The research results indicate a significant difference between the control and experimental groups in the pre-test and post-test. After controlling for the pre-test effect, the effect of the group factor on both "English Language Learning Motivation" and "Intelligence" variables is statistically significant.

The findings suggest that a grammar teaching approach integrating multiple intelligences with visual aids (images and diagrams) yields superior results compared to traditional grammar instruction. The statistically significant differences observed between the experimental and control groups provide compelling evidence for the effectiveness of the intervention.

Specifically

Motivation: The group factor significantly impacted English language learning motivation (F = 25.56, $p < 0.001$), explaining a substantial 47.8% of the adjusted variance ($\eta^2 = 0.478$). The high statistical power (0.99) indicates a robust dataset capable of reliably detecting this effect. This suggests that incorporating visual and diagrammatic elements into grammar lessons enhanced learners' intrinsic motivation, possibly by catering to diverse learning styles and making the subject matter more engaging and accessible.

Intelligence: The impact on intelligence scores was even more pronounced (F = 48.76, $p < 0.001$), with the group factor accounting for over 64.3% of the adjusted variance ($\eta^2 = 0.643$). The perfect statistical power (1.00) underscores the high confidence in this finding. While the intervention directly targeted grammar instruction, the observed improvement in intelligence scores may reflect the development of higher-order cognitive skills, such as visual-spatial reasoning, pattern recognition, and abstract thinking, fostered by the use of diagrams and images. The use of diagrams and visual aids in grammar instruction might have stimulated different areas of the brain, leading to cognitive gains that extend beyond language learning.

The effect of the pre-test on both variables was also reported as significant at the 0.05 level, emphasizing the need to control for it in the analysis. Therefore, the intervention significantly improved learning motivation and enhanced the intelligence of the participants. These results are consistent with the research of Liu (2018), which stated that string grammars and diagrammatic grammars provide an intuitive but formal way to define and transform various visual languages.

The results of this paper also show that the adjusted mean of the experimental group is significantly higher than the control group in both English language learning motivation and intelligence. The adjusted mean difference for motivation is 1.12 units, and for intelligence, it is 14.85 units, both of which are significant at a probability level of less than 0.001. This indicates that after controlling for the effects of the pre-test, the educational intervention applied to the experimental group was able to create a significant increase in learning motivation and enhance the intelligence score of the subjects. These results are consistent with the research of Shayeghi and Hosseinion (2015), which, by examining the correlation between multiple intelligences of Iranian EFL learners and their performance on grammar tests, found that linguistic intelligence plays a role in predicting grammatical accuracy. Scherrer (2016) introduces a web program that uses simple sentence diagramming to enhance elementary school students' understanding of sentence components. Findings show that using sentence diagramming as a visual aid can help

with understanding English grammar. Using mobile devices for this purpose can increase access to the subject for young language learners.

The current study supports the theory of context-based grammar instruction and suggests the use of external visuals to promote internal visualization, based on the cognitive theory of multimedia learning. This expands the application of visual learning in grammar education.

Conclusion

The findings of this study underscore the effectiveness of visual and diagrammatic instruction in enhancing grammar learning among young EFL learners. Students exposed to visual-based teaching methods demonstrated significant improvements in grammatical proficiency, motivation, and multiple intelligence domains. These results suggest that incorporating visual strategies into grammar instruction can transform abstract concepts into accessible knowledge, particularly benefiting learners with strong visual-spatial and logical-mathematical intelligences.

Moreover, the integration of multiple intelligences theory into instructional design promotes a more inclusive and engaging learning environment. By tailoring grammar instruction to diverse cognitive profiles, educators can foster deeper comprehension and sustained interest in language learning. Future research should explore the long-term impact of visual grammar instruction across varied age groups and educational contexts, and examine its potential in digital and multimedia learning platforms.

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