TEACHING OF ENGLISH GRAMMAR THROUGH TED-ED VIDEOS: AN EXPERIMENTAL STUDY OF UNDERGRADUATE PAKISTANI LEARNERS

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ISLAMABAD

December, 2024

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B.S (Hons)., UCSI University, Malaysia, 2019

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF PHILOSOPHY

In **English**

To

FACULTY OF ARTS & HUMANITIES

NATIONAL UNIVERSITY OF MODERN LANGUAGES, ISLAMABAD

FACULTY OF ARTS & HUMANITIES
NATIONAL UNIVERSITY OF MODERN LANGUAGES

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Candidate of **Master of Philosophy** at the National University of Modern Languages do hereby declare that the thesis **Teaching Of English Grammar Through TED-Ed Videos: An Experimental Study of Undergraduate Pakistani Learners** submitted by me in partial fulfillment of MPhil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in future, be submitted by me for obtaining any other degree from this or any other university or institution.

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ABSTRACT

Title: Teaching Of English Grammar Through TED-Ed Videos: An Experimental Study of Undergraduate Pakistani Learners

Animation has become a pivotal tool in online education, particularly in language acquisition, leveraging platforms like TED for its wide accessibility and user-friendly interface. This study explores the impact of animated TED-Ed videos on English grammar learning among undergraduate students in Mardan, Pakistan. Guided by Mayer's Cognitive Theory of Multimedia Learning (CTML) and Cognitive Load Theory (CLT), the research aimed to assess learning outcomes and student satisfaction. The study employed a mixed-methods approach, initially conducting a pilot study with 10 students followed by a main study involving 206 undergraduates from the English Department of Government Girls Post Graduate College. Data collection included pre- and post-tests alongside a Learning Satisfaction Survey (LSS). A multimodal analysis of selected animated TED-Ed videos evaluated their alignment with the CTML principles: spatial contiguity, temporal contiguity, signaling, redundancy, and coherence. Findings indicated a significant positive impact of animated TED-Ed videos on English grammar learning outcomes, rejecting the null hypothesis in favor of their effectiveness. The multimodal analysis confirmed that videos adhered to CTML principles, effectively managing cognitive load and enhancing learning outcomes. Moreover, the LSS revealed high levels of student satisfaction, affirming the educational value of animated TED-Ed videos in the classroom. In conclusion, the integration of animated TED-Ed videos in English grammar instruction positively influences undergraduate learning experiences by optimizing cognitive load management and enhancing academic satisfaction. This research contributes to the potential of multimedia resources in enhancing educational outcomes in diverse linguistic and cultural contexts. The study's findings have global implications and can potentially enrich the pedagogical approaches of English Language Teaching (ELT) in Pakistan, thereby promoting more effective and engaging environments for language learning.

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CTML: The Cognitive Theory of Multimedia Learning

CTL: Cognitive Load Theory

LSS: Learning Satisfaction Survey

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to the following individuals whose support and guidance have been invaluable throughout my academic journey:

Firstly, to my supervisor, Dr Ghazala Kausar, whose expertise, patience, and mentorship have helped me shape not only this thesis but also my growth as a scholar. Your insightful feedback and unwavering support were greatly appreciated, and I am truly grateful for your guidance.

Secondly, to my close friend Dee, thank you for always being there for me. Your support, listening ear, encouragement, and understanding mean so much to me and keep me going. I truly value your belief in me, especially at times when I didn't believe in myself. Thank you for being my rock and for always cheering me on, when no one else did.

And to the esteemed English Department faculty and staff at Government Girls Post Graduate College, Baghdada, thank you for providing the opportunity to conduct my research at your institution. Your cooperation made this study's data collection possible.

Finally, I express profound appreciation to the participants of this study. Their openness in sharing experiences and insights has been indispensable for the fulfillment of this research. Their invaluable contributions have been duly acknowledged, and I am sincerely grateful for their time and cooperation.

DEDICATION

I dedicate this thesis to myself.

CHAPTER 1

INTRODUCTION

English, recognized as the most widely spoken non-native language globally (Rao, 2019), is reported by the British Council to be acquired by over one billion individuals as a second language at any given moment (Sanchez, 2017). As a global lingua franca, it emphasizes its indispensable role in fostering economic success and international connectivity, both nationally and individually (Rao, 2019). However, the growing demand for English language learning materials for non-native students has overtaken the availability of qualified teachers necessary to offer optimal learning opportunities (Shin, 2008). One way of addressing this issue involves the development of educational materials that utilize modern technologies, such as web-based animated educational videos, teaching materials, and learning platforms, to provide cost-effective and convenient instruction. Thereby, making education more accessible to learners. However, despite the widespread availability of numerous teaching materials developed globally for English language learners, a limited number of these products have been thoroughly assessed to determine how effective they are in helping learners actually improve their linguistic proficiency and competence in the English language (Huang, 2023).

1.1 Background to the Study

In the realm of language acquisition and pedagogy, the teaching of English grammar remains a perpetual challenge in language education, particularly in the context where English serves as a second or foreign language. Effective grammar instruction is fundamental to developing proficiency and competence in English language skills, encompassing listening, writing, reading, and speaking abilities. In the pursuit of enhancing pedagogical strategies, educational technologies have increasingly become integral tools in facilitating language learning processes. Among these resources, the integration of technology, particularly animated educational videos, has emerged as an auspicious tool for enhancing learning experiences and outcomes.

The integration of digital media in education has significantly transformed traditional instructional methodologies with multimedia resources offering interactive and visually compelling resources that engage students and potentially enhance comprehension and retention of linguistic concepts. Animated videos, in particular, have garnered attention for their ability to present complex academic concepts in a dynamic and accessible format, catering to diverse learning styles and preferences, as seen in the works of Huang (2023), Tahira & Batool (2021), Anggraenia et al. (2019) and Silvani (2020).

Despite the establishment of strong online and distance-learning initiatives in multiple developed nations, the integration of such technology remains limited in some regions, particularly in Pakistan, where many educational institutions still lack adequate technological infrastructure (Farooq et al., 2020). The choice of Pakistan as this study's focal point is significant, considering the nation's growing emphasis on English proficiency for academic, professional, and social advancement. However, Pakistani educational institutions predominately adhere to traditional lecture-based teaching methods, resulting in limited exposure among educators and faculty members to innovative, tech-driven pedagogical tools such as animated videos (Farooq et al., 2020). Within Pakistani higher education institutions, the challenge lies not only in imparting grammatical knowledge but also in fostering practical language skills that enable effective communication in English-speaking environments.

In light of these challenges, e-learning platforms such as TED-Ed have emerged as valuable educational resources, offering interactive, animated videos that allow students to engage with content outside the traditional classroom. These platforms enable students to access a wide array of materials, ranging from instructional videos to discussion forums and research articles, which facilitate learning beyond the confines of face-to-face instruction. Multimedia learning materials have emerged as one of the most widely used learning materials in the education world. Amidst the current rapid advancements in technology, educational technologies have undergone significant evolution and change the educational practices. This transformation has been marked by the proliferation of diverse tools, with multimedia elements assuming a pivotal role in shaping educational frameworks (Jonassen, 2004; Malik & Agarwal, 2012).

Multimedia learning, as defined by Mayer and Moreno (2003), involves the integration of both textual and visual elements to enhance cognitive processing. This

approach is especially effective for complex subjects like language learning, where visuals (e.g., animations and diagrams) can significantly aid in the understanding of abstract concepts. Animation has become a ubiquitous and valuable feature in online language acquisition, offering dynamic, engaging, and effective ways of presenting grammatical structures, thus catering to diverse learner needs.

To maximize the benefits of animation for enhanced learning, it is essential to explore various perspectives on its optimal integration into educational materials. Animated content is often visually compelling, creative, and engaging, thus capturing learners' interest and facilitating deeper comprehension of the subject matter. Additionally, with the expanding global need for English proficiency, there is an increasing demand for accessible and reliable English teaching tools, with animation being considered a convenient and credible approach to teaching grammar.

From a semiotic perspective, understanding animation's unique tools for creating meaning is useful for explaining diverse concepts. Understanding how animated representations of grammar can support language learning is crucial, as it helps students not only master grammar rules but also develop the ability to use language effectively in real-world contexts (Unsworth, 2020). Tytler et al. (2018) highlight the importance of mastering both verbal and visual modes of communication, suggesting that success in language acquisition is closely linked to the ability to interpret and produce meaning through both forms of communication (Bazerman, 2009; Klein & Boscolo, 2016; Unsworth, 2001). Therefore, by undertaking an experimental study, this research aimed to contribute empirical evidence on the effectiveness of animated TED-Ed videos as a supplementary tool in grammar pedagogy. It also offered insights into potential avenues for enhancing language education methodologies and improving learning outcomes.

In this study, grammar is defined as the system of rules governing language use, including the formation of words (morphology), sentence construction (syntax), and the relationships between words in sentences (semantics and pragmatics). In the context of English, grammar involves understanding and applying rules related to parts of speech, tense, aspect, voice, sentence structure, punctuation, and other linguistic elements that ensure effective and coherent communication (Chomsky, 1957; Celce-Murcia, 2001). Specifically, the research focused on how grammar instruction through animated TED-Ed videos influenced undergraduate student's ability to learn and apply grammar, with

particular attention to the impact on their academic satisfaction and learning outcomes. Thus, grammar in this context referred not only to the explicit knowledge of grammatical forms but also to the application of this knowledge in real-world language use.

To operationalize the concept of grammar in this study, it was measured through learners' performance on grammar-based pre-and post-test questionnaires. These tests assessed the participants' understanding of key grammatical rules, including syntax, parts of speech, and punctuation, as presented in the selected animated TED-Ed videos. The focus on these specific areas of grammar was grounded in their foundational role in language proficiency and their importance for enhancing students' grammatical skills in both written and spoken English.

Understanding syntax is essential for students to form grammatically correct sentences and express their ideas clearly. Syntax governs the arrangement of words, phrases, and clauses within a sentence, making it crucial for constructing both simple and complex sentences. Mastery of syntactic rules allows students to produce coherent and varied sentence structures, a skill that is vital for effective communication, particularly in academic and professional contexts. Radford (2009) emphasized that the ability to manipulate syntactic structures is a key indicator of language proficiency, especially for non-native English learners. In Pakistan, where students often struggle with word order and sentence formation, syntax becomes a critical focus area. This study, therefore, prioritized syntax as one of the primary challenges faced by Pakistani learners in mastering English grammar.

Additionally, punctuation plays an equally crucial role in ensuring that a sentence conveys its intended meaning clearly. Punctuation marks such as commas, periods, and question marks help organize ideas and indicate relationships between them. Improper use of punctuation can lead to misunderstandings, even when sentence structures are otherwise correct. According to Biber et al. (1999), punctuation is not simply a mechanical tool but an essential component of grammatical accuracy that facilitates effective communication. For Pakistani learners, mastering punctuation is especially important for academic writing and reading comprehension, as errors in punctuation can obscure the clarity of their arguments. This study emphasized punctuation as a critical element for student's ability to communicate clearly and coherently, particularly in written academic contexts.

The parts of speech, such as nouns, verbs, adjectives, and adverbs, form the fundamental building blocks of grammar. A strong understanding of how these parts function within a sentence is key to mastering more complex grammatical structures. For example, recognizing the role of a verb in expressing action or understanding how adjectives modify nouns is essential for constructing meaningful and accurate sentences. Celce-Murcia (2001) noted that a solid grasp of parts of speech is foundational for progressing to more advanced grammar concepts. For undergraduate students in Pakistan, understanding these basic elements is a crucial first step in developing proficiency in English. Given that traditional teaching methods may not always emphasize the practical application of these concepts, this study aimed to address this gap by integrating animated TED-Ed videos to explain and visualize word functions in context.

Learning effectiveness was evaluated based on two primary variables: learning outcomes and learning satisfaction. Huang et al. (2012) similarly underscored learning outcome and learning satisfaction as critical criteria for evaluating the effectiveness of student learning processes. Learning outcomes, through test scores (Shih et al., 2012), reflected how well students had grasped the grammatical concepts taught through the animated TED-Ed videos. Learning satisfaction, on the other hand, encompasses learners' feelings, attitudes, and enjoyment towards their learning activities (Long, 1985 as cited in Kuo et al., 2015). Piccoli et al. (2001) proposed that learning satisfaction reflects learners' contentment with both the learning process and its outcomes, making it a pertinent measure in assessing satisfaction with the classroom experience. Consequently, this study considered learning outcomes and learning satisfaction as pivotal factors in evaluating student learning effectiveness using animated TED-Ed videos in English grammar teaching materials.

The focus of this research was particularly timely and relevant within the context of Pakistani undergraduate education, where English serves as a vital medium for academic and professional success. Understanding and mastering English grammar is crucial for effective communication in diverse contexts, including academia, business, and everyday interactions in an increasingly globalized world. This study aimed to contribute to both research and the Pakistani academic community by assessing how multimedia learning, specifically through animated TED-Ed videos, impacted undergraduate students' learning effectiveness and satisfaction in English

language classrooms in Pakistan. Through this investigation, the study aimed to offer valuable insights into how technology can enhance English language education, particularly in environments with limited access to traditional learning resources.

1.2 Statement of the Problem

In Pakistan, undergraduate English grammar instruction primarily relies on traditional methods, which often fail to engage students effectively or accommodate diverse learning needs. This results in persistent challenges in enhancing students' grammatical proficiency, a crucial skill for academic and professional success. While multimedia tools like animated TED-Ed videos have demonstrated the potential to improve learning outcomes by integrating visual and auditory elements, their use in teaching English grammar within the context of Pakistani higher education has not been sufficiently explored.

Given the growing importance of English proficiency in Pakistan’s educational and professional landscape, there is a clear need for research on the benefits of incorporating animated TED-Ed videos into the English language curriculum. Specifically, the use of such multimedia tools in public educational institutions, particularly in Mardan, Pakistan, has yet to be investigated.

While there has been research into the effectiveness of multimedia in language teaching, few studies have specifically examined the use of animated TED-Ed videos to teach English grammar, particularly in the Pakistani context. This study aimed to fill this gap by evaluating how animated TED-Ed videos can enhance students' understanding of these key areas of grammar increase their engagement and improve overall learning outcomes. By focusing on syntax, punctuation, and parts of speech, the study aimed to provide insights into how these grammatical components could be taught more effectively using multimedia tools, thus improving learning outcomes for undergraduate students in Pakistan. By addressing this underexplored area, the study contributed valuable insights into the potential of multimedia-based grammar instruction in the context of Pakistani tertiary education.

1.3 Research Objectives

1. To assess the impact of animated TED-Ed videos_on the effectiveness of undergraduate students' English grammar learning in the classroom, as measured by learning outcomes.
2. To evaluate the level of academic satisfaction among undergraduate students regarding the integration of animated TED-Ed videos in English grammar learning within a classroom setting.

1.4 Research Questions

1. How do animated TED-Ed videos impact the effectiveness of undergraduate students' English grammar learning in the classroom, based on learning outcomes?
2. How academically satisfied are undergraduate students with incorporating animated TED-Ed videos in English grammar learning within a classroom setting?

1.5 Significance of the Study

In contemporary English education, the traditional approach remains teacher-centered, emphasizing rote memorization from textbooks. Understanding and retaining English concepts, particularly grammar, pose significant challenges for learners. Considering societal and economic advancements, there is a growing demand for proficient English speakers globally. Consequently, the conventional English education paradigm faces considerable scrutiny and pressure across all educational tiers (Liu & Long, 2014).

This current study is significant in the fields of both pedagogy and educational technology pertaining to English language learning among Pakistani undergraduate students. Exploring the efficacy of employing animated TED-Ed videos as a means of teaching English grammar, it addresses a pressing need within the educational landscape of the country. Given the increasing prevalence of digital resources and the challenges often associated with traditional grammar instruction methods, such as rote

memorization and lack of engagement, this study offers potential insights into innovative and effective teaching strategies.

Moreover, the focus on Pakistani undergraduate learners added a nuanced dimension, considering the specific linguistic and cultural context. Understanding how such learners engage with and benefit from animated TED-Ed videos for grammar instruction can inform curriculum development and instructional practices tailored to the needs and preferences of this demographic. It established a connection between the students' attitudes and the implementation of animation in English Language learning materials.

Overall, this thesis contributes to the broader discourse on language education by investigating the practical implications of integrating technology-enhanced instructional methods into the teaching of English grammar, particularly within the context of Pakistani undergraduate education. Moreover, through the identification of beneficial and effective techniques for creating high-quality and effective educational animated videos, recommendations can be offered to higher education instructors and institutions to enhance the quality of linguistic education.

1.6 Organization of the Study

This section outlines the structural organization of the current study across its five chapters, detailing the main content covered in each.

Chapter One is the introductory chapter of the study that presents its background, problem statement, research objectives, research questions, significance of the study, and the organization of the chapters in this paper.

Chapter Two delved into the Literature Review, systematically reviewing relevant literature and past studies of similar research areas to establish interrelations among them. Furthermore, it connected English grammar learning with the use of animation and it cited other works in recent years about English language learning with the employment of animation in other contexts.

Chapter Three described the study's methodology, explaining a comprehensive exposition of the study's research design, data collection, sample, participants,

theoretical framework employed, so on. Overall, this section explained how the research was conducted.

In Chapter Four, the collected data is analyzed within the framework of the study's research methodology and design, encompassing a pilot study, pre-and post-test research design and satisfaction survey to answer the study’s research questions. This segment constitutes the central body of the thesis, presenting the empirical findings derived from the data analysis.

Lastly, Chapter Five is the conclusion chapter in which it summarized the major findings of the research and stated the limitations of the study, as well as recommended some suggestions for future researchers.

CHAPTER 2

LITERATURE REVIEW

In this section, relevant research works related to the teaching of English through multimedia learning are reviewed by the researcher.

2.1 Innovations and Technology in English Language Learning

Ahmad (2012) highlighted the challenges English teachers encounter when incorporating technology media in classrooms, citing the vast array of online resources that can serve as motivational tools and aids for student-directed learning. His study focused on statistical findings regarding the integration of media in English Language Teaching (ELT), suggesting that access to media technologies expands learners' opportunities to engage not only locally but also globally. His research was conducted at King Abdul Aziz University which indicated that both students and teachers strongly agreed on the positive impact of technological devices on English language education. Nevertheless, Ahmad underscored that while technology plays a significant role, teachers remain indispensable in guiding the efficient use of these tools for language acquisition.

In contemporary education, Neumajer (2016) observed that while teachers have access to a wealth of online ideas, they often face time constraints when navigating the extensive array of available materials and sources. He asserts that this abundance presents a significant advantage for language educators who possess the linguistic proficiency to swiftly exchange ideas and innovations. Neumajer (2016) emphasized the benefits of authentic listening experiences and the capability to pause and replay videos as valuable assets. He discusses various tools such as shared video conferences, online dictionaries with pronunciation guides, and the creation of digital books and videos with unique elements, as effective learning resources. These tools have the potential not only to enhance language comprehension but also to foster language production skills.

2.2 Cognitive Theory to Multimedia Learning (CTML)

2.2.1 Background to CTML

In higher educational settings, Becker et al. (2017) stated that blended or hybrid courses have gained popularity, and although students are increasingly adopting online and blended learning models, their acceptance comes with certain reservations.

In Venable's (2018) survey on online students, the primary issue of concern was identified as the quality of instruction and academic support. As online and blended learning continue to expand in popularity, there is a natural inquiry into the optimal design of multimedia environments to enhance learning outcomes. This trend is particularly pertinent in language learning, where the increasing popularity of online and blended language courses underscores the importance of understanding effective learning strategies in these contexts (Meskill & Anthony, 2015).

Given the widespread adoption of technology in language learning, it is crucial to guide its incorporation using proven approaches. Hastings and Tracey (2005) emphasize moving beyond simplistic contrasts of media versus methods, advocating instead for deeper exploration of how these elements can collaboratively enhance learning. Similarly, Sykes (2014) proposes a shift from comparisons between media and non-media approaches to a more nuanced focus on identifying effective practices that foster language learning within multimedia environments. The term multimedia, by definition, refers to using words, pictures, and sound to represent teaching and learning material (Mayer et al., 2003). Through the integration of these multimedia elements, it has the potential to enrich the learning experience and promote deeper comprehension throughout the learning process.

Yang et al. (2014) prompt a broader examination beyond the media versus methods discourse to explore their intersection and stress the pivotal role of learners in shaping multimedia learning environments. Clark (2015) argues for the selection of evidence-based practices combined with media that support fundamental psychological processes of learning.

2.2.2 The Theory of CTML

Research into multimedia learning revolves around the principle that effective multimedia instruction should be crafted in accordance with how the human mind

functions to enhance effectiveness and facilitate significant learning outcomes. One widely recognized and accepted theory within the realm of multimedia instructional design is Richard Mayer's Cognitive Theory of Multimedia Learning (CTML) (2005).

Yang et al. (2014) asserted that historical discourse on learning design, particularly the media versus methods debate, frequently neglected the learner. Nevertheless, Mayer's CTML stands out as a significant departure from this oversight, prioritizing the learner and acknowledging their active cognitive engagement within multimedia learning contexts (Yang et al., 2014).

CTML outlines several cognitive processes: identifying pertinent words from presented text or narration, selecting relevant images from presented graphics, structuring selected words into a coherent verbal representation, organizing chosen images into a cohesive visual representation, and integrating these visual and verbal representations with prior knowledge, as seen in Figure 1 below.

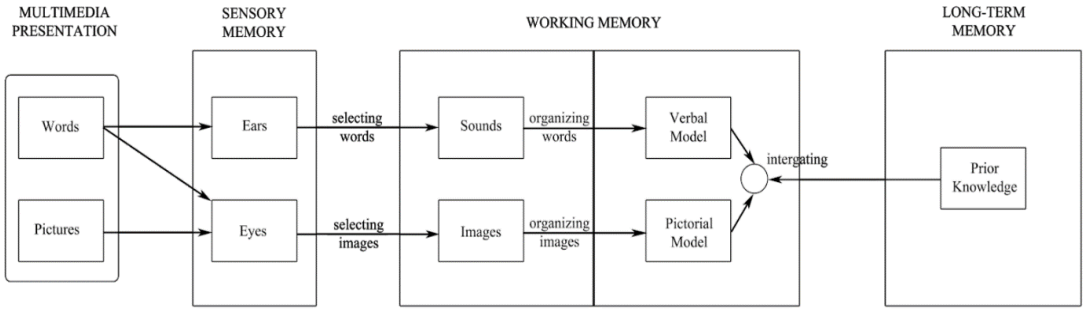

Figure 1. Mayer's (2005) Cognitive Theory of Multimedia Learning.

This theory is based on the assumptions that humans utilize dual channels—visual and auditory—for processing, possess limited processing capacity, and actively engage in processing pertinent information, integrating it into their evolving cognitive framework (Mayer, 2001).

Mayer (2005, 2019) stated that humans possess a limited processing capacity, leading us to engage in active processes of organizing, selecting, and integrating information using our existing knowledge. Therefore, instructional design should incorporate appropriate visual and verbal elements to facilitate learning, avoiding excessive strain on either processing channel (Mayer, 2014).

He formulated evidence-based guidelines for multimedia design, encompassing principles such as the Multimedia Principle, Modality Principle, Temporal Contiguity Principle, Spatial Contiguity Principle, Coherence Principle, Redundancy Principle, Pre-training Principle, Segmenting Principle, Signaling Principle, Voice Principle, Personalization Principle, and Embodiment Principle. The Multimedia Principle asserts that learning outcomes are enhanced when information is presented through a combination of pictures and words rather than through words alone. According to Mayer, this principle serves as the cornerstone of CTML research and demonstrates the most significant impact on learning.

Mayer categorized these principles based on their roles in managing different types of cognitive processing. Regarding the management of extraneous processing, the Contiguity Principles (Temporal and Spatial) suggest that learning is optimized when visual and verbal elements are presented close together in time and space, respectively, rather than apart or sequentially. Similarly, the Signaling Principle emphasizes the benefit of highlighting important information visually, to enhance learning. The Coherence Principle and Redundancy Principle also aim to reduce extraneous processing; the former asserts that learning improves when irrelevant materials are removed, while the latter indicates that learning is enhanced when information is presented through images and either text or narration, but not both simultaneously.

In terms of facilitating essential processing in multimedia learning environments, Mayer identifies the Segmenting Principle, Pre-Training Principle, and Modality Principle to be of importance. The Pre-Training Principle suggests that introducing key terms or concepts beforehand enhances learning outcomes, while the Segmenting Principle states that information is better absorbed when presented in shorter segments rather than continuously. Similarly, the Modality Principle asserts that learning is more effective when information is presented through images accompanied by narration rather than images paired with printed text.

Beyond the above, the Personalization Principle argues that learning is optimized when presented in an informal, conversational style. The Voice Principle contends that human narration enhances learning more than computer-generated voices. Lastly, the Embodiment Principle suggests that incorporating humanlike gestures and realistic interactions from on-screen agents fosters optimal learning experiences.

Considering the above principles, Mayer cautions that the learning processes outlined in his model are likely iterative rather than linear, involving repeated cycles of evaluation, adaptation, and improvement.

2.3 TED-Ed and English Language Learning

Since Pakistan's establishment in 1947, the English language has played a significant role in its official, economic, educational, and to a certain extent, social spheres (Mahboob, 2009). In educational settings, there has been a recent shift among researchers toward using authentic materials for teaching grammar (Aidinlou & Moradinejad, 2016; Takaesu, 2013). The term "authentic" here, refers to materials—such as text, video, or audio—that were not originally developed for English language instruction but are sourced from real-world outlets such as news agencies, podcasts, or video platforms. Teachers then design questions, activities, or projects based on these authentic materials, tailored to the proficiency level of their students.

According to Thomas (2014), authentic materials are designed to convey meaning and information for real communication purposes rather than being primarily intended as tools for language instruction. These resources are easily accessible online or in specific community settings and are frequently utilized in English language education. With advancements in technology and internet accessibility, language educators now have a variety of options available, including the use of authentic materials like TED-Ed. These resources facilitate students' exposure to authentic language use and enable them to learn content alongside language structures.

Nowadays, advancements in technology enable educators the opportunity to integrate online videos and digital platforms into their teaching practices, providing access to authentic resources that enhance the teaching and learning experience. Sanjmyatav and Sumiya (2020) reported that TED talks are widely recognized among educators, and feature presentations by intellectuals, experts, and notable figures addressing a wide array of topics, including health, science, business, and global issues. TED's mission is to influence attitudes, lives, and global perspectives through its talks, speeches, and videos, leading to the establishment of initiatives such as TED Conferences, TEDx events, TED Books, and TED-Ed videos.

TED-Ed is among these initiatives, dedicated to empowering teachers and igniting the curiosity of learners worldwide through short, engaging, and award-winning animated videos. In addition to its educational videos, TED-Ed provides educators with tools like the "lesson creator," which enables them to design tasks based on their videos and evaluate students' engagement with the material. The credibility of TED-Ed's animated resources is emphasized by its team composition, which includes TED Speakers, TED Fellows, educators, designers, animators, screenwriters, directors, science writers, historians, journalists, and editors. These experts are highlighted on TED-Ed's About page on their official website.

Valencia (2018) reported how TEDxFSCJ Talks, alongside other TEDx and TED Talks, have been leveraged to develop innovative TED-Ed Lessons. These lessons serve as tools to extend learning beyond traditional course content and textbooks, illustrating the integration of innovative learning initiatives into both face-to-face and online courses for enhanced educational outcomes.

TED-Ed videos have been the focus of previous research such as Rashtchi et al. (2021) who demonstrated that TED-ED was effective and innovative for university-level second language learning due to its audio-visual nature, offering engaging topics and appealing animations that aid in vocabulary acquisition through word inference in the videos. Anggraeni & Indriani (2018) described similar ideas pertaining to the teachers' perspectives on using TED-ED as an innovative method for teaching listening skills. They noted that the TED website hosts numerous educational videos, enhancing students' listening comprehension through continuous practice with assigned tasks and active listening.

In a study by Feng (2021), a multimodal analysis was conducted on award-winning English micro-lectures, revealing the collaborative interaction of semiotic systems in constructing meaning. Feng observed that removing either images or written text from specific frames in the lectures distorted the intended meaning. Similarly, the alignment of sound with images and text played a crucial role in conveying the intended message. Feng made the connection between the essential relationship between language and visuals in micro-lectures, enhancing learners' retention of information by engaging multiple senses and creating a vivid learning experience. Furthermore, the research noted that brightly colored words and images against light backgrounds effectively highlighted key points, capturing viewers' attention.

According to Bacon et al. (as cited in Akbari, 2016), the application of multimedia materials is beneficial for language learning, particularly in enhancing reading comprehension by introducing new terms and phrases to students. Akbari (2016) further elaborated that the use of authentic materials contributes to the development of students' communicative skills. Additionally, authentic materials in English language teaching positively influenced students' motivation to learn the language.

2.4 Animation as a Teaching Tool

Plailek (2012) stressed the importance of technology in contemporary learning and teaching, particularly highlighting its integration into language education. Animation stands out as one such technological medium that is capable of capturing learners' interest.

Animated videos have been found in previous studies to positively influence children's learning. For instance, Verhallen et al. (2006) noted that children showed more engagement towards visual images, with animated visuals attracting even greater visual attention as compared to static illustrations. Ghilzai et al. (2017) explored the effects of cartoon programs on children's language and behavioral development in Pakistan, revealing that exposure to cartoon videos correlated with higher levels of language acquisition and development among children. Lodhi et al. (2018) observed improvements in cognitive skills among children after watching animated videos, noting enhanced intra and interpersonal behaviors in both boys and girls.

Numerous research centers have employed animations in online editions of major science journals to enhance the clarity of discoveries (Isabella & Horne-Badovinac, 2016), as noted by Unsworth (2020). Animations have served as educational tools supporting teaching and learning for many decades (Smetana & Bell, 2014). An analysis focusing on ideational, interpersonal, and textual aspects of science animations from platforms like TED-Ed, study.com, and Explain Everything has highlighted animation's capability to dynamically illustrate the change in learning outcomes (Ploetzner & Lowe, 2017). This detailed exploration identified a comprehensive range of possibilities for depicting various forms of change through animations.

Video, one of the most versatile and distinctive forms of virtual learning media, captures and presents information, providing a sensory-rich learning environment that enhances understanding and retention among learners, as proposed by Fern et al., (2011). Several studies have suggested that combining audio and visual information in educational materials improves retention compared to using a single source of information. Moreover, research with university students has consistently shown that video enhances learning outcomes. For instance, a study involving 147 psychology students found that video presentations of real-life situations were more effective than text in improving comprehension, retention, and overall satisfaction (Choi & Johnson, 2007). Similarly, in studies involving English and Management students, digital video was found to enhance contextual learning and emotional engagement throughout the learning process (South et al., 2008; Hakkarainen et al., 2007).

Among the different methods employed in classrooms, Lee (2014) identified employing multimedia tools in educational settings to effectively enhance language learning. Additionally, Lee found that comprehension levels were higher when visual aids, such as animated videos, were incorporated into listening comprehension tasks. Beyond the above, Mekheimer (2011) made the connection that integrating video-based materials into whole-language teaching for language skills at the undergraduate and higher levels significantly enhances learners' overall linguistic proficiency. The addition of animation to such video-based materials could prove to add to their usefulness as a teaching tool and prove its need in that level of education, regardless of the subject field.

The evolving landscape of higher education is increasingly integrating video content into university classrooms. A concept that has gained prominence in recent years, particularly suited to video incorporation, is "blended learning," which combines multimedia resources with traditional instructional methods.

One noted concern regarding the widespread adoption of open-source digital content is that it can potentially undermine course structure, posing challenges to student learning (Jackman & Roberts, 2014). Nevertheless, blended learning is strongly favored by students (Ramlogan et al., 2014; Scagnoli et al., 2019; Mitra et al., 2010), aligning with their growing preference for more autonomous learning experiences and the creation of personalized learning environments both within and beyond the classroom (Rasi and Poikela, 2016). Video offers students the flexibility to exercise

greater control over their learning process, including when and how they engage with educational content. Moreover, incorporating animation elements can enhance engagement in language learning classrooms and contribute to increased student satisfaction, thereby positively impacting their learning outcomes.

Chen et al. (2020) investigated student performance across various formats, comparing stimuli that included animations with computer-based assessments. Their findings indicated that stimuli featuring animations resulted in higher student performance. Yousef et al. (2014) adopted a similar stance with their study as they identified evidence suggesting that the use of video-based learning led to enhancements in teaching methods and learning outcomes.

Kay and Kletskin (2012) observed throughout the literature that higher levels of student satisfaction were consistently reported among groups with access to video resources regarding language learning. Additionally, reported benefits of video podcasts include their enjoyable nature, satisfaction, motivational impact, intellectual stimulation, and utility for learning purposes. These findings are corroborated by student feedback obtained through surveys and interviews, which consistently highlight the various ways in which video aids learning (Carmichael et al., 2018).

Similar to this current study, Abdo & Awabdeh (2017) illustrated the effectiveness of using animated movies to teach English grammar in a fun and engaging manner, in their study. The research demonstrated that teaching English grammar through animated videos can be effective, showing applicability to language teaching. This approach enhanced students' understanding and retention of grammar rules, fostering a more comprehensive learning experience. The study specifically investigated the impact of animated videos on students and compared their learning and retention when taught through traditional methods versus animated videos. The findings indicated that animated videos, by providing visual and emotional engagement, facilitated a deeper understanding of language mechanics. Their statistical analysis affirmed the efficacy of using animation-based learning to enhance educational achievements, mirroring one of the objectives of the present study.

In recent years, animated videos have attracted growing interest from researchers across various fields, encompassing education, gender studies, sexuality, and literacy. Nevertheless, research examining the discourse and language employed in

animated videos remains in its initial phases (Asseel, 2020). More specifically, few studies have investigated the English language learning effectiveness and student learning satisfaction of students in the context of Mardan, Pakistan. To this end, this study examines how multimedia learning through animated TED-Ed videos impacted the learning effectiveness of Pakistani undergraduate students' English grammar and how satisfied they are with the experience of using such multimedia learning methods.

Islam et al. (2014) criticized that incorporating animation into child education produces beneficial outcomes. In Pakistan, traditional teaching methods are predominant in classrooms, yet visual learning proves to be a more effective educational approach for engaging students and enhancing conceptual understanding. At Dhaka Primary School, Islam et al conducted a study consisting of three phases: initially, teachers used conventional teaching methods to deliver the curriculum; subsequently, they employed visual learning techniques for the same content; finally, animated videos were introduced alongside verbal instructions in a blended learning approach. Notably, the results from the blended learning phase surpassed those of the other instructional methods. Students responded positively to the blended approach, confirming its efficacy. Thus, the research affirmed that a blended learning model incorporating animated videos and verbal instructions is optimal for educating school-level children.

As technology continues to advance, audiovisual media have emerged as a promising instructional method. According to Kuppens's (2010) study on Dutch-speaking L2 students, those who regularly watched subtitled English TV programs and movies demonstrated notably higher performance on oral translation tests compared to peers with less exposure to the chosen media. Participants completed surveys on media consumption and daily English usage before undergoing an oral test assessing vocabulary, translation skills from English to Dutch and vice versa, as well as grammar. Although this study focused solely on translation test outcomes, it suggested that language learners can acquire language skills implicitly through exposure to English multimedia videos, making it relevant to the current study.

Regarding older English language learners, Abdo and Al-Awabdeh (2017) summarized in their study that L2 high school students scored better grades after learning grammar through the utility of animated videos in class. On the other end of

the age spectrum, amongst children aged three to five, Schlosser (2012) demonstrated animation's effectiveness over static images in improving verb recognition. The children were exposed to both types of images and were asked to interpret and identify symbols related to verbs and prepositions resulting in Schlosser deducing that animation could ease the burden from teachers. Despite skepticism about animation's viability as a teaching medium, these findings propose its potential as a supplementary tool for language education. Moreover, the last decade has witnessed a surge in language-learning programs such as Babbel, Memrise, Duolingo and, reflecting a preference for non-traditional, technology-based style learning due to its affordability, flexibility, and convenience (Bredo, 2023). However, it is essential to assess the factors that determine the effectiveness of animated programs as educational tools, to deem them worthy in linguistic pedagogy, and assess learner satisfaction with the outcomes they achieve in language learning.

From an alternative perspective, the contemporary technology deployed in the field of linguistic learning largely targets the declarative memory system, which could be effective in cultivating explicit metalinguistic knowledge but does not necessarily lead to procedural ability, as asserted by Bolgun and McCaw (2019). They advocate that language learning applications should prioritize learners' procedural memory to enhance their procedural skills.

In contrast to the perspectives of Bolgun and McCaw (2019), Zhao (2003) conducted a meta-analysis involving 156 empirical studies, revealing that technology-supported language learning is as effective as, if not more than, traditional human instruction. The reviewed studies presented technology's facilitation of diverse language learning components such as vocabulary, grammar, reading, speaking, listening, writing, and cultural understanding. He emphasized that technological adaptations in linguistic learning materials, such as the incorporation of animation in learning materials, can improve input quality, cultivate authentic communication, and provide more relevant and beneficial feedback in terms of learning efficacy. In summary, despite Zhao's reviewed studies focusing on college-level language learners and a selected number of target languages - French, Spanish, Arabic, German, and ESL, consistent positive effects were observed. These studies collectively demonstrated the effectiveness of technology-supported language learning in enhancing language

acquisition, proving its potential to complement or even surpass traditional teaching methods.

2.5 Attitude Towards Use of Animation in English Language Learning

Literacy skills are one of the most important areas of education, particularly within language learning contexts. The process of deriving meaning from educational materials relies on several semiotic processes, including visual, auditory, multimodal, and linguistic practices. In the spectrum of language acquisition from foundational to advanced levels, animation holds promise as a promising pedagogical tool for language learners, although their attitudes toward it may influence its effectiveness overall.

Attitude towards an idea or entity refers to an individual's perception and emotional orientation towards it whether in a positive or negative sense. A learner's internal attitude, their appeal towards it and their self-efficacy regarding the use of a particular multimedia learning tool or method will determine their inclination to either adopt and utilize it or refuse it in its entirety.

Taking a look at the favorable perception of animation in scholarly literature, Chiou et al. (2015) conducted an experimental study and demonstrated that instructional materials integrating animation alongside multi-dimensional concept maps outperformed those featuring multi-dimensional concept maps alone, in terms of students’ achievement, satisfaction, and retention. In a similar fashion, Berney and Betrancourt (2016), in their meta-analysis, affirmed that animation-based teaching materials had a beneficial impact on learning compared to materials featuring static images.

Regardless of their studies investigating the domains of science and technology lessons, Dasdemir and Doymuş (2016), Onal and Sondur (2017), and Rosen (2009) reported a positive and moderate correlation between students' engagement with animation and their attitude toward technology being implemented into their classrooms. The effects of animation on their learning efficacy can be transferable to English language learning domains, particularly, undergraduate Pakistani classrooms. Rosen also contributed positive results regarding students' knowledge transfer and

motivation towards science and technology lessons which can be a goal achievable for linguistic gains as well.

Among the various English language learning sources available to educators and learners alike, video files have been observed to be the most popular form of learning the different components of a language (Rashtchi & Mazraehno, 2019; Sulaiman et al., 2017). Rashtchi & Afzali, (2011) and Seo (2002) supported the notion that simultaneous audio and visual input is beneficial for foreign language learners, which is also a stance supported by other researchers such as Chapple & Curtis (2000); Vanderplank (2010) and Williams & Thorne, (2000) who identified through their studies that EFL learning has employed more video files as learning materials than audio or texts alone.

A rationale for this efficacy lies in the ability of video media's ability to integrate visual and auditory stimuli, thereby enhancing listening comprehension and providing a more authentic representation of language and cultural contexts within educational environments. Alongside linguistic elements, these applications incorporate paralinguistic characteristics, meaning non-verbal cues, such as body language, gestures, intonation, and similar features that contribute to conveying meaning to learners.

Multimedia environments allow the integration of visual and auditory elements with written text for the improvement of content comprehension. This integration allows learners to engage with information through various presentation modes—textual, visual, auditory, or combinations thereof and hence can simultaneously process multiple forms of media (text, sound, and video), which seems like a popular trend in educational tool development. The role of images in fostering linguistic competence has been extensively studied and movies have been seen implemented with the end goal of enhancing language learners' linguistic skills such as the studies of Qiu (2017) and Safranj (2015), therefore investigating animated TED-Ed videos to determine its role in English language learning amongst the undergraduate level in Mardan, Pakistan and their attitude towards such integration in their educational pedagogy was crucial and filled in the literature gap.

In Pakistan, proficiency in English is regarded as a hallmark of advancement. New multimedia learning resources pose a conducive classroom environment for

English language instruction and learning. English proficiency is increasingly essential for students, particularly in countries like Pakistan where it serves as the primary medium of education, which contributes to its importance in national development. In support of this, Azmi (2017) advocates for the integration of effective multimedia learning resources to enrich students' language acquisition. Hussein (2010) elaborates this by stating that implementing multimedia learning materials in the classroom creates a certain appeal to students in multiple ways.

From the negative perspective of the topic at hand, however, studies like Catrambone and Seay's (2002) reported that the educational application of animation did not yield positive learning outcomes or demonstrated limited effectiveness. They concluded that animation-enhanced teaching materials had negligible impact on enhancing problem-solving performance in computer algorithms and furthermore, offered only moderate support to its learning outcomes.

Even though animation offers language learners more eye-catching and intriguing nonstatic visuals as compared to text-based teaching material, Stebner, et al. (2017) identified it as having no significant effect on learning. Similarly, Adesope and Nesbit (2013) conducted a comparison between animation-based concept maps and paper-based concept maps regarding their impact on learning, revealing no significant difference between the two instructional materials. Regardless of these studies not specifically pertaining to language learning, the present investigation has the potential to produce comparable findings, suggesting that animation may not offer substantial efficacy in English language learning, particularly for language learners.

An in-depth study of students' attitudes toward the use of new media, specifically animated TED-Ed videos, is the current imperative because students' achievement in English language learning is based on their perspective toward new media (Shafique et al., 2022). While students' positive attitudes may have a great impact on their success in a technical environment, negative attitudes toward the technology of new mediums can pose some challenges in the classroom. Therefore, there is a lack of research in Pakistan at the undergraduate level regarding students' attitudes toward the use of animation-based multimedia learning videos at an undergraduate classroom level (Ajmal et al., 2020).

Previous studies have primarily focused on assessing student learning outcomes, typically gauged by their comprehension levels, to determine the effectiveness of animated resources. However, this approach only captures one facet of students' overall learning experience, specifically the learning outcome. A positive learning experience for students is influenced not only by the content they learn but also by the degree to which the learning process is engaging, enjoyable, and straightforward. There has been limited research exploring these dimensions of the student learning experience in relation to animated resources and this study aimed to address this gap by examining these aspects in its investigation.

CHAPTER 3

RESEARCH METHODOLOGY

In this section, the researcher describes the methodology used to address the research questions of the current study is outlined. The research comprised of four phases: the pilot study, animated TED-Ed videos' multimodal analysis, pre-and post-tests, and the Learning Satisfaction Survey questionnaire.

3.1 Research Design

The present study adopted a quasi-experimental design, specifically a single-group pre-test-post-test design, to evaluate the effectiveness of animated TED-Ed videos in improving the English grammar proficiency of undergraduate Pakistani learners. This design allows for the measurement of the dependent variable—students' English grammar knowledge—before and after the intervention. Changes in the outcomes are believed to occur as a direct consequence of the intervention administered.

This type of research is a study that establishes a cause-and-effect relationship between two dependent variables (Thomas, 2024). In this study, the dependent variable was English grammar proficiency or knowledge of the undergraduate Pakistani learners while the independent variable was the method of instruction or teaching approach, specifically the use of animated TED-Ed videos as a means of teaching English grammar.

The researcher followed a mixed-method research design method and broke down the research into four phases. Phase One included a pilot study to test the study's research validity. Phase Two of the study involved a multimodal analysis of the animated TED-Ed videos in reference to the theoretical framework discussed later in the chapter. Phase Three was a single-group pretest-posttest design, where the dependent variable, the understanding of and proficiency in English grammar amongst undergraduate Pakistani learners, is measured before and after implementing the treatment to assess its effectiveness.

Phase Four was conducted through a questionnaire, named Learning Satisfaction Survey, to understand the students' learning satisfaction regarding employing animated TED-Ed videos in the classroom setting to enhance the learning effectiveness and the understanding of and proficiency in English grammar among Pakistani learners in the classroom setting.

3.2 Sample

The sample consisted of 206 female Pakistani undergraduate students enrolled in various semesters of the B.S. English program at Government Girls Post Graduate College, Baghdada-Par Hoti Road, Mardan, Khyber Pakhtunkhwa, Pakistan.

3.2.1 Sampling Method

This study's sample was selected using purposive sampling, a non-random selection method that allowed for the selection of participants who met specific criteria relevant to the research questions and objectives. The participants were all female, as the research was conducted at Government Girls Post Graduate College, an all-female institution.

The selection criteria for participants required them to be enrolled in the B.S. English program at Government Girls Post Graduate College, ensuring that all participants were undergraduate students pursuing the same field of study. Undergraduate students were specifically chosen due to their appropriate level of education and emotional maturity. These factors were expected to enhance their ability to provide reliable and thoughtful responses, thereby contributing to the quality of the data. Additionally, participants enrolled in the B.S. English program were likely to possess a strong command of English, which helped ensure clarity in communication and minimized the likelihood of misunderstanding instructions. This characteristic also contributed to the reliability and validity of the results.

All students in the B.S. English program were initially assessed through an entry test upon entering the program. Although participants were drawn from different semesters of the B.S. English program, linguistic homogeneity was ensured by utilizing the institution's existing entry test as a basis for assessing students' linguistic abilities. To ensure consistency in the participants' language proficiency levels, all students were required to have passed the institution's standardized entry test at the time of admission.

This test assessed key linguistic skills across reading, writing, and speaking, and students' performance on this test determined their admission into the program. Therefore, the participants shared a similar level of linguistic competence across various academic semesters.

Lastly, students who volunteered to participate in the study were selected, ensuring that their involvement was based on informed consent and interest in the research topic.

3.2.2 Sample Size

The sample size for this study was determined by several key factors to ensure the validity and reliability of the results. Firstly, the selection of a relatively large sample of 206 students was intended to enhance the statistical power of the study. Statistical power refers to the ability to detect a true effect, in this case, the impact of animated TED-Ed videos on English grammar proficiency, should one exist. According to Cohen (1992), a larger sample size increases the likelihood of detecting statistically significant differences.

Secondly, participants drawn from different semesters also facilitated greater generalizability of the findings across diverse student backgrounds and experiences. Including students from various academic levels ensured that the results were not biased toward any particular academic year. As a result, the study's findings could be more readily generalized to a broader population of undergraduate students in similar academic contexts.

And lastly, the chosen sample size aligned with established practices in educational research, particularly in studies exploring the effects of multimedia learning tools. Research in the field of educational technology and language learning often employed sample sizes ranging from 150 to 300 participants to ensure accurate findings and reliable conclusions. For instance, studies by Zhang et al. (2016) and Mei (2019) used sample sizes within this range. Thus, the selection of 206 participants in the present study is consistent with common methodologies in similar educational research.

3.3 Selected Animated TED-Ed Videos

TED-Ed is the educational branch of the TED platform, specifically designed to support school education. It offers a wide range of educational videos that can be utilized by teachers to create dynamic lessons or directly accessed by students. These videos are tailored to cater to various age groups and cover a broad array of subjects, encompassing both curriculum-aligned content and supplementary educational materials.

The justification for selecting TED-Ed videos in this study lies in the unique features of the platform. TED-Ed provides animated videos in which speakers explain content through a combination of audio narration and visual animation. This multimedia approach was particularly relevant to the current research, as it facilitates an engaging learning experience.

The TED platform has gained considerable popularity in various cities across Pakistan, with notable figures such as Taimur Jhagra (Former Provincial Minister of Finance and Health, Khyber Pakhtunkhwa), Sarwat Gilani (Pakistani model, actress, and voice artist), and Adeel Husain (Pakistani actor, director, and photographer) participating as TED speakers on various topics.

Moreover, due to its widespread popularity, free accessibility, and user-friendly interface, TED-Ed has become a valuable resource for language instructors. Many educators have begun leveraging the platform to teach different languages, uploading language learning videos that have attracted millions of views.

For the purposes of this study, videos featuring original designs, animated drawings, or illustrations presented in artistic styles were categorized as animated videos. A screenshot of an animated TED-Ed video is provided in Figure 2 below.

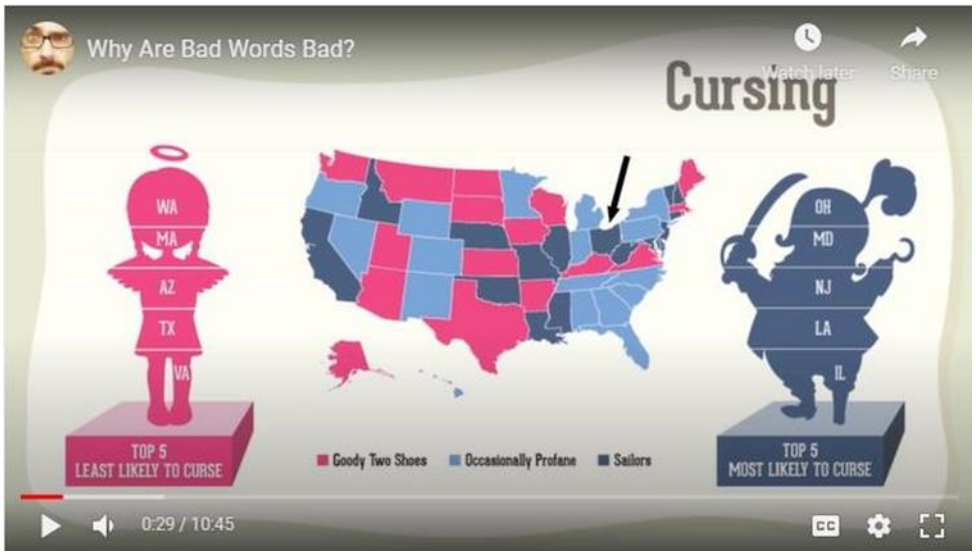

Figure 2. Example of an Animated TED-Ed Video.

3.3.1 Sampling Method

This study used the official TED-Ed website, accessible via *https://ed.ted.com/* to access the animated TED-Ed videos. All video content is openly accessible on both the TED-Ed website and YouTube. The website's search filter was employed to refine the video selection, specifically focusing on those related to learning English grammar.

The researcher employed purposeful sampling to refine the selection of multimedia learning materials, specifically animated TED-Ed videos related to English grammar learning. This sampling method was chosen to mitigate potential personal bias towards specific types of TED-Ed videos, instead adhering to predetermined criteria: alignment with the website's subtopic classification for English grammar, contain animation, and a collective duration of approximately 20 minutes. As a result, Phase 2 of the study included a dataset consisting of six animated TED-Ed videos, in accordance with the established criteria, thus substantiating the selection process.

The selection of six videos provided a manageable size for data collection, ensuring that the study remained feasible in terms of analysis while still capturing sufficient variation and depth in content. An excessive number of videos would have overwhelmed both the participants and the researcher, potentially complicating the maintenance of consistency in student engagement, video comprehension, and learning outcomes. By limiting the number of videos, the study struck a practical balance between comprehensiveness and manageability, which was essential for maintaining the integrity of the controlled experimental design.

The duration of each video was deliberately limited to no more than 5 minutes, based on findings from Swaffar and Vlatten (1997) and Wijaya et al. (2020), which emphasize the importance of short, focused video content for effective learning. Additionally, Brame (2016) advocated for teacher videos not to exceed six minutes in order to effectively regulate students' cognitive load. By adhering to these principles, the study ensured that with the six chosen videos, students could focus on the content without feeling overwhelmed, and that video durations remained manageable for optimal learning retention. The decision to choose six videos along this principle ensured that the videos were consistent with established best practices for video-based learning, further reinforcing the rationale for the selected total video quantity.

Given the nature of this study, which focused on exploring the impact of animated TED-Ed videos on English grammar learning, the emphasis was placed on the quality and relevance of content, rather than the sheer quantity of videos. The decision to select six videos ensured that students engaged deeply with the material, promoting focused learning outcomes without the distraction of excessive content. Six TED-Ed videos allowed for a focused and in-depth exploration of the effects of the videos, rather than spreading attention thin over a larger, less controlled selection.

The titles, short descriptions, durations, and grammar topics of the selected animated TED-Ed videos on English grammar, obtained directly from the TED-Ed website, are presented in Table 1 below. Transcripts for each TED-Ed video can be found in Appendix J.

Table 1

Animated TED-Ed Videos About English Grammar

No.	Video Title	Description	Topic	Duration
1	When to use "me", "myself" and "I" - Emma Bryce	Discusses the distinctions between the pronouns "I," "me," and "myself" and their respective roles in sentences, highlighting how understanding the difference between subjects and objects helps determine the appropriate usage of these pronouns.	Parts of speech	2:57
2	Punctuation explained (by Punctuation!)	Introduces and explains the functions of punctuation marks such as periods, question marks,	Punctuation	1:39

		exclamation marks, and commas, illustrating how each punctuation mark is used in sentences, providing examples, and demonstrating their respective purposes.		
3	How to use a semicolon - Emma Bryce	Overview of the semicolon's role in written English. It depicts the semicolon as a punctuation mark positioned between a comma and a period, emphasizing its versatility in clarifying ideas, organizing lists, and linking independent clauses.	Punctuation	3:36
4	Buffalo buffalo buffalo: One-word sentences and how they work - Emma Bryce	Introduces lexical ambiguity, showing how words can have multiple meanings based on context and demonstrating how varied interpretations can create ambiguity. Emphasizes how lexical ambiguities can cause confusion in everyday speech and writing.	Syntax/Parts of speech	3:27
5	How misused modifiers can hurt your writing	Discusses the importance of correctly placing modifiers in sentences to avoid ambiguity in meaning, ultimately emphasizing the necessity of maintaining clarity in writing by ensuring that modifiers are clearly linked to the words they modify.	Syntax/Parts of speech	3:21
6	When to use apostrophes - Laura McClure	The video provides a concise overview of the usage of apostrophes in written English, explaining three main functions of the apostrophe and clarifying the rules for using apostrophes through examples and explanations. Aims to enhance understanding and usage of apostrophes in written communication.	Punctuation	3:14

3.4 Phase 1 – Pilot Study

The pilot study phase aimed to evaluate the feasibility, clarity, and effectiveness of the study's research designed for this study. This type of study, according to Gruszczyński (1999) cited in Dzwigol (2020) includes: verification of the research tool in which the questionnaire's questions are evaluated for their usefulness in solving the posed research questions; verifying if they are adjusted to the capabilities of the sample;

verifying the obtained answers' degree of accuracy, relevance, and completeness; and evaluating the comprehensibility of the questionnaires' questions.

It also included determining the organizational and technical aspects of the study, such as the time required to implement the research (e.g., time spent giving instructions, respondents filling out the questionnaires, collecting and distributing the hardcopy questionnaires, etc.), methods for reaching the sample, the location for conducting the research, and establishing the costs.

Prior to the main data collection, the pilot test involved 10 students from the target population. The number of participants was based on Dzwigol's (2020) recommendation that the pilot study sample size should constitute around 5% of the target population. The 10 respondents were sixth-semester English undergraduate students who volunteered to partake in the pilot study. All participants were selected from the same semester to facilitate the pilot study, as conducting it within a single classroom, namely their own, provided logistical convenience. The following 10 respondents were not included in the large-scale research as recommended by Dzwigol (2020). The same 10 respondents from the pre-and post-test pilot study were used in the pilot for the Learning Satisfaction Survey (LSS).

This was to identify and address any potential flaws in the questionnaire, and distribution method, and provided instructions to ensure the integrity of the research process. After the questionnaires had been edited, confirmed, and approved by the researcher based on the relevant feedback from the pilot study, full-scale research was carried out.

The main findings of the pilot studies for both the pre-and post-test and LSS questionnaire were discussed in Chapter 4.

3.5 Phase 2 – Pre-and Post-Test

The current study employed a single-group pretest-posttest design, a widely used experimental research method, to assess the changes in the participants' learning outcomes, specifically focusing on their English grammar proficiency, as measured by the pre-test and post-test questionnaire scores. In this study, the experimental group consisted of the participants who viewed the TED-Ed videos, and the pre-test and post-test served as the primary tools for evaluating the effectiveness of the intervention.

The advantage of utilizing this design was that it allowed for a direct comparison of the participants' performance before and after the intervention. By administering the pre-test first, the researcher established a baseline measurement of the participants' existing grammar knowledge. This baseline enabled the researcher to examine the extent of any changes in students' understanding after exposure to the TED-Ed videos.

3.5.1 Pre-Test

At the outset of the study, the pre-test was administered to assess the participants' baseline knowledge of English grammar before they were exposed to the TED-Ed videos. The primary purpose of the pre-test was to gauge the 206 students' existing understanding of key grammar concepts, providing a reference point for their proficiency. By establishing this baseline, the pre-test enabled the researcher to compare students' performance both before and after the intervention.

The pre-test included a set of grammar-related questions designed to assess participants' understanding of key grammar concepts, aligned with the content of the animated TED-Ed videos. All participants were given the same set of questions and instructed to complete the test under identical conditions, ensuring that all participants had a fair and consistent experience. The pre-test was scored by both the researcher and a qualified English lecturer to ensure objectivity. Each correct answer was awarded a point, and the total score for each participant served as the initial measure of their grammar knowledge. This methodical scoring process allowed for a clear, quantitative starting point to evaluate the effectiveness of the intervention.

3.5.2 Intervention- Viewing of Animated TED-Ed Videos

The intervention in this study was the viewing of the six animated TED-Ed videos. The videos were projected onto a classroom wall using a projector connected to a laptop, ensuring a clear visual display for all participants. To ensure that the sound quality was adequate for the entire group, the audio was amplified using an external speaker, as the built-in speakers of the researcher's laptop would not suffice for the classroom setting. The use of external speakers allowed for optimal audio delivery, making the narrated content of the videos clear and understandable for every participant, thereby reducing any potential barriers to learning.

Each video was introduced by the researcher, who provided clear oral instructions to the participants before starting the viewing. These instructions, which were also projected onto the wall, outlined the objectives of the intervention and the purpose of watching the videos. To create a focused learning environment, the students were instructed to remain silent throughout the video viewing, allowing them to concentrate solely on the video content. The classroom environment was carefully managed to minimize distractions. The ceiling fans were turned off to prevent interference with the audio, and students were seated at a distance that enabled all of them to see the projector screen clearly.

In terms of video content, the TED-Ed videos integrated animated visuals, narrated audio, and textual elements (subtitles) to enhance comprehension and facilitate learning. This combination of modes was designed to maximize the potential for learning by engaging multiple cognitive channels (i.e., visual and auditory) at the same time.

3.5.3 Post-Test

After the participants were exposed to the TED-Ed videos, the post-test was administered. The post-test was structured identically to the pre-test in terms of format, content, and time allocation. This ensured consistency and controlled for potential variables such as test format or testing conditions. The purpose of the post-test was to measure any improvements in grammar knowledge and skills after the intervention. Similar to the pre-test, the post-test was scored based on accuracy, with each correct answer contributing to the overall score.

To maintain the experimental rigor and avoid any confounding factors, the same time frame was allocated for both the pre-test and post-test. The participants were informed in advance about the time limit, which was consistent across both tests. This standardization was crucial for isolating the effects of the TED-Ed videos as the sole variable that could explain any differences between the pre-test and post-test scores.

To minimize external variables that could affect the results, the tests were administered under identical conditions in terms of the environment, materials, and timing. The researcher ensured that no distractions were present during testing, and participants were instructed to remain silent during both the pre-test and post-test. The

administration process was closely monitored to ensure that all students adhered to the established guidelines.

The post-test scores were analyzed in the same way as the pre-test scores, by calculating the total score for each participant based on the accuracy of their responses. The comparison of pre-test and post-test scores allowed the researcher to objectively assess whether the animated TED-Ed videos had a statistically significant effect on the participants' grammar proficiency.

Throughout this phase of the study, the researcher adhered to experimental research protocols, ensuring that the data collection process was consistent, reliable, and objective. This approach, which included carefully controlling testing conditions and using standardized measures, was integral to maintaining the validity of the study and ensuring that any observed differences between pre-test and post-test scores could be attributed to the intervention rather than other factors.

3.5.4 The Experimental Group

The sample formed the experimental group. As the research utilized a single-group pretest-posttest design, the experimental group was assessed before and after the intervention, viewing the animated TED-Ed videos. The research design focused solely on the experimental group’s performance and satisfaction with the intervention.

3.3.5 Research Instruments

The researcher designed a set of five open-ended questions corresponding to each TED-Ed video listed in Table 1. These questions evaluated the effectiveness of animated TED-Ed videos on the participants' learning outcomes using a pre-and post-test research design. The questions across all six questionnaires underwent validation by an English language lecturer with extensive teaching experience spanning over two decades, to confirm their accuracy and appropriateness.

In this phase of the study, the pre-and post-test questionnaires were distributed using the survey method. The questionnaires were distributed to the students through printed papers as the participants were not allowed mobile phones inside their institution premises. The questionnaire survey instructions and questions regarding the selected TED-Ed videos can be found in Appendix A to H. Moreover, this study used the researcher as an instrument in data collection and analysis.

The pilot study was conducted to assess feasibility, duration, cost, and adverse events, and improve upon the study design before executing the full-scale research. This was to identify and address any potential flaws in the questionnaire, and distribution method, and provide instructions to ensure the integrity of the research process. After the questionnaires had been edited, confirmed, and approved by the researcher based on the relevant feedback from the pilot study, full-scale research was carried out.

3.5.6 Data Collection

This phase used a single-group pre-test-post-test experimental group design, in which the dependent variable was measured once before the treatment was implemented and once after it was implemented.

Pre-test: The 206 participants were given and asked to answer the questionnaires containing the 5 open-ended questions about the content of the animated TED-Ed video listed in Table 1. This was to measure the participants' preexisting understanding of the TED-Ed video's content regarding English grammar. The questionnaires were collected back and checked by the researcher; the data was then tabulated.

Treatment: The 206 participants were shown all six animated TED-Ed videos listed in Table 1. The videos were presented using a projector and external speakers, ensuring that all students in the classroom could clearly see and hear both the video and audio. This constituted the intervention provided to the participants.

Post-test: The same questionnaires from the pre-test were distributed to the 206 participants who were asked to answer them after receiving the treatment.

The post-test was to measure the participants' understanding of the TED-Ed videos' content regarding English grammar after being exposed to the animated videos. The questionnaires were collected back and checked by the researcher; the data was then tabulated.

3.5.7 Data Analysis

A descriptive analysis was conducted using IBM SPSS Statistics to analyze data from both pre-and post-tests, specifically a paired-sample *t*-test. A measurement taken

at two different times (e.g., pre-test and post-test score with an intervention administered between the two time points)

Measures such as means, standard deviations, and paired sample *t*-tests for pretest scores, post-test scores, and their differences were computed to assess the influence of animated TED-Ed videos on the effectiveness of undergraduate students' English grammar learning in classroom settings. To check if the results rejected or accepted the null hypothesis, which was that there is no statistically significant effect of animated TED-Ed videos on the undergraduate students' English grammar learning outcome within their classroom setting. The alternate hypothesis being that there is a statistically significant effect of animated TED-Ed videos on the undergraduate students' English grammar learning outcome within their classroom setting and therefore, treatment is effective.

3.6 Phase Three – Multimodal Analysis

In this study, a multimodal analysis was applied to the selected six animated TED-Ed videos, which involved examining the interaction between different communicative modes present in the videos—visual animations, text, and audio (narration). Unlike a traditional, single-mode analysis, multimodal analysis considers how these modes work together to affect the learning process. Specifically, the analysis explored the integration of animation (visual mode), spoken language (audio mode), and text (written mode) in the videos.

This phase of the study was framed by Mayer's Cognitive Theory of Multimedia Learning (CTML) and Cognitive Load Theory (CLT), which provided a theoretical basis for understanding how multimedia content influences cognitive processing. CTML and CLT is further discussed in a later section of the study. However, briefly, CTML's principles—spatial contiguity, temporal contiguity, signaling, redundancy, and coherence—were used to evaluate how these modes were arranged and combined in ways that either facilitated or hindered cognitive processing. For example, the spatial contiguity principle was used to assess whether text and corresponding animations were placed in a way that helped students efficiently integrate information, while the redundancy principle considered whether too much information was provided

simultaneously in different modes, potentially leading to cognitive overload and thus, reduced learning outcomes.

Additionally, Cognitive Load Theory (CLT) was incorporated to analyze how the combination of these modes impacted intrinsic, extraneous, and germane cognitive loads. The study focused on how well the videos managed these cognitive loads to enhance or impede learning outcomes. For example, how well the visual animations supported or conflicted with the spoken narration, and how these modes either reduced extraneous cognitive load or encouraged germane cognitive load to facilitate deeper learning. This methodological approach allowed for a comprehensive evaluation of how the instructional videos managed cognitive demands and facilitated learning outcomes among the participants.

3.7 Phase Four – Learning Satisfaction Survey Questionnaire (LSS)

3.7.1 Participants

In this phase, the study continued with the same 206 female undergraduate students majoring in English Language at Government Girls Post Graduate College, located on Baghdada-Par Hoti Road, Mardan, Khyber Pakhtunkhwa, Pakistan.

3.7.2 Research Instruments

After Phase Three, the participants answered a questionnaire pertaining to learning satisfaction named the Learning Satisfaction Questionnaire (LSS), see Appendix I. The questionnaire was designed to understand the students' learning satisfaction with learning English grammar content from animated TED-Ed videos. Particularly, this questionnaire was adapted from the questions proposed by Hui et al. (2008), to tailor to the pre-and post-tests in this research study.

The feedback from the pilot study was incorporated into the final version of the questionnaire and its instructions. The LSS questionnaire was composed of 9 items and each item was measured on a four-point Likert scale (1 strongly disagree, 2 disagree, 3 agree, and 4 strongly agree) regarding the statement pertaining to the students' learning satisfaction. The 'forced choice' scaling technique was implemented, omitting the 'neutral' option. This decision was due to the recognition that the neutral option serves as an easily accessible alternative, particularly for students facing uncertainty in their

selections. Participants opting for the 'neutral' choice may signify indecision rather than a true stance of agreement or disagreement (Li, 2018).

In adherence to experimental research protocols, the LSS was administered after the post-test phase, ensuring that all participants had experienced the intervention (viewing the TED-Ed videos) before evaluating their learning satisfaction.

3.7.3 Data Collection

The LSS questionnaire was distributed to the participants in printed form, and they were asked to complete the survey based on their experiences with the pre-and post-tests and the intervention (the TED-Ed video viewing). In compliance with experimental protocols, all participants were provided with the same instructions, and the same time constraints were applied to the questionnaire completion to maintain consistency across the group. The completed questionnaires were collected by the researcher, and the data was subsequently tabulated for analysis. By maintaining controlled conditions throughout this phase, the researcher ensured the reliability and validity of the data collected from the LSS.

3.8 Theoretical Framework

3.8.1 Cognitive Load Theory (CLT)

Cognitive load refers to the total working memory resources required to carry out a learning task. One of the many aspects to consider when establishing educational multimedia materials, including animated videos, is the Cognitive Load Theory (CLT). CLT was first proposed by Sweller in 1988 who referred to it as how teachers and students can manage and process tasks to significantly improve learning.

This concept is based on the theory that working memory, or short-term memory, has limited capacity, and overburdening it reduces the effectiveness of teaching. Processing new information demands mental exertion, leading to a cognitive load on working memory, thereby impacting learning outcomes.

Considering that the objective of learning is to transfer new information from working memory to long-term memory, Cognitive Load Theory suggests that instructional materials and environments should be designed to reduce this load.

Minimizing distractions facilitates a more effective transition of desired learning from working memory to long-term memory.

Cognitive load theory differentiates three types of cognitive load:

1. **Intrinsic load** indicates the difficulty of a learning task; and the inherent difficulty in processing information. Intrinsic loads are driven by the material itself; the more complex the subject is, the heavier its intrinsic cognitive load. Sweller believed that the intrinsic cognitive load can only be reduced through changes in the learning material's nature or in the cognitive tasks or processes of learning. For instance, a reader's mental effort can be decreased by using clear and readable handwriting instead of cursive font.
2. **Extraneous load** is the type of cognitive load created due to the way the instructional materials are presented, which does not help in the learning process. It is the way information is presented and the ease or difficulty with which learners can process it. Excessive distractions lead to an increase in extraneous load. Additionally, inadequately designed materials can contribute to the split-attention effect and further increase extraneous cognitive load.
3. **Germane load** pertains to the components that help the processing of information and contribute to the long-lasting construction of schemas. The systematic organization of Germane materials makes complex learning easier and aids memory attention. An example of Germane load is creating diagrams and flowcharts to perform complex tasks. This represents the optimal cognitive load for effective learning.

If a learner’s working memory is overloaded with intrinsic load (i.e. making the content of the animated video too difficult to comprehend) or extraneous load (i.e. an animated video having too many distracting stimuli), that does not leave enough processing power to be used by the germane load, which is what is needed for optimal learning outcome and achievement. To build a schema, or a mental framework of understanding, students can manage their cognitive capacity by minimizing extraneous load. This includes removing unnecessary information that could otherwise divert their attention from the current task. Instead, the germane load should be prioritized, which refers to the essential information that students need to acquire new knowledge effectively.

3.8.2 Application of CLT in the Classroom

John Sweller's (1998) Cognitive Load Theory suggests that cognitive resources are limited, which implies that effective management of student cognitive load in classroom settings is a necessity. One way is by designing learning activities that align with learners' cognitive capabilities. Beginner language learners, in particular, can benefit from explicit instruction and reduced extraneous load to effectively process new information. Learning materials can further aid them by being designed in such a way that they provide clear, step-by-step guidance, break down complex concepts into smaller segments, and employ visual aids such as animations, diagrams, or charts. Through this, students can manage their cognitive capacity by reducing extraneous load as it eliminates unnecessary information that may distract students from the main content of the multimedia learning material. Instead, the germane load, which refers to the essential information that students need to acquire new knowledge effectively, should be prioritized.

Understanding cognitive theory is imperative for all educators, as it elucidates how learners process and retain information. It must be kept in mind that learners have limited memory resources therefore, attention should be directed towards relevant information by structuring multimedia learning materials with CTML's principles to help students easily understand the critical connections between concepts. By embracing CTL, multimedia learning materials can establish learning environments conducive to schema acquisition, thereby enhancing students' comprehension of curriculum content and as a result, optimizing students' intellectual performance and achieving meaningful learning outcomes.

3.8.3 The Cognitive Theory of Multimedia Learning (CTML)

This study followed the theoretical framework of The Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2019). Mayer described 12 principles; however, this study looked at only 5 out of those 12 that multimedia learning materials could adopt to reduce cognitive load and thus, increase learners' learning outcomes and academic satisfaction.

1. **The Spatial contiguity principle** states that on-screen text should be positioned close to relevant animations. Learning is enhanced when associated words and

pictures are situated nearby, rather than being distant from each other on the page or screen.

2. **The Temporal contiguity principle** states that narrations and animations should be presented at the same time. Synchronizing narration and animation ensures the simultaneous processing of verbal and nonverbal models in working memory, therefore, both should be treated as a single unit rather than separate entities.
3. **The Signalling principle** refers to various techniques used to draw attention to relevant concepts contained in multimedia learning materials. They do not add new information but simply draw attention to or repeat material to facilitate selection and organization. This reduces cognitive load by eliminating the need for working memory to scan the visual information.
4. **The Coherence principle** involves minimizing the amount of information presented on each slide, page, or worksheet to only essential content. By doing so, students' working memory is presented with fewer stimuli, allowing for increased processing capacity to be used by the germane load. Better learning outcomes are achieved through the exclusion rather than the inclusion of extraneous material.
5. **The Redundancy principle**, an extension of the coherence principle, emphasizes that on-screen text should not repeat narration as despite on-screen text being visual and the auditory nature of narration, both are processed in the verbal channel, leading to increased cognitive load, and hindering learning. Optimal learning occurs when images are paired with narration, as they complement each other and reduce cognitive load. Employing animation with minimal text and narration efficiently minimizes extraneous load, enhancing working memory capacity and improving learning outcomes (Sweller, 2011).

Moreover, CTML was used to analyze the selected animated TED-Ed videos, regarding English grammar (multimedia learning) to understand the reasons behind the effect animated TED-Ed videos have on Pakistani undergraduate English students' English grammar learning effectiveness in the classroom setting.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

This research investigated how animated TED-Ed videos affect Pakistani undergraduate students' learning of English grammar, examining both their learning outcomes and satisfaction levels with the multimedia learning resource.

The researcher collected the quantitative data through a quasi-experimental research design and conducted a single-group pretest-posttest research design and a Learning Satisfaction Survey through a questionnaire. Two hundred and six female Pakistani undergraduate students of English Language (B.S English) voluntarily participated in the pre-and post-test experiment whereas one hundred and ninety-eight filled out the Learning Satisfaction Survey questionnaire.

4.1 Phase One – Pilot Study

The pilot testing was conducted on 10 undergraduate English students from Government Girls Post Graduate College, Baghdada. This preliminary, small-scale investigation aimed to assess feasibility, time frame, expenses, and adverse effects, and refine the research methodology before conducting the full-scale study.

By carrying out this pilot study, the researcher ensured that no deficiencies were present in the questionnaire, or distribution method, and provided instructions. Following the pilot study, the questionnaires were edited, confirmed, and approved by the researcher after receiving the relevant feedback, ensuring that the study design was ready for full implementation on a large scale.

As the study employed a single-group pre-test-post-test design, consisting solely of an experimental group with no control group, it adhered to experimental protocols by implementing a structured and systematic approach to test variables, refine the procedure, and identify potential issues before the larger-scale study.

4.1.1 Pre-and Post-Test Pilot Study

4.1.1.1 Participants

The 10 respondents were sixth-semester English undergraduate students who volunteered to partake in the pilot study. To ensure consistency and control for potential selection bias, participants were selected from the same academic cohort, which helped standardize the study's conditions. The sample size was deliberately small for the pilot phase to test the feasibility of the study design and methodology.

4.1.1.2 Procedure

Even without a control group, the use of pre-tests and post-tests allowed for the measurement of changes in students' performance (the dependent variable) before and after the treatment (viewing of the animated TED-Ed videos). This approach helped to establish a baseline for comparison and evaluate the effect of the treatment on participants' grammar proficiency. The pre-test results provided an initial measure of participants' knowledge, and the post-test allowed for the measurement of any changes, directly linked to the treatment phase.

Throughout the pre-test, treatment (showing of the animated TED-Ed videos), and post-test phases, instructions for each stage were projected onto the classroom wall using a projector and also verbally communicated by the researcher before the initiation of each step. This measure was taken to ensure the participants comprehended the objectives of the present research and the instructions of each step through both written and verbal communication. This dual approach was utilized to ensure participants comprehended the research objectives and procedural instructions. The instruction was standardized across participants, with both verbal and visual instructions given before each phase to ensure clarity. Standardizing instruction delivery in this manner ensured that each student received the same guidance, and the experimental integrity was preserved.

Incorporating the research introduction and instructions within each printed questionnaire led to a rise in printing expenses due to increased paper consumption, consequently elevating the overall costs associated with the printing process. Hence, the choice of projecting the instructions was chosen by the researcher.

After the introduction and the pre-test instructions were shared, students received the six animated TED-Ed video questionnaires to answer, sequentially. This approach aimed to prevent students from feeling overwhelmed or flustered by the simultaneous presentation of multiple questionnaires. All pre-tests were completed before the implementation of the treatment involving the viewing of the animated TED-Ed videos.

The students demonstrated a tendency to engage in discussions with their peers regarding the questionnaire answers and displayed a willingness to assist one another. Consequently, to prevent any academic dishonesty or confounding variables, a silent, examination-like atmosphere was established during the questionnaires. This experimental protocol aimed to ensure that responses were based solely on individual knowledge rather than group discussions This requirement was therefore incorporated into the instructional guidelines.

All questionnaires were to be collected prior to the treatment phase (i.e., the viewing of the animated TED-Ed videos) to deter students from memorizing the questions for the post-test. This precaution was implemented due to students' inclination to strive for the correct answers, potentially leading them to retain the questions in pursuit of improved performance.

During the treatment phase, the instructional materials were displayed on the classroom wall using a projector, and the instructions were also verbally delivered by the researcher. The treatment involved the researcher playing the downloaded animated TED-Ed videos, which were connected to the projector via the researcher’s laptop. Each session took place in a classroom with the participants.

To mitigate potential confounding factors, such as varying levels of prior knowledge or external distractions, the study was conducted under controlled classroom conditions. The same set of animated TED-Ed videos was shown to all participants, with the researcher ensuring that environmental factors such as noise and technical issues were minimized.

In terms of controlling the learning environment, students were instructed to maintain silence during the viewing of each video to minimize distractions and encourage full engagement with the content. Additionally, the ceiling fans were turned off to prevent any audio interference, ensuring that all students received the same

quality of sound. The use of an external speaker was critical for amplifying the audio so that all participants, regardless of seating location, could clearly hear the content.

No technical issues were encountered with the projector and speakers used during the treatment phase as the researcher took great care to ensure that no technical issues interfered with the treatment phase. The projector and speakers were tested beforehand, and the researcher conducted a trial run to confirm that the equipment was functioning as expected. This step was crucial in preventing any interruptions during the treatment, thereby ensuring that all students experienced the treatment in the same manner.

Regarding the post-test, the respective questionnaires were distributed to the students only after the viewing of each corresponding video. This measure was implemented to reduce the tendency of students to prioritize the pursuit of correct answers over focusing on the content of the animated TED-Ed videos.

To minimize the influence of external variables, such as maturation effects, which might naturally occur between the pre-test and post-test assessments, the researcher implemented several key protocols. For example, participants were selected from the same academic field of study, reducing potential variability in educational background. Moreover, the time gap between the pre-test and the post-test was minimized to reduce the likelihood of any external factors (e.g., additional learning experiences or development) influencing the outcome. The treatment was administered two days after the pre-test to reduce the chance of participants recalling specific pre-test questions and instead focusing on the content of the TED-Ed videos. This short interval also helped control potential historical effects, where external events might influence learning outcomes. Immediately following the viewing of each animated TED-Ed video, the respective questionnaires were distributed among the participants. This practice helped in minimizing the temporal gap between the pre-test and post-test.

Standardization of procedure was exercised in the pre-test, post-test, and treatment consistently across all participants. All the students watched the same videos, under the same conditions, ensuring that the only variable was the content presented in the videos. The researcher ensured that the viewing environment (e.g., seating arrangements, lighting, and sound) was controlled to minimize variability and to ensure that the results were attributable to the treatment rather than external factors.

4.1.1.3 Materials and Data Collection

Each semester's classes accommodated approximately 40 students. To ensure effective oversight and maintain the integrity of the research environment by the researcher, one class was administered at a time. The attendance list for each class was monitored to confirm consistency in student participation across pre-test questionnaires, post-test questionnaires, and treatment administration. Students who were absent during a session where any of these were being administered were promptly contacted the following day to facilitate the completion of missed assessments or treatments.

Due to the prohibition of mobile phones within the institution's premises, employing Google Forms for data collection was deemed impractical. Consequently, the questionnaires had to be printed and physically distributed, followed by retrieval and analysis by the researcher herself. This ensured consistency in the distribution and collection methods.

The process of collecting the questionnaires consumed time and occasionally caused disruptions among the participants. Therefore, it appeared more practical to instruct the students to remain seated and simply pass their complete questionnaires to the individual in front of them. This approach facilitated a quicker, smoother, and less cumbersome collection process.

Each questionnaire consists of 5 questions. However, students demonstrated a tendency to lose focus when an undefined time frame was allotted for answering each questionnaire, as it was based on their response times. Therefore, implementing a maximum time limit of six minutes per questionnaire seemed sufficient and adequate for answering each questionnaire. If participants completed all questions within this time frame, they would proceed to the subsequent questionnaire. A specific time limit was set for completing each questionnaire to prevent variability in response times that could influence the results.

The participants demonstrated no difficulty in comprehending the questions and their format. Feedback from participants indicated that the questions were aligned with the content of the animated TED-Ed videos and were formulated concisely, facilitating a less burdensome and clearer process of response. Responses provided in both the pre-

test and post-test questionnaires were deemed satisfactory and relevant to the posed questions.

4.1.1.4 Ethical Considerations

Initially, an application was submitted to the institution's head principal to obtain authorization and approval for conducting the research within the English department. The researcher then coordinated with the English department to identify optimal time slots for conducting both the pilot and full-scale research. During this process, the researcher adhered to the experimental protocol by maintaining consistency in timing and conditions across all participants.

In accordance with ethical guidelines for research with human participants, all participants were provided with informed consent detailing the study's purpose, procedures, and any potential risks. Participants' confidentiality was ensured by anonymizing all data collected.

4.1.2 Learning Satisfaction Survey Pilot Study

4.1.2.1 Participants

The same 10 respondents from the pre-and post-test pilot study were used in the pilot for the Learning Satisfaction Survey (LSS). This allowed the researcher to assess the effectiveness of the treatment in terms of participants' learning satisfaction, which served as an additional measure of the treatment's potential impact.

4.1.2.2 Procedure

As in the pre-and post-test phases, the Learning Satisfaction Survey was standardized across all participants. The LSS questionnaire was conducted after the pre- and post-tests for all 6 animated TED-Ed videos were completed. Similar to the pre- and post-test instruction procedure, the LSS's instructions were displayed to the participants using a projector. The questionnaire was then distributed to the 10 participants. Feedback from the participants indicated that the questions were clear and straightforward, facilitating ease of comprehension and response.

4.1.2.3 Materials and Data Collection

The LSS questionnaires were printed copies; distributed physically and followed by retrieval and analysis by the researcher herself. During each class, the

students were instructed to remain seated and simply pass their completed questionnaires to the individual in front of them for quicker collection. The participants were initially given 10 minutes to answer the questionnaire, however, most were able to complete it in 5 minutes. Therefore, a 7-minute time allocation was adequate for answering the questionnaire to accommodate both the fast and slow-answering participants.

By adhering to established experimental research protocols, including a pre-and post-test design, standardization of procedures, control of external variables, ensuring homogeneity, and clear instructional guidelines, the pilot study was conducted in a controlled manner, despite the absence of a control group. The primary focus was on refining the methodology, ensuring the reliability and validity of the research instruments, and minimizing potential biases or confounding factors being key principles of experimental research.

4.2 Phase Two – Pre-and Post-Tests

In Phase Two, the experimental methodology described in the pilot study was continued. This included the use of pre-and post-tests, the standardization of procedures, and the use of animated TED-Ed videos as the treatment. All efforts to control extraneous variables, such as ensuring a distraction-free environment and providing clear instructions, were upheld. The feedback from Phase One was incorporated to refine the methodology, including the handling of questionnaires and ensuring the treatment was delivered consistently.

After the pilot study, pre-and post-test research was undertaken for all six animated TED-Ed videos. The pre-test evaluated the initial performance of undergraduate students using the questionnaires focused on the content of these six videos concerning English grammar. This assessment served as a baseline to determine participants' starting points in terms of knowledge prior to undergoing the treatment — which involved viewing the animated TED-Ed videos as language learning material. This structure helped in clearly presenting how the animated

videos affected the learning outcome of the participants after engaging with the animated educational content provided in the videos.

A paired samples *t*-test was performed to evaluate whether there was a difference in the English grammar knowledge level of undergraduate Pakistani learners before and after viewing the animated TED-Ed videos. This analysis helped show evidence of change or difference between the two dependent sets of scores. Below is a tabulated summary of the results from the pre-and post-tests conducted for each animated TED-Ed video. The two-tailed critical value of the paired samples *t*-test with 205 degrees of freedom (*df*=205) at a set significance level of 0.05 is 1.97 (*α/2*=1.97). The critical value for the paired samples *t*-test was determined from the *t*-distribution table. This critical value was used to determine the boundaries for accepting or rejecting the null hypothesis in a two-tailed *t*-test.

4.2.1 Video 1 - 'When to use "me", "myself" and "I" - Emma Bryce'

The results in Table 2 indicated that the mean post-test score obtained by the undergraduate students after viewing animated TED-Ed video 1, titled 'When to use "me", "myself" and "I" - Emma Bryce', (M = 3.86, SD = 0.74) was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 3.43, SD = 0.82), *t* (205) = -5.54, *p* = <.001.

Table 2

Pre-and Post-Test Scores of TED-Ed Video 1

	n	**Full Score**	**Score Obtained**		***t* value**	***df***	***p* value**	**95% Confidence Interval of Difference**	
			Mean	***SD***				**Lower**	**Upper**
Pre-Test	206	5	3.43	0.82	-5.54	205	<.001		
Post-Test	206	5	3.86	0.74					
Difference			-0.43					-0.52	-0.28

*p<0.05

Based on the results of the paired-samples *t*-test, it can be concluded that watching animated TED-Ed Video 1 had a statistically significant effect on the learning outcomes of undergraduate students regarding the grammar topic covered in the video.

The mean difference between pre-and post-test scores was -0.43, indicating effectiveness in the treatment administered. The rejection of the null hypothesis was supported by the fact that the mean post-test score was greater than the mean pre-test score. Notably, this mean difference was the smallest observed across all six paired-samples *t*-tests.

To further validate this rejection, inferential judgment was necessary. As shown in Table 2, the *t*-value (t = -5.54) exceeds the critical value ($\alpha/2 = 1.97$), indicating that the mean difference was statistically significantly different from zero, thereby confirming the effectiveness of the treatment. The negative sign of the *t*-value signified that the mean post-test score was higher than the mean pre-test score obtained, further supporting the rejection of the null hypothesis. Therefore, the mean difference of -0.43 was statistically significantly different from zero, thus endorsing the alternative hypothesis.

Furthermore, both the lower and upper interval values of the 95% confidence interval of difference exhibited negative signs and do not cross zero. This alignment signified both values to be on the same side of zero, further supporting the conclusion that the mean difference of -0.43 was statistically significantly different from zero, thereby rejecting the null hypothesis.

Additionally, since the p-value (< .001) was less than the set significance level of 0.05, it provided additional evidence to reject the null hypothesis, suggesting that animated TED-Ed videos had a significant effect on undergraduate students' English grammar learning within their classroom setting.

In conclusion, it was inferred that animated TED-Ed videos enhance learning outcomes among undergraduate students and serve as valuable multimedia learning materials in higher educational English language learning classes. Specifically, animated TED-Ed videos are recognized as effective learning materials for language acquisition. These findings strongly support the alternative hypothesis, which was that animated TED-Ed videos had a positive impact on undergraduate students' English grammar learning within their classroom setting.

4.2.2 Video 2 - *Punctuation Explained (by Punctuation!)*

The results in Table 3 indicated that the mean post-test score obtained by the undergraduate students after viewing animated TED-Ed Video 2, titled 'Punctuation explained (by Punctuation!), (M = 4.22, SD = 0.81) was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 3.36, SD = 1.04), t (205) = -9.07, p = <.001.

Table 3

Pre-and Post-Test Scores of TED-Ed Video 2

	n	**Full Score**	**Score Obtained**		***t* value**	***df***	***p* value**	**95% Confidence Interval of Difference**	
			Mean	***SD***				**Lower**	**Upper**
Pre-Test	206	5	3.36	1.04	-9.07	205	<.001		
Post-Test	206	5	4.22	0.81					
Difference			-0.86					-1.05	-0.67

*p<0.05

Similar to Video 1's paired-sample t-test, it can be concluded from Table 3 that watching animated TED-Ed Video 2 had a significant positive impact on the learning outcomes of the participants, as evidenced by the increased mean score obtained in the post-test compared to the mean pre-test. Thus, the null hypothesis is rejected. The p-value served as one of the indicators of whether to accept or reject the null hypothesis. As shown in Table 3, the p-value ($p < .001$) was less than the significance level of 0.05, indicating that the mean difference was statistically significantly different from zero, confirming the effectiveness of the treatment and rejecting the null hypothesis.

The paired-samples t-test for Video 2 showed that the t-value exceeded the critical value ($\alpha/2 = 1.97$), suggesting that the mean difference was statistically significantly different from zero. The negative sign of the t-value indicating that the post-test score was higher than the pre-test score obtained.

Moreover, a higher t-value implied a smaller probability that this difference occurred by chance. The t-value (t = -9.07) was significantly large, meaning that the

difference in means could not have occurred by chance but rather due to the effectiveness of the treatment.

Additionally, both the lower and upper interval values of the 95% confidence interval of difference have negative signs, indicating that neither crosses the zero mark. This suggested that the mean difference of -0.86 was statistically significantly different from zero, thereby rejecting the null hypothesis and supporting the alternative hypothesis.

Results from Table 3 stated that animated TED-Ed videos effectively enhanced educational outcomes for undergraduates, serving as valuable multimedia resources in English language learning within higher education.

4.2.3 Video 3 - *How to use a semicolon - Emma Bryce*

Table 4 reported that the mean post-test score obtained by the undergraduate students after viewing animated TED-Ed video 3, titled 'How to use a semicolon - Emma Bryce', (M = 4.00, SD = 0.82) was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 2.99, SD = 1.01), t (205) = -10.58, p = <.001.

Table 4

Pre-and Post-Test Scores of TED-Ed Video 3

	n	**Full Score**	**Score Obtained**		***t* value**	***df***	***p* value**	**95% Confidence Interval of Difference**	
			Mean	***SD***				**Lower**	**Upper**
Pre-Test	206	5	2.99	1.01	-10.58	205	<.001		
Post-Test	206	5	4.00	0.82					
Difference			-1.02					-1.20	-0.83

*p<0.05

Yusuf (2016) emphasized the pivotal role of outcome measurement as a robust method for assessing students' comprehension of educational video content, as exemplified in this phase of the study. The paired-samples *t*-test was employed to evaluate the difference between the means of pre-and post-test scores to determine the statistical effectiveness of the treatment administered to the participants. Table 4

revealed a mean difference of (-1.02) between the pre-and post-test scores for Video 3. This negative difference indicated that the post-test yielded a higher mean score than the pre-test, suggesting a significant positive effect of the animated video on learning outcomes and thereby rejecting the null hypothesis.

In comparison to the calculated critical value, the *t*-value was higher, inferring that the mean difference between the pre-and post-tests was statistically significantly different from zero, thereby rejecting the null hypothesis that there was no significant effect of animated TED-Ed videos on undergraduate students' English grammar learning outcomes within their classroom setting.

Table 4 showed a *t*-value of -10.58, which was notably large, similar to Video 2's *t*-value. This suggests that the higher scores obtained by participants in the post-test were not due to chance but rather attributable to the educational benefits of watching the animated TED-Ed videos, leading to improved learning outcomes. The negative sign showed that the post-test score was higher than the pre-test score, thus supporting the rejection of the null hypothesis.

Additionally, both the lower and upper interval values were negative and less than zero, implying that the mean difference was statistically significantly different from zero, thereby rejecting the null hypothesis and supporting the alternative hypothesis.

These findings aligned with the alternative hypothesis, supported by a probability value ($p < .001$) below the predetermined significance level of 0.05, indicating that post-test scores significantly exceeded pre-test scores. Furthermore, the findings rejected the null hypothesis, underscoring that there was indeed a statistically significant effect of animated TED-Ed videos on undergraduate students' English grammar learning outcomes within their classroom setting.

4.2.4 Video 4 - *Buffalo buffalo buffalo: One-word sentences and how they work - Emma Bryce*

Table 5 indicated results that showed the mean post-test score obtained by the undergraduate students after viewing animated TED-Ed video 4, titled 'Buffalo buffalo buffalo: One-word sentences and how they work - Emma Bryce', ($M = 4.11$, $SD = 0.89$)

was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 2.73, SD = 1.20), *t* (205) = -13.40, *p* = <.001.

Table 5

Pre-and Post-Test Scores of TED-Ed Video 4

	n	**Full Score**	**Score Obtained**		***t* value**	***df***	***p* value**	**95% Confidence Interval of Difference**	
			Mean	***SD***				**Lower**	**Upper**
Pre-Test	206	5	2.73	1.20	-13.40	205	<.001		
Post-Test	206	5	4.11	0.89					
Difference			-1.37					-1.57	-1.17

*p<0.05

Among the total number of participants (n = 206), all of whom were female undergraduate students, statistical analysis using paired-sample *t*-tests on the pre-and post-test data of Video 4 revealed a significant enhancement in English grammar learning outcomes following exposure to the animated TED-Ed video. This improvement indicated heightened comprehension of the subject matter among students, as evidenced by their increased accuracy in questionnaire responses in the post-test compared to the pre-test. The negative difference between the pre-and post-test scores indicated a positive effect of the treatment.

The *t*-test also showed negative lower and upper interval values of the 95% confidence interval of difference, which do not cross zero. Therefore, the mean difference of -0.86 was statistically significantly different from zero, supporting the rejection of the null hypothesis. Additionally, the critical value (α/2 = 1.97) was smaller than the large negative *t*-value (t = -13.40), further supporting the rejection of the null hypothesis. The high *t*-value and consequently the significant mean difference suggested that this difference was unlikely to have occurred by chance, indicating the effectiveness of the treatment.

These results rejected the null hypothesis, as evidenced by a mean difference of -1.37 favoring the post-test, underscoring the statistical significance of this effect.

Moreover, the p-value (< .001), which was below the predetermined significance threshold of 0.05, provides further support for rejecting the null hypothesis.

Concurrently, this rejection aligns with the endorsement of the alternative hypothesis, affirming the beneficial impact of animated TED-Ed videos on the English grammar learning outcomes of undergraduate students within an academic setting.

4.2.5 Video 5 - *How misused modifiers can hurt your writing*

The results in Table 6 indicated that the mean post test score obtained by the undergraduate students after viewing animated TED-Ed video 5, titled 'How misused modifiers can hurt your writing', (M = 3.43, SD = 0.89) was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 1.97, SD = 1.02), t (205) = -14.95, p = <.001.

Table 6

Pre-and Post-Test Scores of TED-Ed Video 5

	n	**Full Score**	**Score Obtained**		***t* value**	***df***	***p* value**	**95% Confidence Interval of Difference**	
			Mean	***SD***				**Lower**	**Upper**
Pre-Test	206	5	1.97	1.02	-14.95	205	<.001		
Post-Test	206	5	3.43	0.89					
Difference			-1.46					-1.65	-1.27

*p<0.05

According to the null hypothesis, the animated TED-Ed video was not expected to exert a significant impact on the English grammar learning of undergraduate students in their classroom environment. However, the paired-sample *t*-test revealed a significant difference in the mean scores obtained in the pre-and post-tests for Video 5, which exhibited the highest mean difference (-1.46) among all six paired-samples *t*-tests conducted. This statistical procedure was utilized to compare scores obtained before and after exposure to the grammar-themed animated TED-Ed videos. Significantly higher scores were observed in the post-test (M = 3.43, SD = 0.89)

compared to the pre-test (M = 1.97, SD = 1.02), indicating that the video effectively enhanced students' comprehension and proficiency in grammar concepts.

The lower and upper interval values of the 95% confidence interval of difference are both negative, indicating that neither crosses the zero mark. This negative sign implied that the mean difference of -1.46 is statistically significantly different from zero, thereby supporting the rejection of the null hypothesis. Additionally, since the p-value (< .001) was less than the significance level of 0.05, it further supports the rejection of the null hypothesis, which shows significant effect of animated TED-Ed videos on undergraduate students' English grammar learning within their classroom setting.

The *t*-value in this paired-samples *t*-test was the highest among all six conducted tests, with a value of (t = -14.95). This value exceeds the critical value (α/2 = 1.97), indicating that the mean difference was statistically significantly different. The negative nature of the *t*-value confirmed that the mean difference is statistically significant and supports the rejection of the null hypothesis.

Overall, these findings rejected the null hypothesis and support the alternative hypothesis, implying that engagement with animated TED-Ed Video 5 was advantageous, resulting in improved understanding and proficiency in English language grammar usage. Video 5 was considered a useful multimedia learning tool for English language learning among undergraduate students.

4.2.6 Video 6 - *When to use apostrophes - Laura McClure*

The results in Table 7 indicated that the mean post test score obtained by the undergraduate students after viewing animated TED-Ed video 6, titled ‘When to use apostrophes - Laura McClure’, (M = 3.61, SD = 0.85) was significantly higher than the mean pre-test score of the undergraduate students before watching the animated TED-Ed video (M = 2.99, SD = 1.13), t (205) = -6.43, p = <.001.

Table 7

Pre-and Post-Test Scores of TED-Ed Video 6

	n	Full Score	Score Obtained		*t* value	*df*	*p* value	95% Confidence Interval of Difference	
			Mean	*SD*				Lower	Upper
Pre-Test	206	5	2.99	1.13	-6.43	205	<.001		
Post-Test	206	5	3.61	0.85					
Difference			-0.62					-0.81	-0.43

*p<0.05

Based on Table 7, an improvement in the learning outcomes of undergraduate students can be observed through the post-test scores. The scores obtained in the pretest (M = 2.99) increased by 0.62 in the post-test scores. With the post-test scores surpassing the pretest scores, it can be concluded that there was an increase in student learning outcomes after watching the animated TED-Ed Video 6. The negative difference in means indicated a positive effect of the treatment on the sample.

Furthermore, the p-value ($p < .001$) was less than the significance level of 0.05, providing strong evidence against the null hypothesis and supporting the alternative hypothesis. This suggested that the observed results are unlikely to be due to chance alone.

Additionally, inferential statistics revealed that the calculated *t*-value ($t = -6.43$) exceeded the critical *t*-value ($\alpha/2 = 1.97$) and was negative, indicating significant evidence to reject the null hypothesis due to a statistically significant mean difference.

In essence, the high *t*-value ($t = -6.43$) in the paired-samples *t*-test signified a substantial and statistically significant difference between the paired observations, supporting the alternative hypothesis that a true difference exists in the means of the scores obtained in the pre-and post-test questionnaires.

The consistent negative signs in the lower and upper interval values of the 95% confidence interval of difference suggest that the confidence interval does not include zero. This reinforced the conclusion that there was indeed a genuine difference between the pre-and post-test scores obtained. When both bounds of the confidence interval

shared the same signs, it provided further evidence to reject the null hypothesis confidently, indicating that the observed effect was not likely attributable to random chance.

4.2.7 Summary of Collected Pre-and Post-Test Data

Among the six paired-samples *t*-tests conducted, all revealed statistically significant differences in the mean scores, thereby rejecting the null hypothesis. The paired-samples *t*-test of Video 5 exhibited the highest mean difference, indicating the most pronounced effect, while Video 4's paired-sample *t*-test showed the lowest mean difference among the tests. These findings provide strong evidence supporting the alternate hypothesis, demonstrating that there was a statistically significant effect of animated TED-Ed videos on the undergraduate students' English grammar learning outcome within their classroom setting, indicating that the treatment was effective.

4.3 Phase Three – Multimodal Analysis of Animated TED-Ed Videos

The CTML, proposed by Richard Mayer, focuses on how people learn from words and pictures presented together and emphasized optimizing visual and auditory elements, excluding unnecessary information, and promoting active learning through multimedia adjustments (Mayer, 2009). In his theory, he formulated evidence-based guidelines for multimedia design that incorporate appropriate visual and verbal elements to facilitate learning, avoiding excessive cognitive load on the learner (Mayer, 2014).

The sample animated TED-Ed videos were analyzed using five of Mayer's CTML principles, namely Spatial Contiguity Principle, Temporal Contiguity Principle, Signaling Principle, Redundancy Principle and Coherence Principle. Screenshots from the animated TED-Ed videos were included to illustrate these principles where applicable and relevant.

4.3.1 Spatial Contiguity Principle

Spatial Contiguity Principle pertains to when the related text and graphics in a video are physically close together in the frame. This makes it easier for learners to process the information, using less cognitive load to comprehend the content and input new information. In the animated TED-Ed videos, words were strategically placed near

visual elements, adhering to the spatial contiguity principle. This practice is significant as aligning images with the texts on screen enhances learners' comprehension of unfamiliar or complex content. This has been substantiated by Jiang et al. (2017), who demonstrated that closely integrating related information can easily facilitate the retention of specific details in learners' working memory.

As seen in Figure 3, the allocation of pronouns to each robot animation and their consistent use throughout the video exemplify the spatial contiguity principle. The words 'me', 'myself', 'I', and 'interchangeably' are visually grouped above each robot's head within the video frame, demonstrating their interconnectedness. This spatial organization facilitates immediate association between each pronoun and its corresponding robot, enhancing learners' ability to grasp the concept of interchangeability among pronouns. By keeping these elements closely linked visually, the video reduces cognitive load by minimizing the mental effort required to connect pronouns with their respective entities, thereby promoting efficient learning.

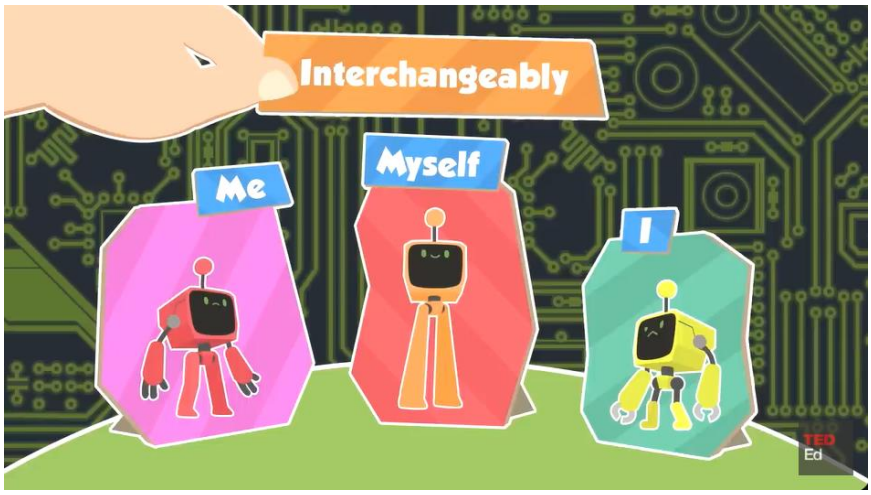

Figure 3. Screenshot from animated TED-Ed video 1.

Additionally, CLT emphasizes the importance of managing cognitive load by presenting information in a structured and organized manner. By visually grouping the pronouns above each robot's head, the video provides a clear and consistent visual representation of pronoun usage, which helps learners understand and remember the concept without overwhelming them with extraneous details. This approach helps learners focus on the essential information—how pronouns can be used interchangeably—while minimizing cognitive strain.

Furthermore, the allocation of three pronouns to the animation entity robots, as illustrated in Figures 4, 5, and 6, utilizes the principle of spatial contiguity throughout the video. This technique helps engage learners and enhance their focus on how pronouns can be used interchangeably, potentially contributing to a reduction in cognitive load.

These instructional strategies align with Cognitive Load Theory and support the alternate hypothesis by demonstrating how animated TED-Ed videos positively impact undergraduate students' English grammar learning outcomes within their classroom setting.

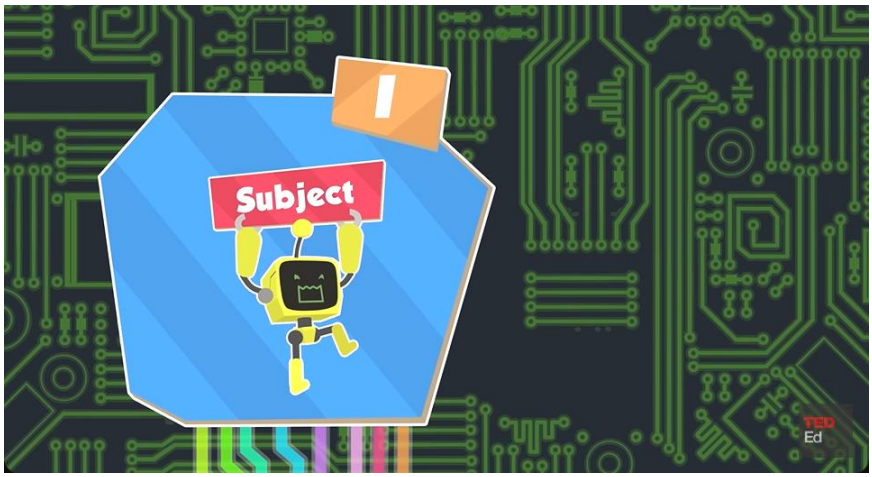

Figure 4. Screenshot from Animated TED-Ed Video 1.

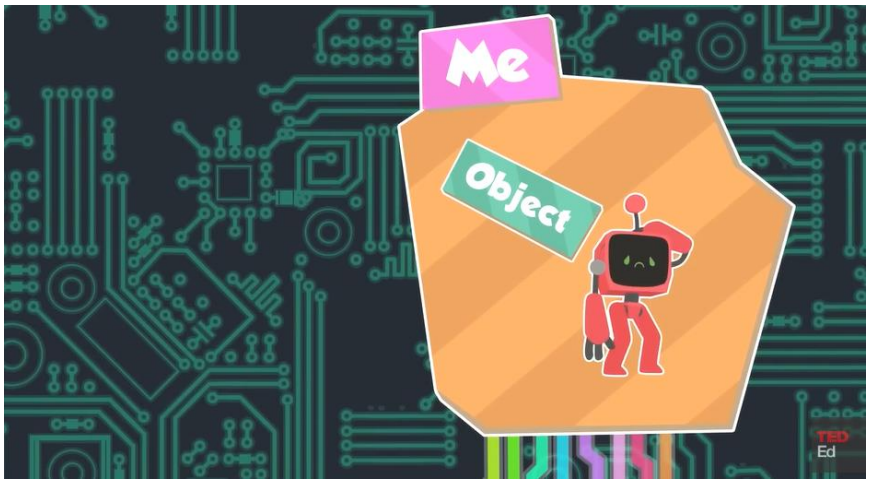

Figure 5. Screenshot from Animated TED-Ed Video 1.

Figure 6. Screenshot from Animated TED-Ed Video 1.

CTML's principle of spatial contiguity suggests that learners benefit when related words and visuals are presented close together. Figures 7 and 8 demonstrated the use of spatial contiguity when presenting sentence examples above animated entities illustrating the use of the pronouns 'I' and 'me'. The spatial contiguity was evident as the sentence examples and the animated entities were closely positioned within the video frame. This proximity encourages learners to associate the sentence examples directly with the corresponding animations, facilitating a clearer understanding of the grammatical usage of these pronouns in the mentioned sentence structures. As the sentence example appeared, the animated entities moved across the screen in synchronization with the narration, enabling learners to follow along easily and increase comprehension of the example sentence and grammatical rules explained.

Furthermore, Cognitive Load Theory emphasizes the importance of managing cognitive load by presenting information in a structured and coherent manner. The synchronized movement of the animated entities across the screen in coordination with the narration helped to reduce extraneous cognitive load. Learners can easily follow along with the example sentences as they unfold, which promotes comprehension of the grammatical rules being explained without overwhelming cognitive processing. These instructional methods were consistent with Cognitive Load Theory and provide evidence in favor of the alternative hypothesis while refuting the null hypothesis. They illustrated that the animated TED-Ed videos have a positive effect on the participants' learning outcomes.

Figure 7. Screenshot from Animated TED-Ed Video 1.

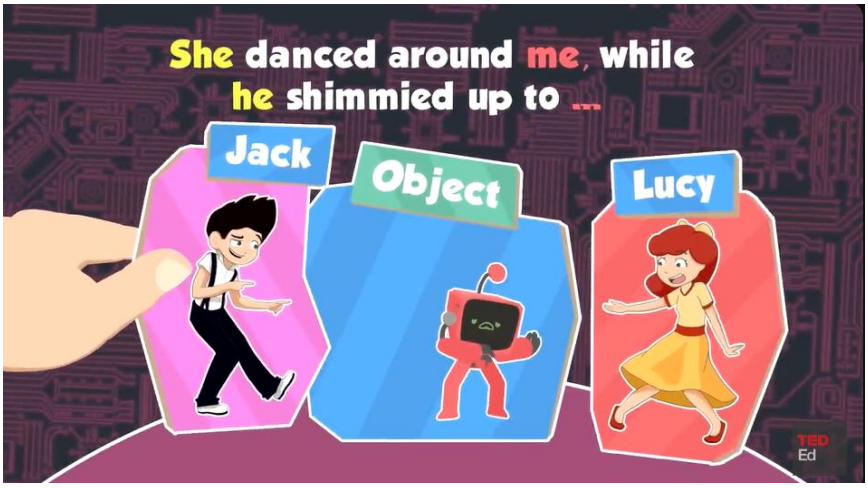

Figure 8. Screenshot from Animated TED-Ed Video 1.

In the animated TED-Ed video titled "Punctuation explained (by Punctuation!)", spatial contiguity was maintained consistently across its entirety. The video presented animated renditions of punctuation marks alongside explanatory text detailing their application within sentences. This textual information was enclosed within speech bubbles directly linked to the respective animated punctuation, enhancing clarity, and easing cognitive load on learners by eliminating the need for them to actively search for connections between text and animation. The video employed this method uniformly to explain the roles of punctuation marks such as the period, question mark, exclamation mark, and comma, as depicted in Figures 9 to 12. Consequently, supporting the rejection of the null hypothesis, and inferring that the use of spatial contiguity in facilitating comprehension and learning in educational contexts was effective.

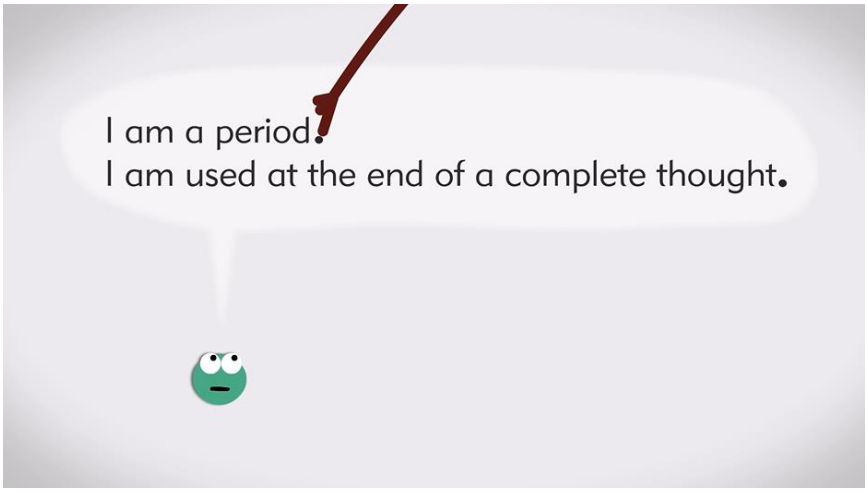

Figure 9. Screenshot from Animated TED-Ed Video 2.

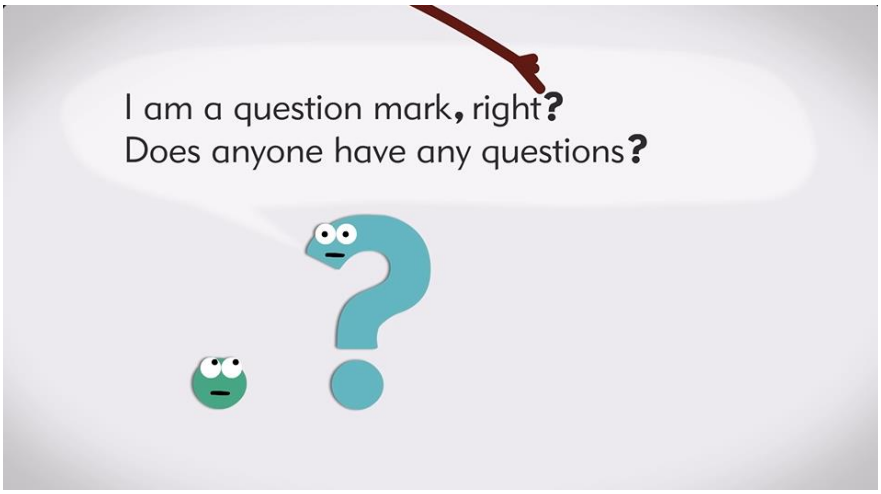

Figure 10. Screenshot from Animated TED-Ed Video 2.

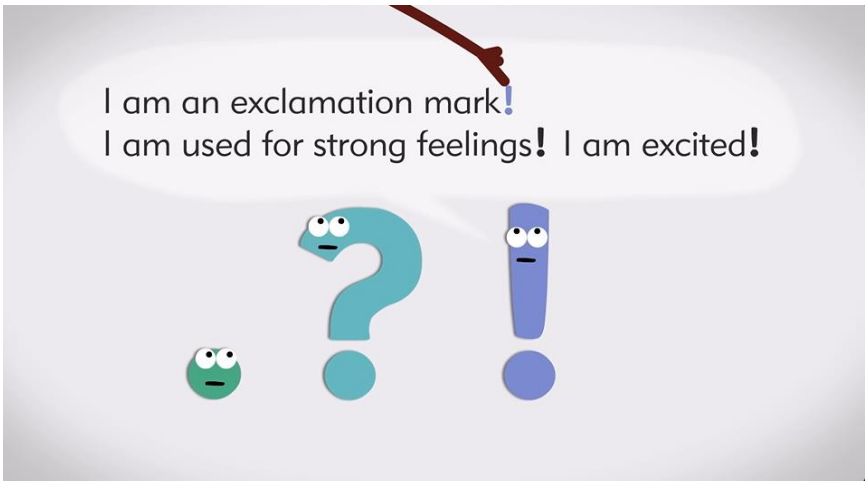

Figure 11. Screenshot from Animated TED-Ed Video 2.

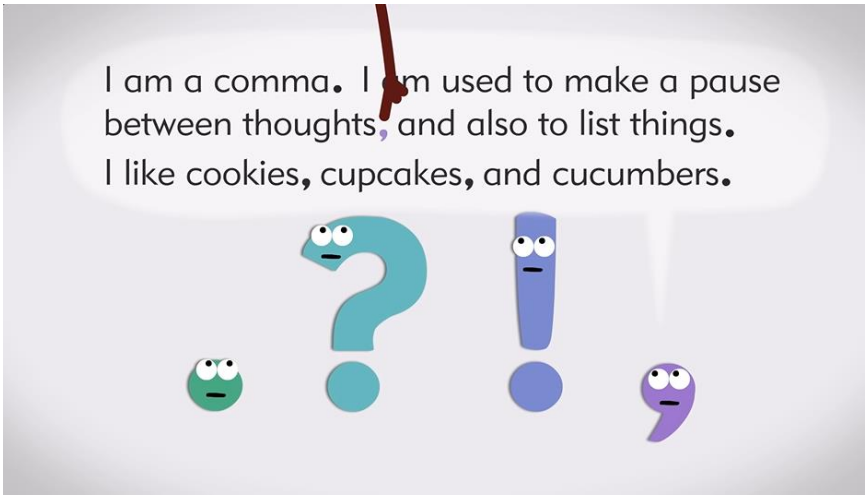

Figure 12. Screenshot from Animated TED-Ed Video 2.

In Figure 13, the video illustrated the correct usage of a semicolon in writing. One of its functionswass to establish links between two distinct yet related clauses. In the animation, the semicolon representation jumped from the ground and collided with the incomplete text 'connections', directing learners' focus to the primary role of a semicolon. This action symbolically embodied the concept of 'connection' by physically linking the three separate blocks that spell out the word 'connection'. By using the animation to visually demonstrate the semicolon's function, the video reduced extraneous cognitive load by presenting information in a cohesive and integrated manner. Learners can focus on the primary message—understanding the role of the semicolon—without being overwhelmed by unnecessary cognitive processing.

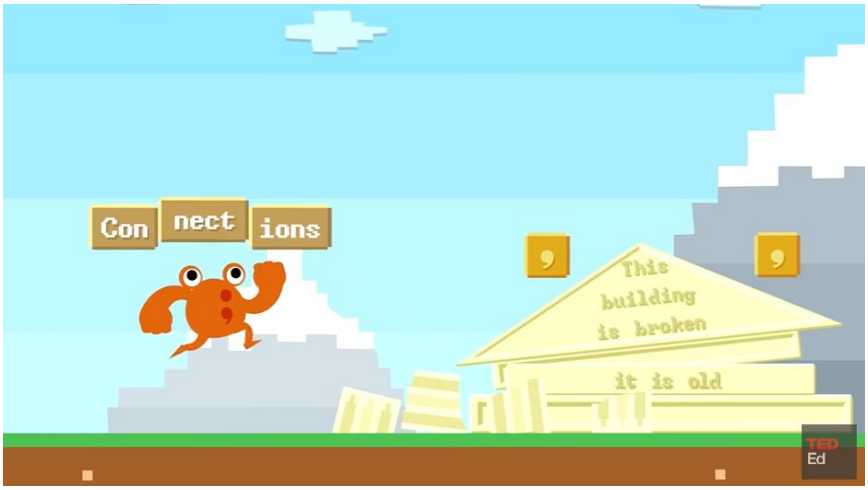

Figure 13. Screenshot from Animated TED-Ed Video 3.

In Figures 14 and 15, the animated representations of the semicolon and period engage were in a symbolic confrontation within the central spotlight of the frame whenever the incorrect punctuation mark appeared in the sentence example. This visual

emphasis highlighted the appropriate occasions to use a semicolon instead of a period. This visual strategy aligned with the principles of Cognitive Theory of Multimedia Learning (CTML) and Cognitive Load Theory, both of which are crucial in enhancing CTML's principle of spatial contiguity, asserted that learners benefit when related words and visuals are presented close together. Positioned atop the text boxes, this dynamic interaction highlighted the grammatical correctness of pairing each punctuation mark with its respective type of clause—whether related or unrelated.

Furthermore, the animated conflict emphasized the significance of avoiding such errors, which could potentially lead to substantial grammatical inaccuracies and result in confusion or a failure to convey the intended meaning effectively. Furthermore, Cognitive Load Theory posits that effective learning occurs when instructional materials manage cognitive load by minimizing extraneous processing and focusing attention on essential information. By featuring the symbolic confrontation in the central spotlight of the frame, the animation directed learners' attention to the critical distinctions between semicolons and periods. This focused presentation reduced cognitive load by providing clear and contrasting examples, aiding learners in understanding the grammatical nuances without unnecessary cognitive strain. Therefore, through the strategic use of visual representation and spatial contiguity in Figures 14 and 15, the animation effectively utilized CTML principles to enhance comprehension of punctuation usage while aligning with CLT to optimize learning conditions.

Figure 14. Screenshot from Animated TED-Ed Video 3.

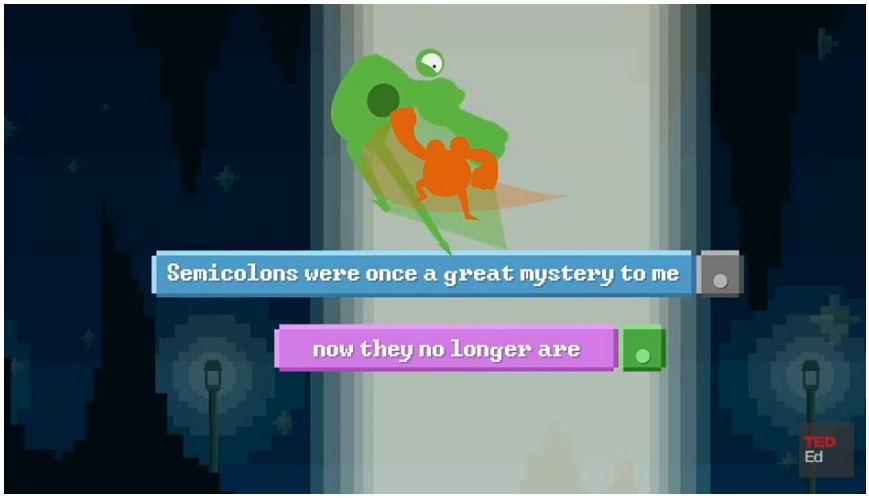

Figure 15. Screenshot from Animated TED-Ed Video 3.

The animated semicolon was prominently positioned at the center of the video frame, as seen in Figure 16, encircled by three text boxes that delineate its primary functions: ensuring clarity, emphasizing points, and enhancing writing style. The deliberate placement of the animated semicolon in the central position of the video frame, surrounded by explanatory text boxes, illustrated the application of spatial contiguity.

The semicolon was visually highlighted within the video, encircled by text boxes that defined its primary functions. This spatial proximity focused learners' attention directly on the semicolon's roles, facilitating immediate comprehension of its significance through the association of visual representation with key textual explanations. By maintaining spatial contiguity, the video optimized the cognitive process of connecting visual and verbal information, thereby promoting effective understanding and retention of the semicolon's usage. The clear and concise presentation of the semicolon's functions in Figure 16 minimized extraneous cognitive load by providing learners with a cohesive visual framework. This approach enabled

learners to grasp and recall key aspects of semicolon usage efficiently, supporting their learning process without excessive cognitive load.

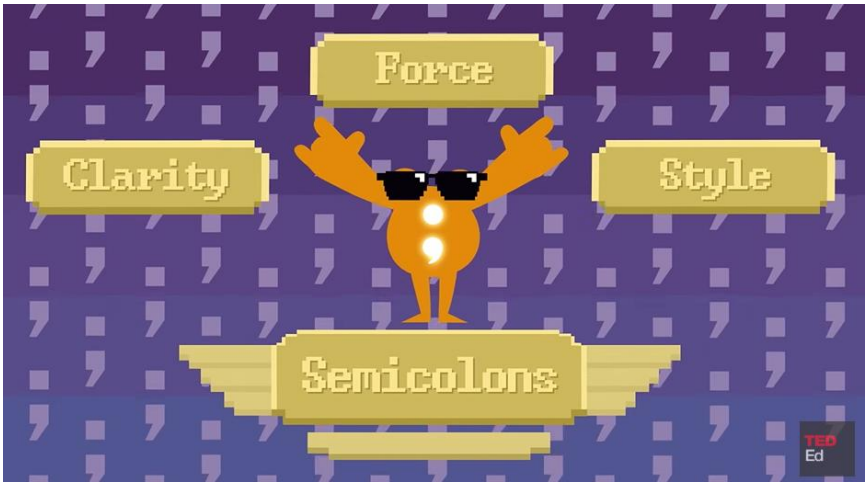

Figure 16. Screenshot from Animated TED-Ed Video 3.

In Figure 17, three distinct animations representing the word 'buffalo' are displayed above corresponding text descriptions. Placing the text in close proximity to its respective animation facilitates a clearer understanding of the word's multiple meanings for the learner. The video discussed lexical ambiguity, which was a complex concept to grasp hence animation was a useful tool for such a topic as it helped in representing the concept effectively, simply, and clearly. The spatial contiguity principle emphasized the effectiveness of presenting related information close together to enhance learning. By aligning animations with descriptive text, this principle supported the learner's ability to grasp and associate the different meanings of the word 'buffalo' more easily. Additionally, considering Cognitive Load Theory (CLT), the arrangement of animation and text minimized extraneous load by eliminating unnecessary cognitive effort in linking visuals with explanations. It directed attention

to relevant information (germane load), facilitating deeper understanding of lexical ambiguity without overwhelming the learner with irrelevant details.

Figure 17. Screenshot from Animated TED-Ed Video 4.

Similarly, in Figure 18, the clarity and simplification of the different meanings of the term "ship" were evident. The animation illustrating the verb form of "ship," meaning to transport, was complemented by the motion depicted by the ship animation. Conversely, the noun form of "ship," referring to a vessel, was distinguished by the addition of cargo blocks atop the ship, as depicted in Figure 18. By juxtaposing animations with corresponding explanations, learners were better able to associate different meanings of the word "ship" effectively. The closeness of the text to the animation reduced extraneous load by clearly illustrating each meaning without unnecessary complexity, while highlighting the essential information (germane load) about the dual meanings of "ship." Thus, this integrated approach supported learners in understanding lexical ambiguity through effective multimedia presentation.

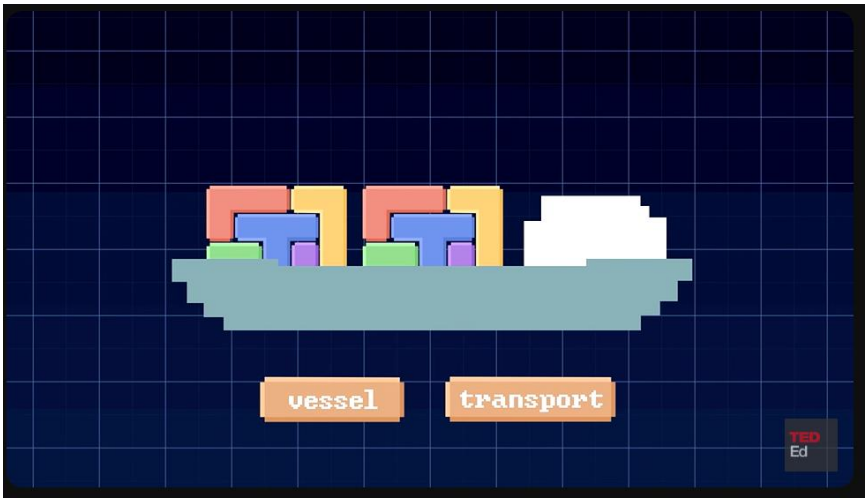

Figure 18. Screenshot from Animated TED-Ed Video 4.

Spatial contiguity was also seen being applied in Video 2 titled ‘How misused modifiers can hurt your writing,’ as evidenced in Figure 19. The short spatial difference in the animation depicting the squinting entity and the simplified explanation of the term ‘squinting modifiers’ illustrated the effectiveness of this principle. This spatial arrangement brought forth the reduction of both extrinsic and intrinsic cognitive load, thereby promoting germane load and easier comprehension. As a result, this approach minimized cognitive effort and fostered a clearer, easier understanding of the topic. Moreover, this supported the finding that Video 2 exhibited the highest mean difference in pre-and post-test scores, thereby corroborating the alternate hypothesis that the mean difference was statistically significant and affirming the effectiveness of the treatment for the participants.

Figure 19. Screenshot from Animated TED-Ed Video 5.

The effective integration of animations in the videos was achieved through strategic alignment of images and text, guided by the principle of spatial contiguity to

prevent audience confusion. Johnson and Mayer (2012) had previously supported this approach, providing evidence that placing corresponding animation segments and words together on a screen facilitated better integrative and cohesive transitions, leading to more in-depth learning.

Moreover, students generally tended to favor simpler designs, as they were more likely to recall both the interface and the content when it was easier to comprehend. If the platform had been overly complex, students' attention might have shifted toward functionality rather than the educational content itself. Figures 20 to 32 exemplified this preference for simplicity and its impact on learning outcomes. This use of spatial contiguity was akin to what had been observed in Figures 3 to 8, where sentence examples were positioned directly above corresponding animated entities. This arrangement enabled learners to easily follow and comprehend example sentences and grammatical rules. By reducing cognitive load associated with processing visual animations and texts due to the close spatial proximity, this approach supported the principles of Cognitive Load Theory (CLT), reducing intrinsic and extraneous loads, while optimizing germane cognitive loads for effective learning experiences.

Figure 20. Screenshot from Animated TED-Ed Video 6.

Figure 21. Screenshot from Animated TED-Ed Video 6.

Figure 22. Screenshot from Animated TED-Ed Video 6.

Figure 23. Screenshot from Animated TED-Ed Video 6.

Figure 24. Screenshot from Animated TED-Ed Video 6.

Figure 25. Screenshot from Animated TED-Ed Video 6.

Figure 26. Screenshot from Animated TED-Ed Video 6.

Figure 27. Screenshot from Animated TED-Ed Video 6.

Figure 28. Screenshot from Animated TED-Ed Video 6.

Figure 29. Screenshot from Animated TED-Ed Video 6.

Figure 30. Screenshot from Animated TED-Ed Video 6.

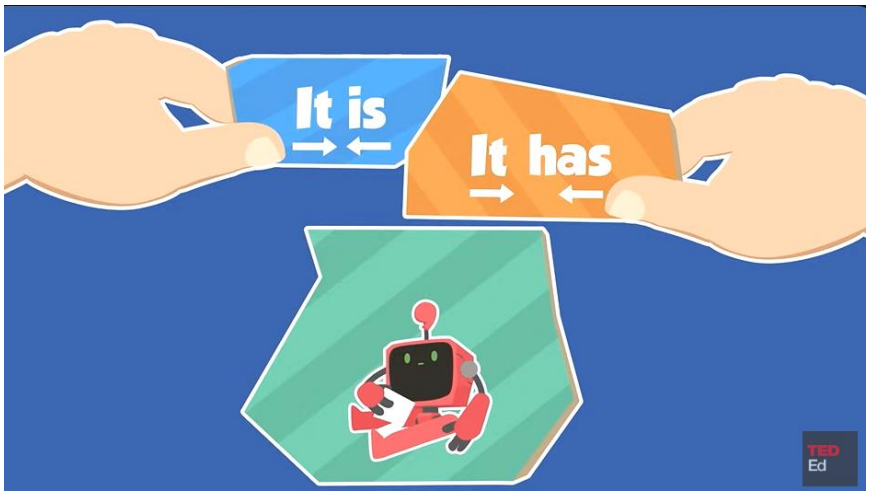

Figure 31. Screenshot from Animated TED-Ed Video 6.

Figure 32. Screenshot from Animated TED-Ed Video 6.

4.3.2 Temporal Contiguity Principle

Mayer and Moreno (2002) present the temporal contiguity principle which suggests learning is improved when extraneous or distracting material is reduced or eliminated. The temporal principle indicates that two modes of communicating material should occur simultaneously rather than in succession. Most animations should provide critical information visually and through narration to reinforce the most critical information.

A temporal contiguity effect was first reported by Baggett and her colleagues (Baggett, 1984, 1989; Baggett & Ehrenfeucht, 1983 as cited in Mayer, 2002). In their study, students watched a narrated film demonstrating the assembly of Fischer Technik 50. The narration was synchronized with the corresponding segments of the film, or occasionally ahead or delayed by 21 seconds. They found that students who received simultaneous narration and animation performed better on subsequent assembly tasks compared to those who experienced misaligned narration and animation by 21 seconds.

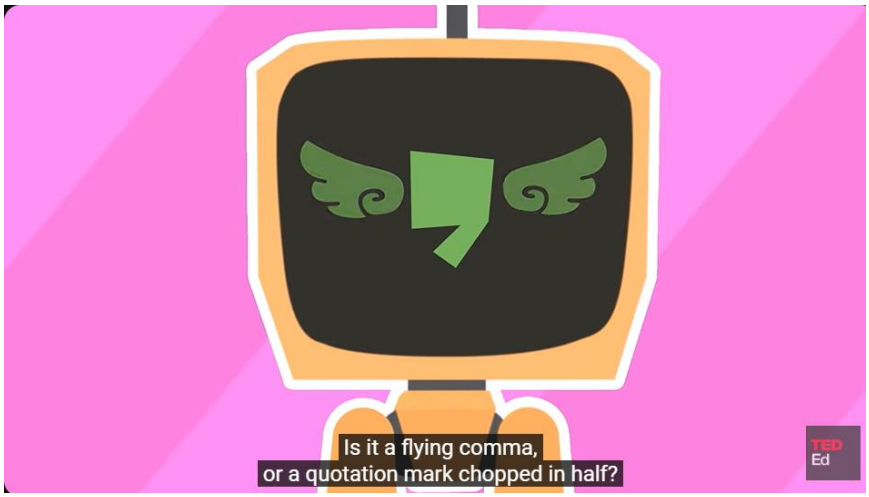

Figure 33. Screenshot from Animated TED-Ed Video 6.

Figure 34. Screenshot from Animated TED-Ed Video 6.

As you could see, the narration (indicated as the highlighted text in the lower center area of the frame) described the possibilities that an apostrophe could represent by explaining its physical attributes as they were depicted in the concurrent animation (indicated in the animations in the frames). For example, in Figure 33, when the narrator said "Is it (the apostrophe) a flying comma?", the animation simultaneously showed a comma symbol with wings. This narrated animation had temporal contiguity because corresponding words and pictures were presented at the same time. We called this version simultaneous presentation. Similarly, in Figure 34, when the narrator said “Or a quotation mark chopped in half?”, the animation simultaneously showed the quotation marks being divided into two. As an alternative that destroyed temporal contiguity, the entire narration would have been presented followed by the entire animation (or vice versa), thus introducing an increase in intrinsic and extraneous cognitive load. This version would have been called a successive presentation. Therefore, these two figures demonstrated that a temporal contiguity effect had occurred, as learners who received simultaneous presentation performed better on the post-test compared to the pretest.

Figure 35 demonstrated temporal contiguity when the narration began to point out the three uses of the apostrophe while simultaneously showing an animation of a robot displaying the number 3 on its screen. This synchronized presentation reduced cognitive load for learners by making the processing of information more seamless and less tedious to follow.

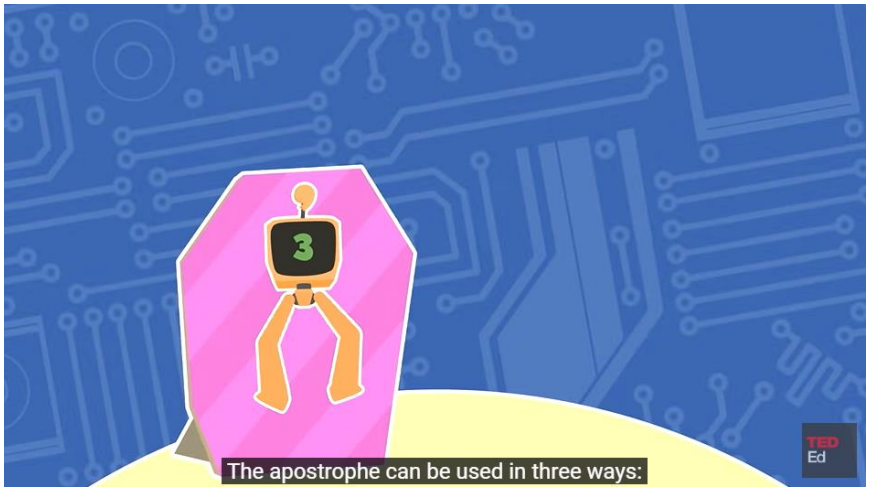

Figure 35. Screenshot from Animated TED-Ed Video 6.

Figures 36 to 39 depicted screenshots from the video titled ‘When to use apostrophes - Laura McClure.’ The sentence examples in each frame were simultaneously presented alongside the animations. Moreover, while the sentence examples were positioned above animated entities in the frame, the narrator simultaneously explained how the apostrophe functioned in each particular sentence example. The learners viewing the video absorbed the narrator’s explanation without the need to independently interpret how the apostrophe adhered to grammatical rules.

For instance, in Figure 36, the sentence demonstrated the use of the apostrophe in the word ‘don’t,’ illustrating its contraction of ‘do not.’ Instead of deciphering this independently, the narration clarified that the apostrophe was used “to mark a contraction.” This was one of three explanations provided in the video about the uses of the apostrophe in English grammar.

The second use of the apostrophe was shown in Figure 37, where the narrator explained that the apostrophe indicated possession while the animation visually depicted the corresponding sentence example, all presented simultaneously..

Figure 36. Screenshot from Animated TED-Ed Video 6.

Figure 37. Screenshot from Animated TED-Ed Video 6.

Figure 38 exemplified the third use of apostrophes, specifically "to mark the plural of single letters." Within the video frame, the animation, sentence example, and narration were presented in a simultaneous manner instead of sequentially. This deliberate alignment adhered to CTML's temporal contiguity principle and optimized CLT's germane cognitive load. By presenting information in this synchronized manner, there was an evident increase in germane cognitive load while reducing the burden of intrinsic and extraneous cognitive loads on the cognitive process of learning the different grammatical uses of the apostrophe in the English language. This was the optimal result desired by both learners and educators for the best learning outcome within the classroom setting. This approach enhanced learning by facilitating a clearer understanding of the various grammatical uses of apostrophes in English, thereby

streamlining the cognitive process for students. Achieving such optimal learning outcomes was highly valued by both learners and educators in classroom settings. The incorporation of animations in these TED-Ed videos, aligned with CTML and CLT theories, underscored their positive impact on the design of multimedia learning materials.

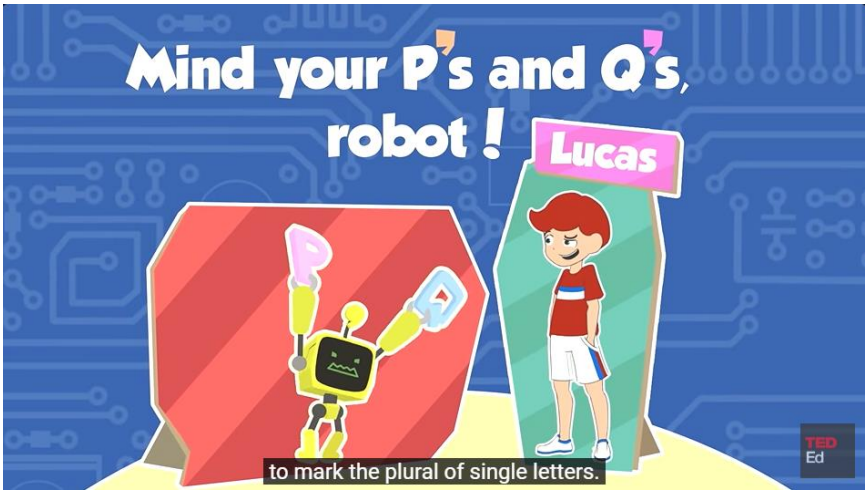

Figure 38. Screenshot from Animated TED-Ed Video 6.

The use of two apostrophes to add double contractions in a word “generally aren’t accepted in writing”, such as the word ‘shouldn’t’ve’ which expands as ‘should not have’. Although the use of two apostrophes to add double contractions in a word is generally avoided in formal writing, it is used “with the exception of dialogue”. These rules were demonstrated through simple animations showing a paper with writing lines, a pen, and a girl with a speech bubble, as seen in Figures 39 and 40. The simultaneous presentation of animations and corresponding explanations in the video frame aligned with the temporal contiguity principle advocated by CTML. This alignment enhanced germane cognitive load by facilitating immediate comprehension of grammar rules, thereby minimizing intrinsic and extraneous cognitive load for more effective learning outcomes.

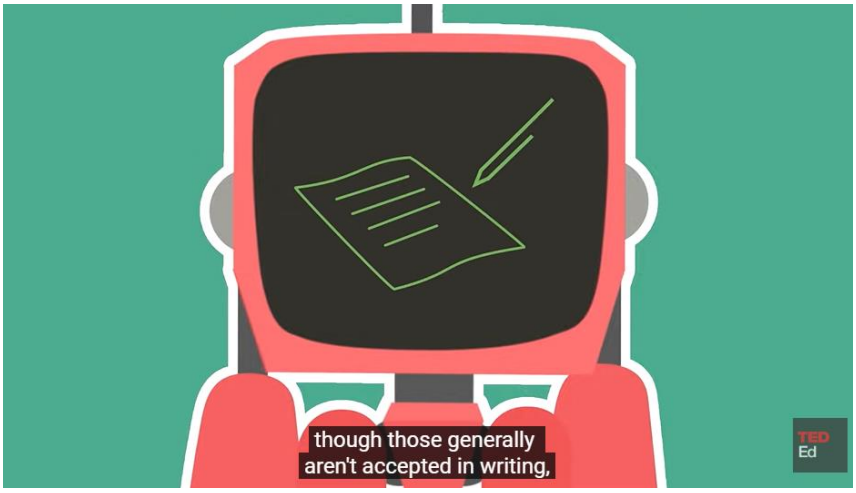

Figure 39. Screenshot from Animated TED-Ed Video 6.

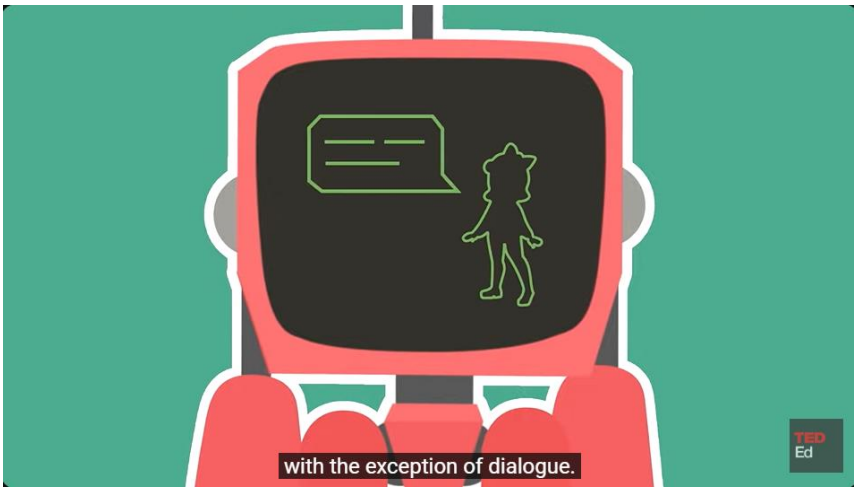

Figure 40. Screenshot from Animated TED-Ed Video 6.

There is a better transfer of knowledge and germane load during learning when corresponding narration and animation are presented concurrently rather than sequentially in multimedia learning materials, as demonstrated in Video 2 titled 'When to use apostrophes - Laura McClure'. Figures 41 and 42 illustrate this approach, where the narrator explains sentence examples of how each punctuation was used in a sentence, concurrently with their corresponding animations. This simultaneous presentation adhered to CTML's temporal contiguity principle, facilitating better integration of information and reducing cognitive load on learners. The screenshots also reflected the Coherence principle by maintaining focus solely on the punctuation being explained, minimizing extraneous stimuli. This focused approach optimized working memory utilization, enhancing germane load processing capacity and overall learning

effectiveness. Conversely, aspects of CTML's redundancy principle were also observed in this video, as discussed later in the chapter.

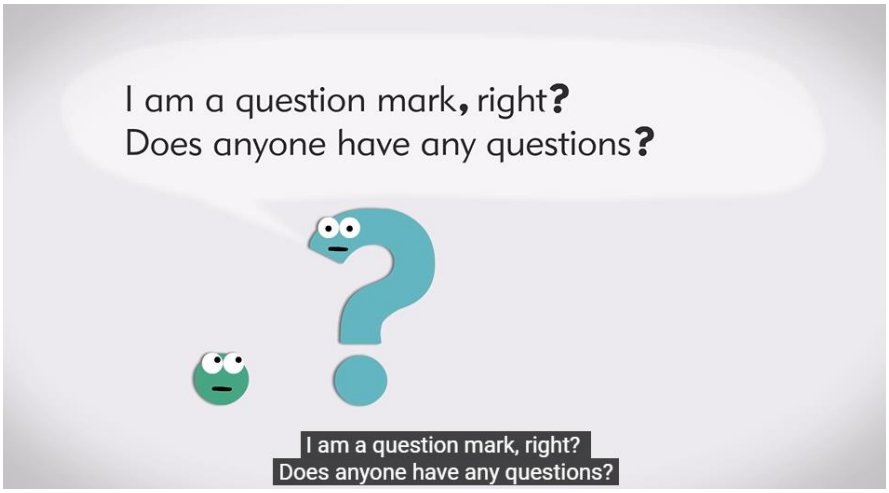

Figure 41. Screenshot from Animated TED-Ed Video 2.

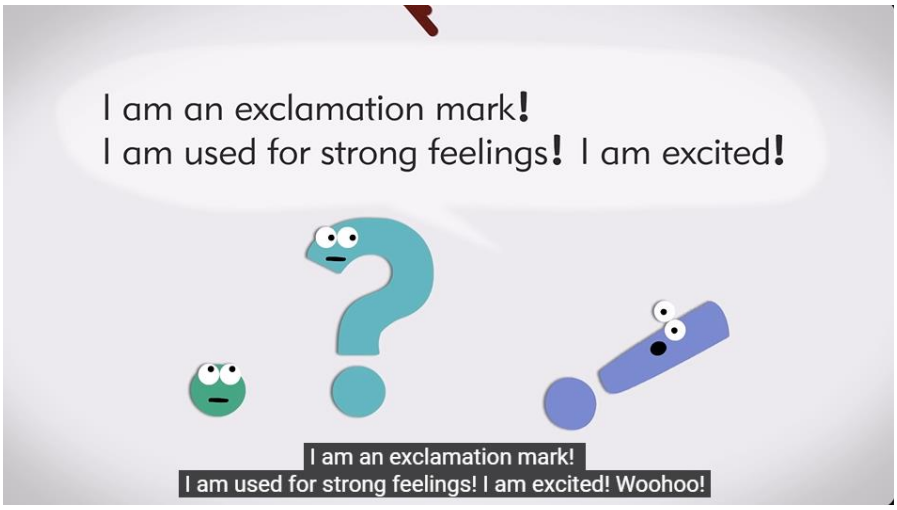

Figure 42. Screenshot from Animated TED-Ed Video 2.

Video 3 explained the semicolon's use in the English language and how to better the viewer's academic writing through the use of the punctuation. With the temporal contiguity principle, it was highlight and illustrated the important parts of the knowledge to the students through the delivery of narration and animation graphics synchronically to guarantee understanding of the meaning of the visuals.

Figure 43 exemplified this approach by synchronously narrating the description of a semicolon as "like a comma crossed with a period" while visually depicting this amalgamation of a comma and period in animation with a link between the two to show the crossover. All of this occurred in one frame and within the same time span in that

frame. By aligning narration with animation in this manner, learners, especially novice language students unfamiliar with punctuation nuances, could more easily grasp the distinct role of the semicolon with respect to commas and periods in English grammar.

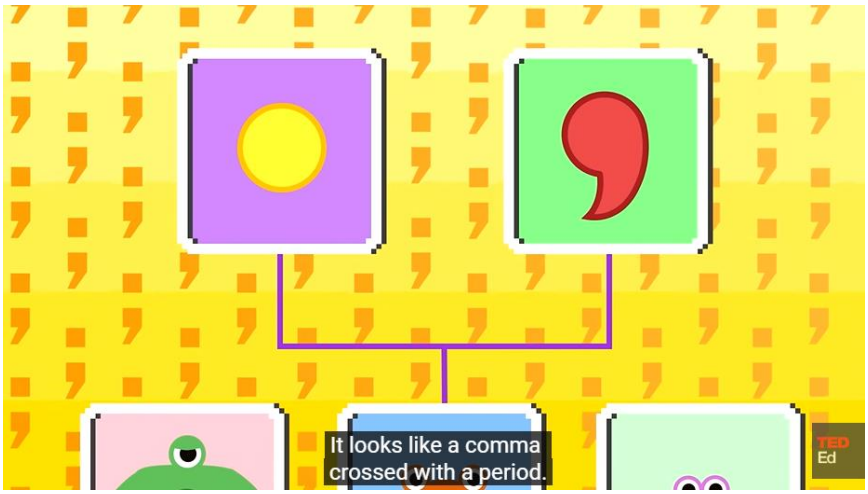

Figure 43. Screenshot from Animated TED-Ed Video 3.

Much like Figures 39 and 40, in Figures 44 and 45, the application of the temporal contiguity principle was evident as they illustrated the dual functions of semicolons in writing; to separate items in a list and to connect related clauses. These animations were synchronized with corresponding captions and narration within the same frame. For instance, as the narration "firstly, unless they’re being used in lists" is stated, the pop-up of an animation of a list was seen next to it. The narration "semicolons should only connect clauses that are related in some way" coincided with animations of interlocked puzzle pieces. This simultaneous presentation aligned with the temporal contiguity principle by ensuring that visual and verbal explanations were delivered concurrently, facilitating comprehension of semicolon usage rules. This approach minimized extraneous cognitive load and enhanced germane load, allowing learners to focus on essential information without distraction, thereby optimizing learning outcomes.

Figure 44. Screenshot from Animated TED-Ed Video 3.

Figure 45. Screenshot from Animated TED-Ed Video 3.

The narration at the time frame in Figure 46 stated “periods work best here because these are two totally different ideas”, coinciding with the animation of a period standing triumphantly over the sentence example in the frame. This visual metaphor, where the period is enlarged and depicted as if it has won a boxing match against the semicolon, reinforced its grammatical role in marking the end of a sentence segment unrelated to the clause prior, as highlighted by the red textbox. The integration of these animations and visual techniques within the same frame adhered to the temporal contiguity principle by ensuring that verbal explanations and visual representations were presented concurrently. This synchronized presentation reduced cognitive load on learners by facilitating the immediate and cohesive understanding of how punctuation influences sentence structure. By minimizing extraneous distractions and promoting

direct engagement with pertinent content, multimedia learning materials optimize germane load and enhance overall learning efficiency.

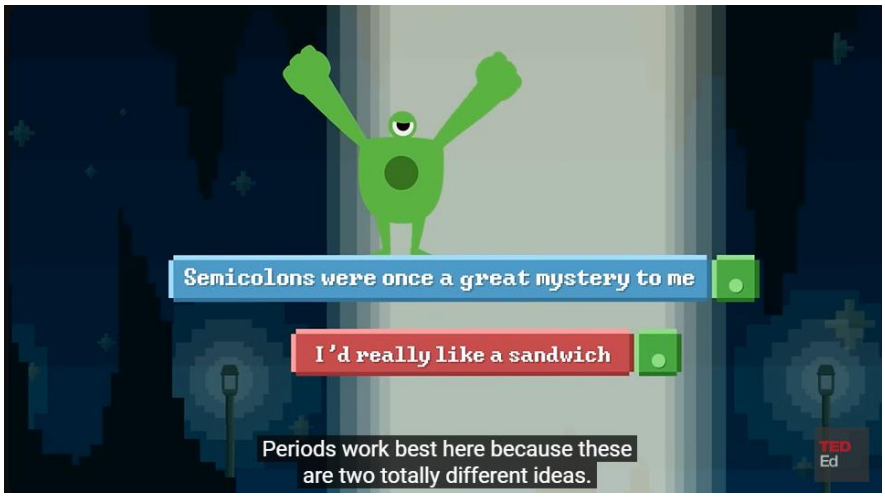

Figure 46. Screenshot from Animated TED-Ed Video 3.

In Figure 47, the use of a semicolon to replace a conjunction was illustrated, demonstrating how it can effectively shorten sentences and introduce writing variety. The animation of the semicolon jumped up and replaced the comma and conjunction "but" as depicted. Figure 48 shows the semicolon animation now prominently positioned in the sentence, demonstrating its grammatical appropriateness in context. Throughout this sequence, the narration concurrently stated, "A semicolon can replace a conjunction to shorten a sentence or to give it some variety." This synchronized presentation exemplified the application of the temporal contiguity principle, ensuring that verbal explanations and visual demonstrations are aligned in time. By presenting information in this manner, the temporal contiguity principle minimized cognitive load, both intrinsic and extraneous, while enhancing the germane load. Learners were thereby facilitated in understanding the grammatical usage of semicolons more effectively with the aid of animations that employ CTML principles.

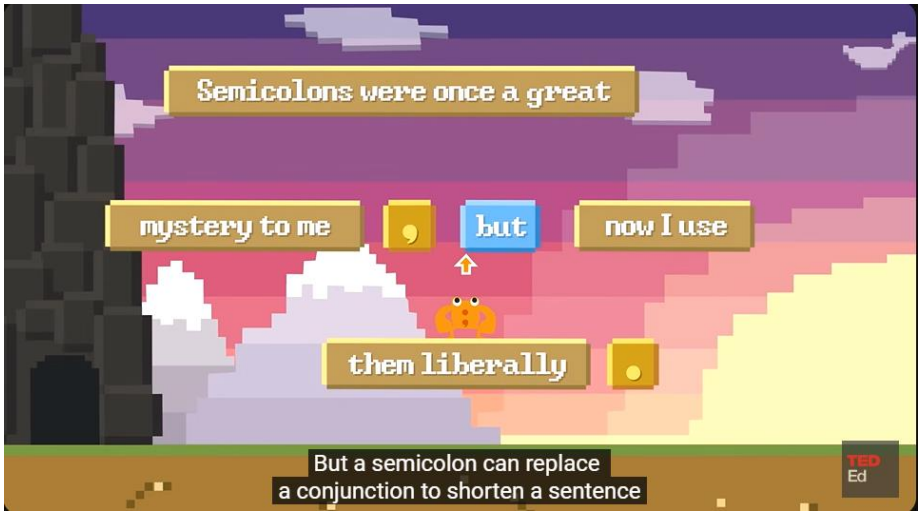

Figure 47. Screenshot from Animated TED-Ed Video 3.

Figure 48. Screenshot from Animated TED-Ed Video 3.

4.3.3 Signaling Principle

The Signaling Principle refers to various techniques used to draw attention to relevant concepts contained in multimedia learning materials. They do not add new information but simply draw attention to or repeat material to facilitate selection and organization.

Effective signaling reduces extraneous processing, guiding learners to focus on essential elements. It is a positive indicator for a video to align well, as Alpizar et al. (2020) found that in multimedia learning, signaling enhances outcomes, especially for learners with low prior knowledge. The effectiveness of the queueing/highlighting technique was heavily dependent on the video design quality of the multimedia learning

material. This encompasses two key areas of expertise. Regardless of if the material was created by an expert in the subject being explained, lacking skills in designing eye-catching and legible cues/highlights in the video could still pose a challenge.

Signaling was prominently used throughout Video 2 as demonstrated in Figures 49 to 52. Following the narration on the use of punctuations in the English language by the animated punctuations, animated arms emerged from various directions within the frame. Positioned at the ends of these arms, hands precisely indicated the locations where the punctuations appear in the example sentences presented in the speech bubbles. This application of the signaling principle in multimedia learning strategically directed learners' focus toward critical content, employing animated arrows to highlight significant information. This reduced cognitive load by relieving the working memory of the task of scanning the visual information.

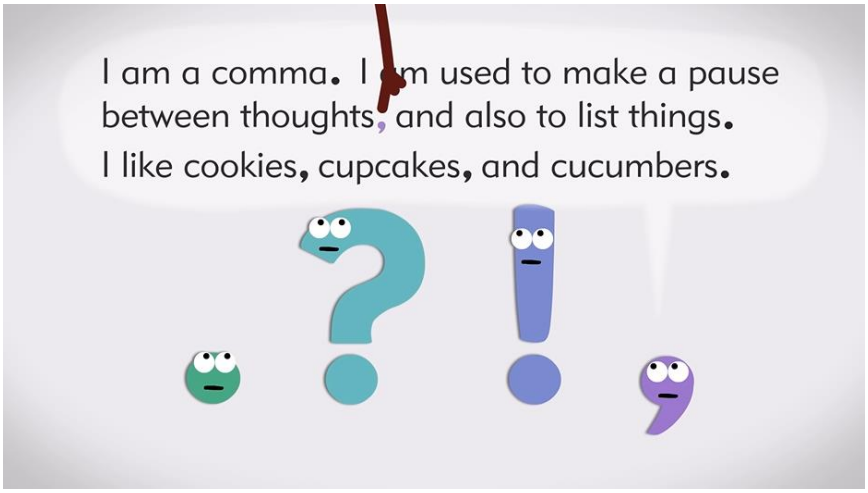

Figure 49. Screenshot from Animated TED-Ed Video 2.

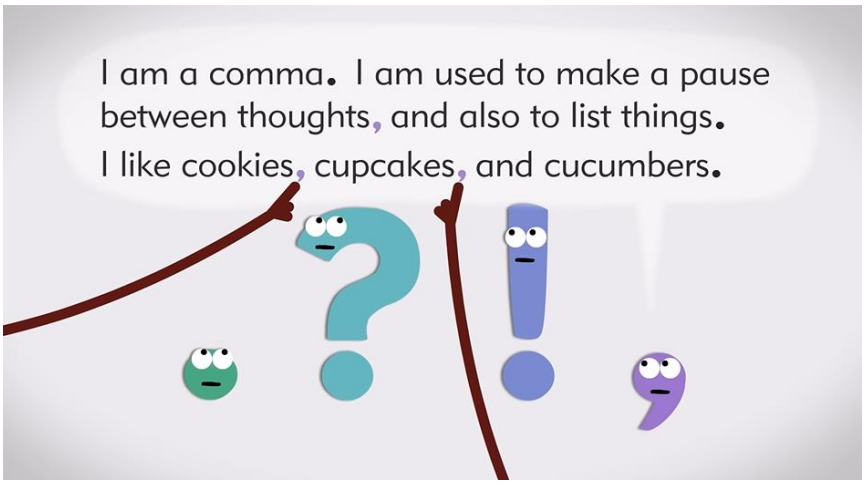

Figure 50. Screenshot from Animated TED-Ed Video 2.

Figure 51. Screenshot from Animated TED-Ed Video 2.

Figure 52. Screenshot from Animated TED-Ed Video 2.

Using features such as animated arrows to emphasize significant information represented one approach to implementing the Signaling Principle. Another straightforward method involved highlighting crucial words within the video frame. Figures 53 to 56 depicted screenshots from the video addressing how misused modifiers could impact writing. The misuse of modifiers create ambiguity in the sentence and can be a complex concept to explain to a learner. The complexity inherent in understanding modifier misuse contributes to a high intrinsic cognitive load. However, to mitigate this challenge, the video employed signaling techniques such as highlighting critical segments of the sentences prone to ambiguity. By reducing the intrinsic load through these methods, the video enhanced germane load, thereby facilitating learners' cognitive processes related to the proper use of modifiers in English. Jahanlou et al. (2020) revealed that professional designers of academic learning materials often struggle to

accurately represent the subject matter, compelling experts with a deep understanding of the topic to use complex software, thereby leading to suboptimal outcomes. Therefore, both subject mastery and video design skills are deemed essential for creating effective cues and highlights that guide learners to key elements in the learning material.

Figure 53. Screenshot from Animated TED-Ed Video 5.

Figure 54. Screenshot from Animated TED-Ed Video 5.

Figure 55. Screenshot from Animated TED-Ed Video 5.

Figure 56. Screenshot from Animated TED-Ed Video 5.

Another application of the Signaling Principle involves using slides or scenes that separate learning sections. Figure 57 exemplified this feature of the Signaling Principle. Positioned midway through the video, the screenshot introduced a new subsection focusing on apostrophes, specifically comparing 'its' and 'it's'. This served as a clear signal to learners that the video was transitioning to a different topic. The animation of the text box and the enlarged 'VS' symbol enhanced the visibility of this transition, making the shift in focus more conspicuous. This approach reduced extraneous cognitive load by alleviating the need for learners to actively scan for changes, thereby enhancing their ability to focus on the substantive content being presented.

Figure 57. Screenshot from Animated TED-Ed Video 6.

4.3.4 Redundancy and Coherence Principle

As explained in depth in the theoretical framework, the Coherence Principle involves minimizing the amount of information presented on each slide, page, or frame to only essential content. By doing so, students' working memory is presented with fewer stimuli, allowing for increased processing capacity to be used by the germane load. Better learning outcomes are achieved through the exclusion rather than the inclusion of extraneous material.

The Redundancy Principle, an extension of the Coherence Principle, emphasizes that on-screen text should not repeat narration as despite on-screen text being visual and the auditory nature of narration, both are processed in the verbal channel, leading to increased cognitive load, and hindering learning.

In Figures 58 to 61, the informational texts were minimized by using only keywords in the video frames which demonstrates the application of the Coherence Principle. With audio narration voiceovers, it is recommended to try to include only graphics or text, but not both. But if they are together, the texts ought to be minimal to exclude extraneous load. When text and graphics were presented together, the emphasis on minimal text served to enhance learning outcomes by promoting coherence. This approach ensured that students' working memory was less burdened with stimuli, thereby allowing greater cognitive processing capacity to focus on processing essential information.

Figure 58. Screenshot from Animated TED-Ed Video 1.

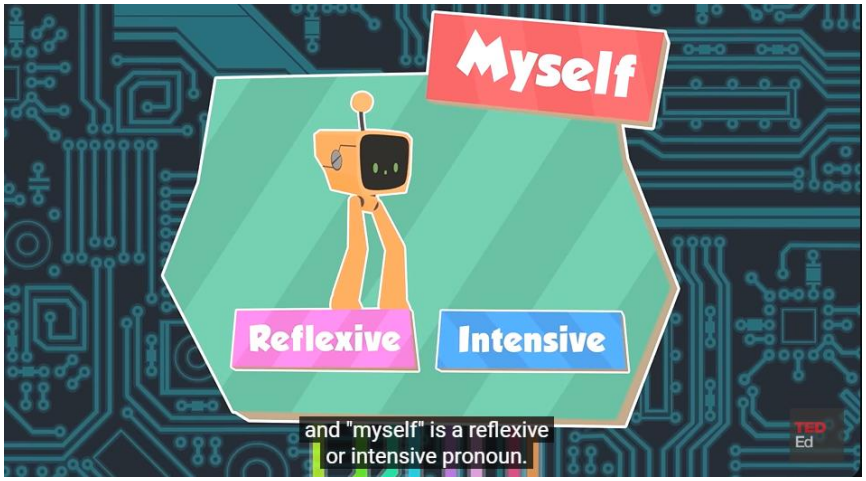

Figure 59. Screenshot from Animated TED-Ed Video 1.

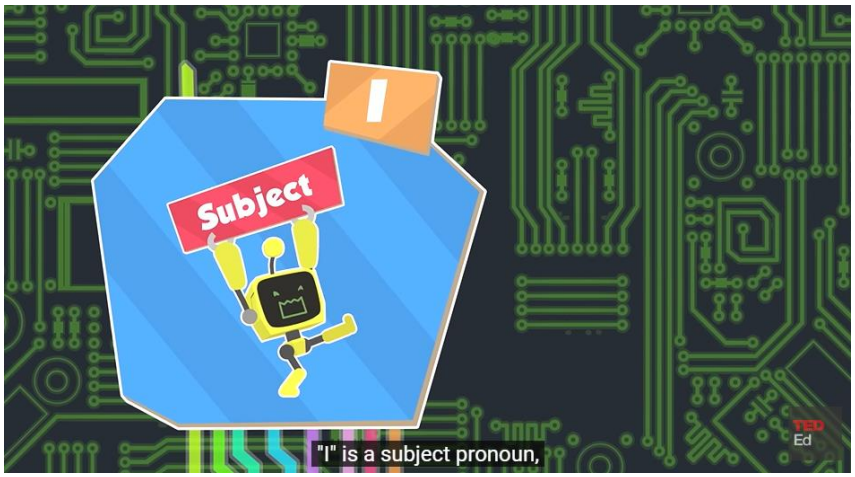

Figure 60. Screenshot from Animated TED-Ed Video 1.

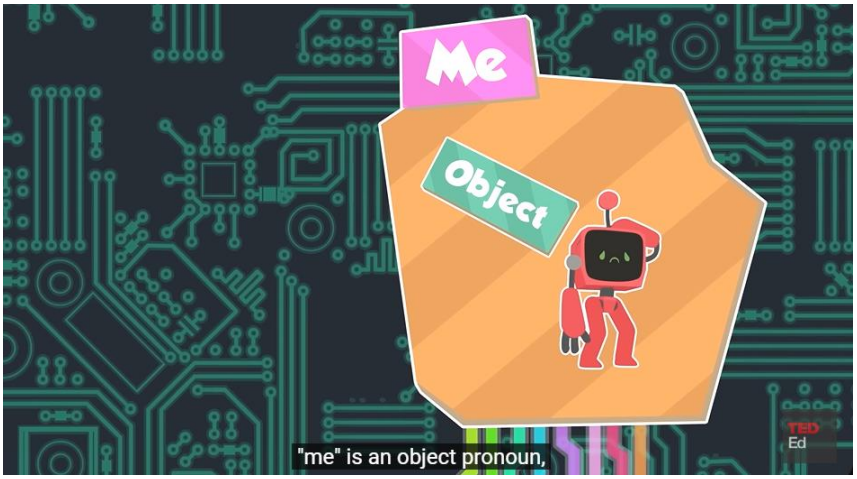

Figure 61. Screenshot from Animated TED-Ed Video 1.

The Redundancy Principle asserts that learners benefit most when multimedia learning materials include narration and graphics without overwhelming amounts of accompanying text. The rationale behind this principle is that if narration and graphics are present, then the additional text is redundant information and can overload learners, increasing extraneous cognitive load. Figure 62 illustrated that the narration effectively complemented and enriched the on-screen text, although there was occasional duplication to an extent, as observed in Figure 63, which was the frame that followed.

The narration sequence spanning Figures 62 to 63 read: "Let's start with the difference between subject and object. Imagine the subject as the actor in a sentence and the object as the word that is acted upon. 'I invited her but she invited me'." This occasional duplication remained beneficial, aligning with findings by Kalyuga et al. (2004), who noted improved learning outcomes when verbal narration preceded the display of on-screen text. Moreover, effective scripting and storyboarding, along with skilled narration, were key contributors to the Redundancy Principle. Careful scripting was crucial to ensure that the on-screen text complemented the narration rather than duplicating it. The core of the storyboard was the voiceover text, shaping the video's narrative (Hodam et al., 2021).

Figure 62. Screenshot from Animated TED-Ed Video 1.

Figure 63. Screenshot from Animated TED-Ed Video 1.

Figures 64 to 66 showed a lack of redundancy management through the entire TED-Ed video. The text contained within the animated punctuation's speech bubbles mirrored the exact narration provided, word for word. Employing animation that aligned closely with minimal text and narration effectively reduced extraneous cognitive load, thereby enhancing working memory capacity and fostering improved learning outcomes (Sweller et al., 2011). However, Video 2 did not adopt this strategy, resulting in a higher proportion of cognitive load being categorized as extraneous. Nevertheless, Video 2 did implement principles of spatial and temporal contiguity, which likely contributed significantly to the observed differences in posttest scores.

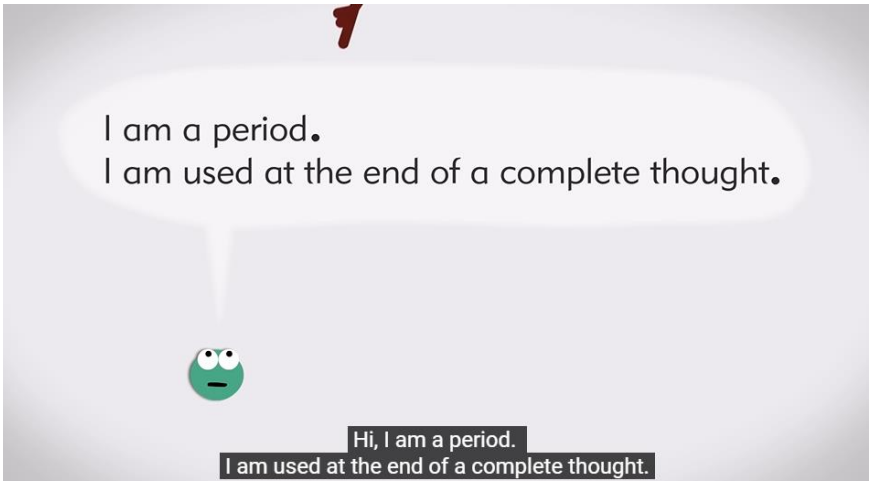

Figure 64. Screenshot from Animated TED-Ed Video 2.

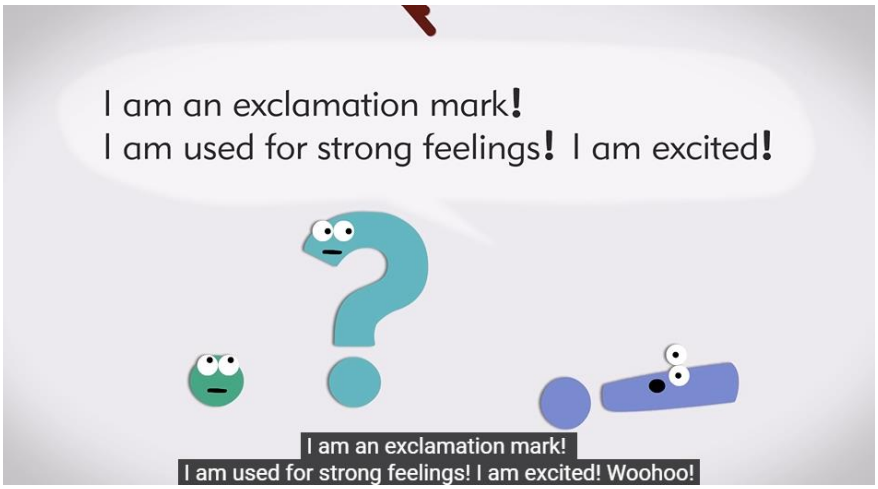

Figure 65. Screenshot from Animated TED-Ed Video 2.

Figure 66. Screenshot from Animated TED-Ed Video 2.

The full narration in Figure 67's video frame stated, "Well, Buffalo is a proper noun, a noun, and a verb. It referred to an animal also known as a bison, an American city, and it can also mean to bully." This explanation of the different meanings of the term 'buffalo' was represented in the TED-Ed video using key terms alongside corresponding animation. Throughout the video, the narration complemented and enhanced the on-screen key terms, although there was occasional duplication to an extent. Duplication occurred mostly during the narration of the example sentences including lexical ambiguity.

D'Angelo (2018) and Grech (2018) pointed out that excessive text in multimedia learning presentation could bore and distract learners, potentially diminishing their interest and reducing comprehension and retention. Therefore, it was crucial to minimize extraneous load caused by redundant text and distractions to ensure a more effective learning experience. A similar application of the Coherence Principle was observed in Figure 68, where two distinct meanings of the word 'ship' are explained using minimal text alongside appropriate animation graphics and corresponding narration.

Figure 67. Screenshot from Animated TED-Ed Video 4.

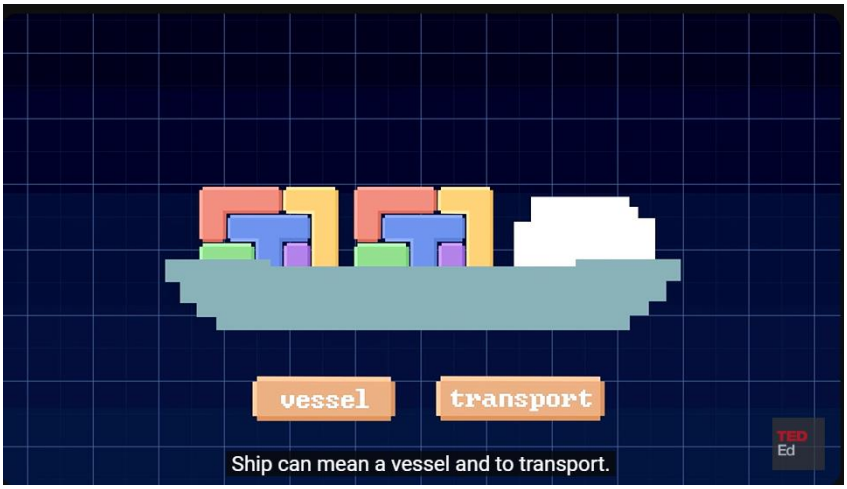

Figure 68. Screenshot from Animated TED-Ed Video 4.

Figure 69 is a great representation of the Coherent Principle in play. No text was added in the TED-Ed video frame beyond the narration caption added in by the researcher for the sake of understanding the spoken content. The practice of not adding in text aligns with the principle that in multimedia presentations with audio narration, it is advantageous to include either graphics or text, but not both simultaneously, as mentioned by Sweller (2011). This approach reduced the cognitive load on students' working memory by limiting the number of stimuli, thereby enhancing their processing capacity allocated to germane tasks. Consequently, minimizing the information displayed in each video frame helped mitigate the potential for extraneous load and promoted better learning outcomes.

Figure 69. Screenshot from Animated TED-Ed Video 4.

4.3.5 Summary of Multimodal Analysis

All six videos demonstrated adherence to CTML's five principles, as evidenced by the animations presented. The application of these principles aligned with the results

of the pre-and post-tests, which lead to rejecting the null hypothesis and supporting the alternate hypothesis. The findings indicated that there was a statistically significant impact of animated TED-Ed videos on the English grammar learning outcomes of undergraduate students within their classroom environment.

4.4 Phase Four – LSS Questionnaire

In Phase Four, the data analysis adhered to the experimental design protocols established in the pilot phase. The same measures for controlling bias and ensuring internal validity were applied during the analysis, ensuring that the findings from the LSS were reliable and could be interpreted within the context of the treatment effects.

4.4.1 Data Analysis

To determine the level of academic satisfaction of undergraduate students regarding the incorporation of animated Ted-Ed videos in English grammar learning, an LSS questionnaire was adapted by the researcher. It included 9-items that were scored using a 4-point Likert type scale: strongly disagree, disagree, agree and strongly agree.

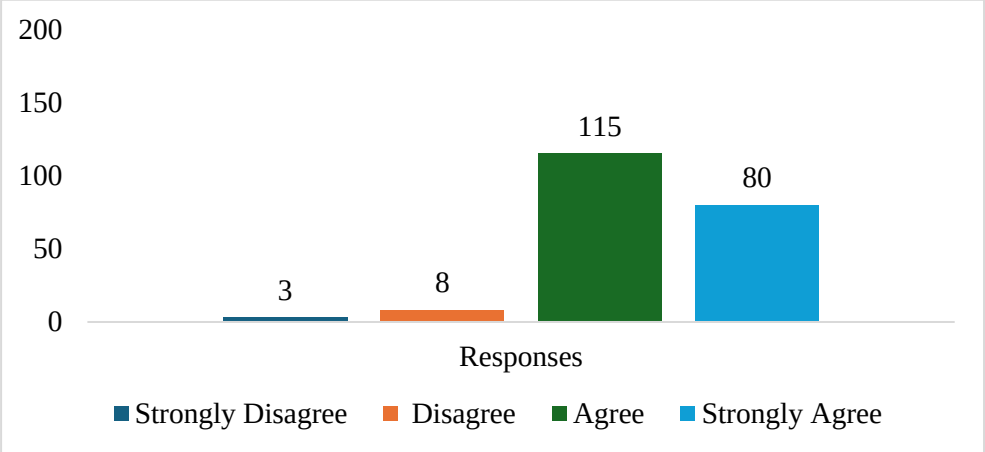

Figure 70. Item 1: I like the idea of learning English grammar in my class using animated videos as a learning material.

Regarding whether the participants liked the idea of learning English grammar in their class using animated TED-Ed videos as a learning material, 115 out of 206 students agreed, and 80 strongly agreed. Most students responded positively and believed that learning English grammar from animated videos was beneficial, with only a minority of 11 students holding a contrary opinion.

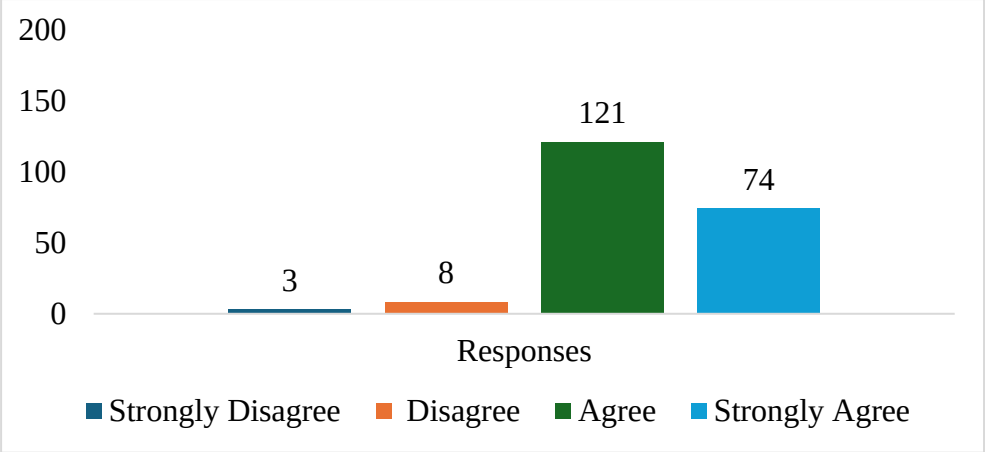

Figure 71. Item 2: My learning experience with using animated TED-Ed videos as a method of English language learning was positive.

Figure 71 showed the responses regarding participants' learning experiences with this method of English language learning, which were predominantly positive. Of the 206 respondents, 3 strongly disagreed, 8 disagreed, 121 agreed, and 74 strongly agreed with the effectiveness of this learning approach. Most participants expressed positive views, either agreeing or strongly agreeing that their learning experience in using this method of English language learning was beneficial, suggesting a belief in the efficacy of animated TED-Ed videos for grammar learning. Conversely, a minority of 11 participants held negative views, either disagreeing or strongly disagreeing. These findings indicated a generally favorable reception toward the use of animated videos to enhance grammar instruction, despite some dissenting opinions. This result matched the data from the pre-and post-tests and the multimodal analysis.

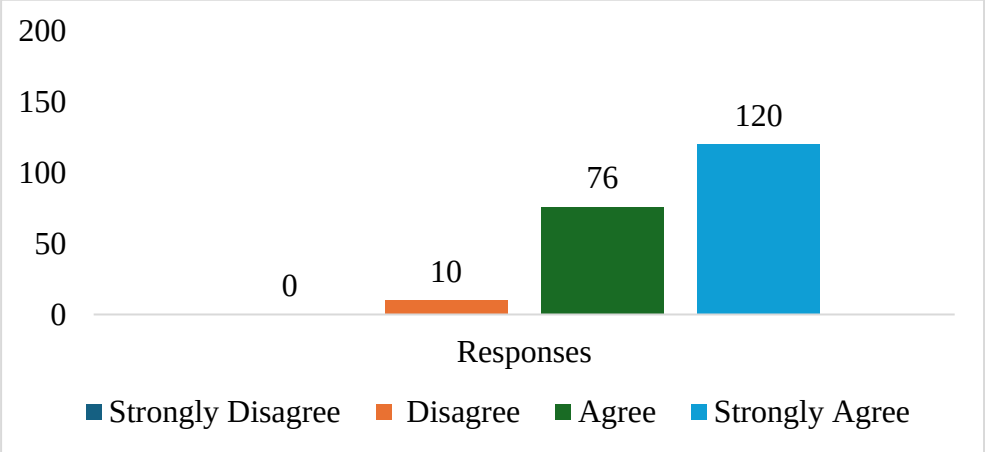

Figure 72. Item 3: Learning English in a class with animated TED-Ed videos was enjoyable.

In Figure 72, the responses of the participants regarding their enjoyment of learning English in a class, with animated Ted-Ed videos are summarized. The majority of respondents (196 out of 206) expressed enjoyment in incorporating TED-Ed videos with their English learning: 76 agreed and 120 strongly agreed. This indicated a strong belief among participants in the enjoyment derived from using animated TED-Ed videos for grammar instruction. In contrast, a minority (10 participants) held negative views, all of whom disagreed. Overall, these findings underscored a generally favorable reception toward incorporating animated videos to enhance grammar instruction, despite some opposing opinions.

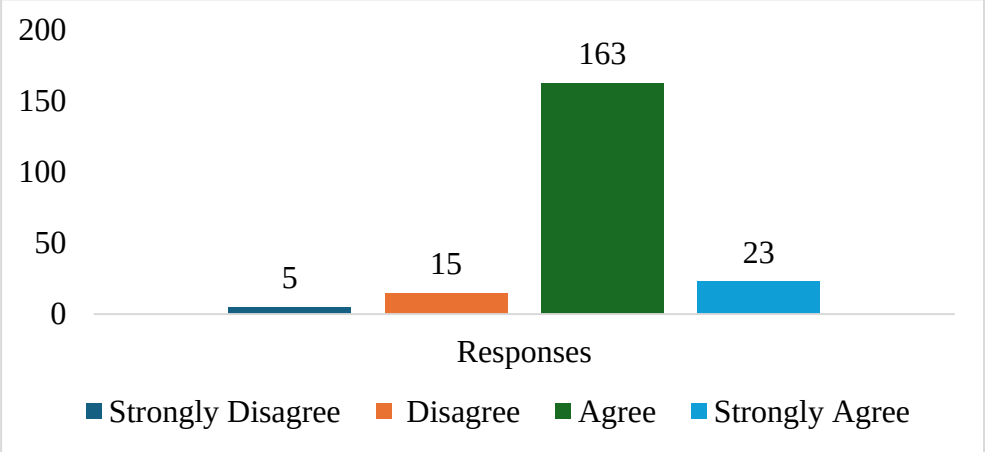

Figure 73. Item 4: Overall, I found learning from animated videos easy.

186 out of the 206 students agreed that they found learning from animated Ted-Ed videos to be easy, with 163 agreeing and 23 strongly agreeing. This suggested that the majority do not encounter complications or complexities when using these videos as a learning material, indicating the videos giving off low cognitive load onto the participants. In contrast, a minority of 20 participants held opposing views, 5 of whom strongly disagreed. This disparity could be attributed to variations in the cognitive abilities of these 20 students, such as differences in working memory capacity or attention span. Despite the straightforward design of the videos, they may still overwhelm students with limitations in these areas. Additionally, students' diverse learning preferences and styles contribute to varying perceptions. A video that one student finds easy to understand may not align with another student's preferred learning style or modality, potentially increasing cognitive load. Overall, these findings underscored a positive inclination towards integrating animated videos to enhance grammar instruction, despite some differing viewpoints.

The high levels of enjoyment and ease experienced from using such learning materials in class likely contributed to the students' positive scores in the post-test following the treatment. The presence of CTML's principles in the animated Ted-Ed videos appeared to explain why most students found the videos easy and enjoyable. Therefore, the results of the LLS questionnaire items aligned with the findings of the multimodal analysis and the pre-and post-test results.

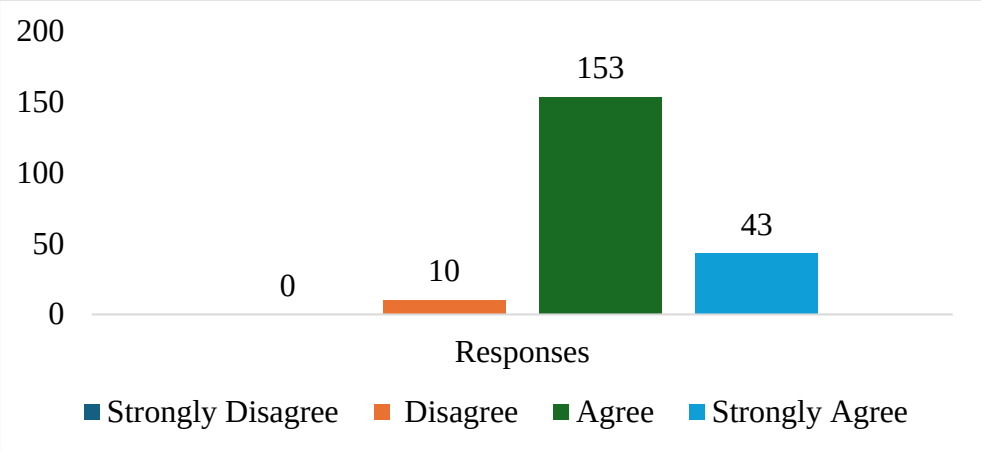

Figure 74. Item 5: The use of animated TED-Ed videos allowed me to improve my understanding of English grammar.

Figure 74 illustrated that the majority of students, specifically 153, responded with 'agree' when asked about their views on the effectiveness of animated Ted-Ed videos in enhancing their understanding of English grammar. The second highest response came from 43 students who strongly agreed with this notion. The least popular opinion was that the use of such videos did not contribute to improving their knowledge of English grammar. To conclude, among the 206 respondents, the majority exhibited a positive outlook towards the use of animated Ted-Ed videos in improving their understanding of English grammar.

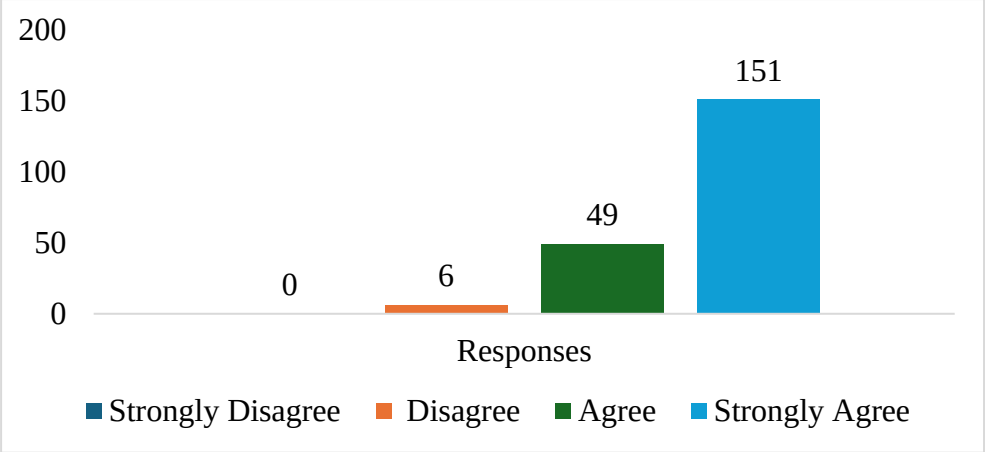

Figure 75. Item 6: Using animated videos supported my learning of English grammar by providing more resources and tools.

When asked whether animated videos supported students' learning of English grammar by providing more resources and tools, 151 participants selected 'Strongly Agree,' demonstrating strong endorsement of the videos as resourceful and beneficial in enhancing their language learning experience. Additionally, 49 chose 'Agree,' indicating they recognized the resourcefulness and utility of these videos in similar contexts. Notably, no participants chose 'Strongly Disagree,' highlighting a lack of outright rejection of the videos among the respondents but 6 students did disagree, and found the animated videos unresourceful, thus unsuitable or ineffective for their learning needs. These findings collectively underscore a prevailing positive reception among participants towards incorporating animated Ted-Ed videos into the learning process. Overall, these results revealed a notable preference among students for 'strongly agreeing' over 'agreeing' when evaluating animated Ted-Ed videos as providing more resources and tools. It was also the greatest number of 'strongly agree' responses through the LSS survey. This preference underscores students' steadfast advocacy of animated Ted-Ed videos as a highly effective learning aid, not only within the classroom setting but also potentially extending to home use, home schooling and as supplementary academic resources. The abundance of 'strongly agreeing' responses indicated a widely shared belief in the significant advantages these tools provide for improving learning outcomes and supporting educational pursuits beyond traditional school environments.

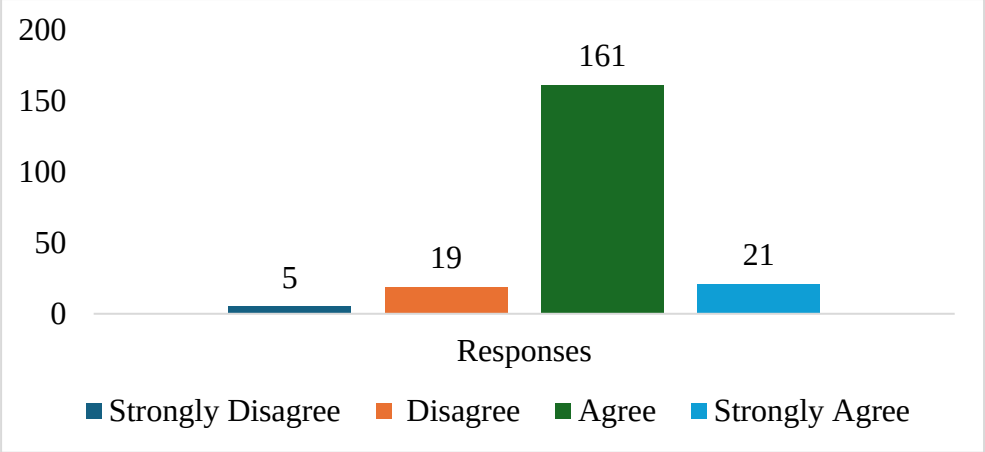

Figure 76. Item 7: I had no difficulty understanding the video content delivered in class through the animated TED-Ed videos.

A substantial number of students expressed disagreement when asked to evaluate on having no difficulty understanding the video content delivered in class through the animated TED-Ed videos. Much like the response to the questionnaire item pertaining to the ease of learning from these videos, this variability in responses may be attributed to differences in students' cognitive abilities and attention spans, as well as their individual preferences for learning styles and modalities. Clark et al. (2005) stated that the optimal goal is to minimize wasteful forms of cognitive load and maximize useful forms. Such factors can contribute to increased cognitive load, thereby hindering knowledge acquisition and comprehension of video content, resulting in lower learning outcomes.

On the other hand, 161 students, along with an additional 21 students, reported having no difficulty in understanding the video content delivered in class through animated TED-Ed videos. These findings indicate a prevailing trend where most students find it easy to comprehend and follow along with animated TED-Ed videos in the classroom.

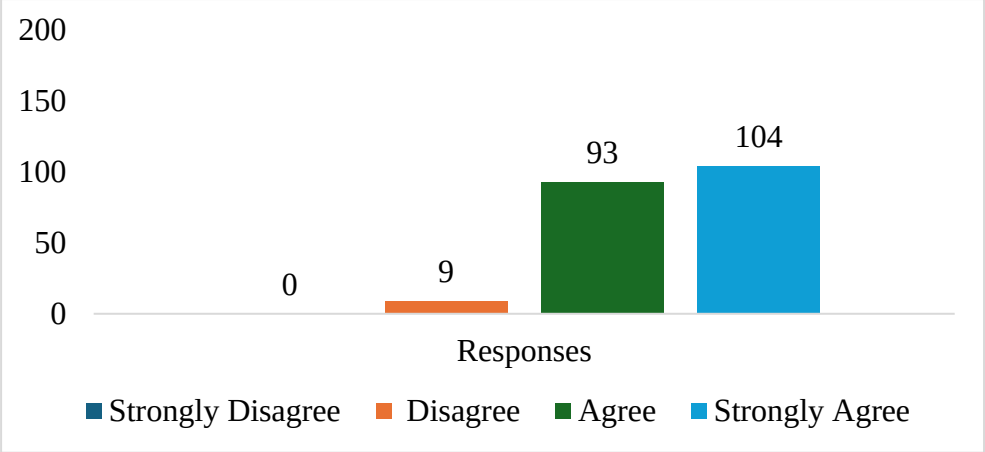

Figure 77. Item 8: As a whole, learning from animated TED-Ed videos in classrooms was effective for my English language learning overall.

The findings presented in Figure 77 collectively accentuate the dominant positive reception among participants towards learning from animated Ted-Ed videos in classrooms for effective English language learning. The high number of 'Agree' and 'Strongly Agree' responses indicated a widespread belief in the efficacy and positivity towards these animated videos, highlighting their potential to effectively support grammar instruction as a valuable language learning material and engage learners more effectively. These results are consistent with the findings of the pre-and post-tests and the multimodal analysis, supporting the hypothesis that animated Ted-Ed videos have a statistically significant effect on undergraduate students' English grammar learning outcomes within their classroom setting.

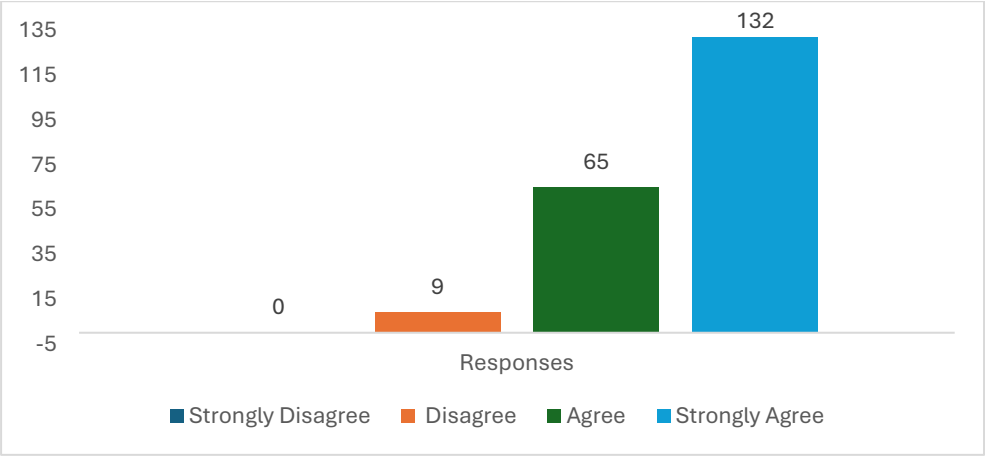

Figure 78. Item 9: Overall, I am satisfied with the method of English grammar learning with animated TED-Ed videos as teaching materials in class.

In Figure 78, the prominently displayed data is the 132 ‘strongly agree’ responses to students overall being satisfied with the method of English grammar learning with animated Ted-Ed videos as teaching materials in class. Despite there being a small number of students (9) expressing dissatisfaction with the use of animated Ted-Ed videos, those who agree to any extent constitute 95.6% of the entire sample. This high percentage underscores a widespread fulfilment and approval of using animated Ted-Ed videos for grammar instruction among the participants. Additionally, there were no participants who opted for 'Strongly Disagree,' indicating a notable absence of complete rejection of the videos among the respondents.

4.4.2 Summary of Collected LSS Data

Based on the data analysis, students recognized the potential benefits of integrating animated Ted-Ed videos into higher educational classrooms for enhancing student learning outcomes. The widespread availability and technological advancements in animated videos can assist the students in providing them with easily accessible and effective language learning materials that are low in cognitive load, leading to optimal learning outcomes. While some students may not have find this learning mode suitable for their needs, the majority exhibited positive attitudes towards animated Ted-Ed videos. Therefore, their strong academic satisfaction with incorporating these videos into English grammar learning within a classroom setting was evident.

4.5 Contextualizing Findings with Past Literature

The findings of this study provided strong evidence for the effectiveness of TED-Ed videos in enhancing undergraduate students’ English grammar learning outcomes, aligning with literature that emphasizes the positive impact of multimedia tools on language education. For instance, Rashtchi et al. (2021) highlighted the engaging and immersive nature of TED-Ed videos, which was reflected in the current study where all six paired-samples t-tests revealed statistically significant improvements in mean scores. Video 5, in particular, demonstrated the most pronounced effect, confirming the crucial role of engagement in facilitating learning outcomes, as suggested by Anggraeni and Indriani (2018).

In line with Mayer's Cognitive Theory of Multimedia Learning (CTML), the multimodal analysis of TED-Ed videos revealed their adherence to five key CTML principles: Spatial Contiguity, Temporal Contiguity, Signaling, Redundancy, and Coherence. These principles were consistent with the positive pre-and post-test results, supporting the idea that multimedia, when designed according to CTML principles, optimizes cognitive load and promotes active engagement through visual and auditory elements (Mayer, 2009, 2014). The current findings further corroborated this, emphasizing the value of multimedia content in improving grammar learning outcomes.

Feng (2021) also highlighted the importance of synchronized audio, visuals, and text in enhancing comprehension, a finding consistent with the results of this study. The combination of these elements in TED-Ed videos likely contributed to the effectiveness of the learning experience by aiding students in processing and retaining complex grammar concepts. This was further supported by the work of Akbari (2016), who found that multimedia learning materials improved language learning by motivating students and enhancing their communicative competence.

Despite the overall positive impact of TED-Ed videos, some variability in effectiveness was observed across videos. For example, Video 4 showed a lower mean difference in pre-and post-test scores. This suggests that factors such as content complexity or the specific grammar topics addressed may have influenced the magnitude of the observed effects. This is consistent with Bacon et al. (as cited in Akbari, 2016), who suggested that not all multimedia content is equally effective, and that factors like content relevance, video length, and presentation style must be carefully considered.

Additionally, the current findings aligned with broader studies on animation and multimedia in educational settings. Verhallen et al. (2006) and Ghilzai et al. (2017) noted that animated visuals foster greater engagement and retention compared to static illustrations, which may explain the significant improvements in grammar learning outcomes observed in this study. Furthermore, Ploetzner and Lowe (2017) emphasized that animations dynamically illustrate changes, making them valuable tools for conceptual learning, as seen in the context of English grammar instruction in TED-Ed videos.

The high levels of student satisfaction, as indicated by the Learning Satisfaction Survey (LSS), were consistent with research by Kay and Kletskin (2012) and Chen et al. (2020), who linked video-based learning materials to increased motivation and engagement. The flexibility and interactivity of animated videos provided a more enjoyable and autonomous learning experience, which directly addressed the second research question of the study: how satisfied are undergraduate students with incorporating TED-Ed videos into their grammar learning? The positive responses from students suggested that these videos fostered a more engaging learning environment, aligning with findings from the literature.

Moreover, the application of CTML principles in TED-Ed videos mirrored the recommendations of studies by Fern et al. (2011) and Yousef et al. (2014), who argued that combining visual and auditory elements enhances learners' understanding and retention. The alignment of TED-Ed videos with these principles ensured both cognitive effectiveness and engagement, reinforcing the idea that well-designed multimedia tools can be powerful for language learning.

This study also addressed a gap in the literature by exploring the effectiveness of TED-Ed videos in the specific context of undergraduate Pakistani learners. While multimedia tools have been widely studied, few studies have focused on the Pakistani context, particularly at the undergraduate level. By examining the impact of TED-Ed videos on English grammar learning in this demographic, this study adds new insights to the body of research on multimedia learning in non-Western contexts, further supporting the argument that multimedia learning tools can be effective across diverse cultural and educational settings.

In conclusion, the findings of this study contribute to the growing body of research on the efficacy of multimedia tools in language education. By demonstrating the significant impact of TED-Ed videos on English grammar learning outcomes, this study supports and extends existing literature, particularly in the context of Pakistani undergraduate learners. The results underscore the potential of TED-Ed videos as a valuable tool for English language teaching, enhancing grammar comprehension and fostering a more engaging and effective learning environment.

CHAPTER 5

CONCLUSION

This chapter begins with a brief look into the summary of the research area and topic, followed by an analysis of the collected data using the chosen methodology to address the research questions critically. Finally, limitations, suggestions and recommendations of the study are listed.

5.1 A Summary of the Present Research

Animation has become pervasive and valuable in online educational content, serving as a significant mode of representation across various fields, including language acquisition. Due to the TED website's widespread popularity, free accessibility, and user-friendly interface, many language instructors have started using it as a platform to teach various languages. They accomplish this by uploading language learning videos, some of which garner millions of views. This study aimed to evaluate the impact of animated TED-Ed videos on the teaching of English grammar among undergraduate students in Mardan, Pakistan.

The study had two primary objectives: detect the impact animated TED-Ed videos have on the effectiveness of undergraduate students' English grammar learning in the classroom, based on learning outcomes, and to explore the level of academic satisfaction regarding the integration of these videos in the classroom. The theoretical framework of Mayer's Cognitive Theory of Multimedia Learning, in conjunction with Cognitive Load Theory (CLT), guided this study.

Educational multimedia materials have the potential to cognitively overload learners, negatively impacting their learning outcomes and academic satisfaction through intrinsic and extraneous cognitive load, rather than beneficial germane load, according to CLT. To counteract this, CTML offers different principles to help manage the unwanted cognitive load in multimedia learning materials that this study adopted: spatial contiguity, temporal contiguity, signaling, redundancy and the coherence principle.

The sample comprised of students from the English Department of Government Girls Post Graduate College, Baghdada-Par Hoti Road, Mardan, Pakistan. Initially, a pilot study was conducted involving 10 female undergraduate English students, followed by 206 participants in the main study who completed pre-and post-tests along with the Learning Satisfaction Survey (LSS) questionnaire. The researcher also conducted a multimodal analysis of selected animated TED-Ed videos.

5.2 Findings

5.2.1 Answer to Research Question One

To address Research Question 1, which investigates how animated TED-Ed videos impact the effectiveness of undergraduate students' English grammar learning in the classroom based on learning outcomes, the researcher conducted a descriptive test through a pre-and post-test and a multimodal analysis using CTML and CTL's frameworks of multimedia learning.

In the pre-and post-test design, the dependent variable was measured once before the treatment was implemented and once after it was administered. In order to determine the impact, a null and alternate hypothesis were formulated: the null hypothesis being that there is no statistically significant effect of animated TED-Ed videos on the undergraduate students' English grammar learning outcome within their classroom setting; whereas the alternate hypothesis is that there is a statistically significant effect of animated TED-Ed videos on the undergraduate students' English grammar learning outcome within their classroom setting and therefore, treatment is effective.

The pre-and post-test results rejected the null hypothesis and supported the alternate hypothesis, indicating that the treatment involving viewing animated TED-Ed videos was effective and had a positive impact on the sample's learning outcomes.

The multimodal analysis was conducted on the 6 animated TED-Ed videos, applying five principles selected from Mayer's CTML: spatial contiguity, temporal contiguity, signaling, redundancy, and the coherence principle. These principles were utilized to assess the alignment of the videos with effective learning design and their ability to manage cognitive load, thereby positively influencing the learning outcomes reflected in the post-test scores. Furthermore, the analysis considered Cognitive Load

Theory (CLT), which categorizes cognitive load into intrinsic, extraneous, and germane types. This methodological approach facilitated a comprehensive evaluation of how the instructional videos addressed cognitive demands and improved learning outcomes among the participants.

The data from the multimodal analysis reported that the animated TED-Ed videos had adopted all 5 principles of CTML which aid in managing the intrinsic and extraneous load while, simultaneously, increasing the germane load.

The data from the multimodal analysis indicated that the animated TED-Ed videos had effectively incorporated all five principles of CTML. These principles assisted in managing both intrinsic and extraneous cognitive loads while simultaneously enhancing germane cognitive load. The findings from both the pre-and post-tests and the multimodal analysis were mutually consistent and complementary. Therefore, the animated TED-Ed videos positively influence the effectiveness of undergraduate students' English grammar learning in the classroom by applying CTML's principles to optimize cognitive load management. This facilitates student comprehension of the animated TED-Ed videos and ultimately leads to improved learning outcomes.

5.2.2 Answer to Research Question Two

To address the second research question regarding the academic satisfaction of undergraduate students with the integration of animated TED-Ed videos in English grammar learning within a classroom setting, the researcher employed a Learning Satisfaction Survey (LSS) questionnaire to gather relevant data. Analysis of the LSS responses revealed that most students exhibited a positive attitude towards the use of animated TED-Ed videos in English grammar learning. However, a minority of participants expressed skepticism about the benefits of these videos for their learning outcomes, as evidenced by their experiences in the pre-and post-tests. This discrepancy may be attributed to variations in students' cognitive abilities, attention spans, and individual preferences for learning styles and modalities.

In summary, effective management of cognitive load through the incorporation of CTML's principles correlated positively with higher learning outcomes in the post-test. This alignment also contributed to higher levels of academic satisfaction among students, indicating the effectiveness of the treatment. Therefore, the data strongly

supports the conclusion that undergraduate students are highly satisfied with the use of animated TED-Ed videos within classroom settings for English grammar learning.

5.3 Limitations

The study primarily involved undergraduate students from a single institution in Mardan, Pakistan, which limits the generalizability of the findings to other demographics, educational settings, or cultural contexts. The sample consisted solely of female students from the English Department of Government Girls Post Graduate College, which may not represent the broader population of undergraduate students or other genders within different educational contexts.

Moreover, while the study focused on the impact of animated TED-Ed videos on English grammar learning outcomes and academic satisfaction, it did not explore potential long-term effects beyond the immediate post-test period. Longitudinal studies could provide insights into the sustainability of learning gains and satisfaction levels over time.

5.4 Suggestions

The following are suggestions which can be taken into consideration for future research in a similar area:

1. Future research could replicate this study across primary, middle, and high school classrooms within the Pakistani context, allowing for comparative analysis of the results.
2. Consideration could be given to replicating the study in contexts where English serves as a second language, in different countries, facilitating comparative analysis of the outcomes.
3. Replicating the study in contexts where English is a foreign language, in various countries, would allow for comparative analysis of the results.
4. Future studies could explore alternative aspects of language learning beyond grammar i.e. vocabulary, listening and speaking skills, etc.
5. Various educational videos with potential as effective teaching materials could undergo analysis similar to the current study to determine their relevance and utility for students.

6. Given that the current study focused on female students, it is advisable to investigate both male and female students in future research.

5.5 Recommendations

Based on the findings of this study, the following recommendations can be readily implemented by pedagogists, educators and educational institutions:

1. Incorporate a variety of animated TED-Ed videos that cater to different aspects of English language learning to sustain student engagement and meet diverse learning needs. Moreover, ensure that the selection of animated TED-Ed videos closely aligns with the curriculum goals and learning objectives of the English grammar course. This alignment promotes coherence and relevance, thereby enhancing student motivation and comprehension.
2. Design interactive language-learning activities that incorporate animated TED-Ed videos. For instance, after watching a video regarding using relative clauses in academic writing, students can join group discussions or quizzes on interactive platforms to enhance understanding. Collaborative learning, which promotes peer interaction, critical thinking, and deeper comprehension (Johnson & Johnson, 2019), is encouraged through activities where students analyze and discuss the content from multimedia learning materials.
3. Provide professional development for educators to improve their use of multimedia resources and Cognitive Load Theory (CLT) principles in language education. Offer ongoing training and support for instructors to skillfully integrate CLT and CTML principles into their teaching, incorporating resources like animated TED-Ed videos. This includes guidance on selecting videos, facilitating discussions, and managing classroom dynamics during multimedia-enhanced lessons. Effective training enables educators to refine their instructional strategies (Klepsch, 2020), ensuring effective management of cognitive load and enhancing learning outcomes.

5.6 Conclusion

In today's educational landscape, students are typically proficient with technology and have shorter attention spans, as a result of the rapid pace of modern life

they are living in now. Simply incorporating a video from the internet as a supplementary or primary learning material in a curriculum is inadequate. This emphasizes the critical importance of selecting multimedia learning tools thoughtfully, a decision that educators and curriculum developers should approach with serious consideration. Such decisions can significantly impact students' learning potential and satisfaction. The current study reported that animated TED-Ed videos incorporate essential elements that allow them to effectively manage unfavorable cognitive load effectively, allowing for learners in activating cognitive functions crucial for English language grammar acquisition, demonstrating their utility as effective instructional materials in language learning classrooms. Furthermore, the study recommended that future designs of English language learning courses integrate both theoretical and practical applications in the selection and construction of multimedia learning materials to ensure optimal learning effectiveness over the long term.

REFERENCES

Abdo, I. B., & Al-Awabdeh, A. (2017). Animated videos prove to be beneficial in teaching English grammar as EFL: A neurological study of how students learn and retain English grammar. *Creative Education, 8*(9), 1415-1423. https://doi.org/10.4236/ce.2017.89099.

Adesope, O. O., & Nesbit, J. C. (2013). Animated and static concept maps enhance learning from spoken narration. *Learning and Instruction* (27), 1-10. https://doi.org/10.1016/j.learninstruc.2013.02.002.

Ahmad, J. (2012). English language teaching (ELT) and integration of media technology. *Procedia-Social and Behavioral Sciences*, *47*, 924-929.

Aidinlou, N. A., & Moradinejad, A. (2016). Short-term and long-term retention of vocabulary through authentic subtitled videos. *Advances in Language and Literary Studies, 7*(5), 14-22. https://doi.org/10.7575/aiac.alls.v.7n.5p.14.

Ajmal, M., Alrasheedi, S., Keezhatta, M. S., & Yasir, G. M. (2020). Covid-19 and online English language teaching: Students' response and feedback. *The Asian ESP Journal, 16*(5-2), 39-56.

Akbari, O., & Razavi, A. (2016). Using authentic materials in the foreign language classrooms: Teachers' perspectives in EFL classes. *International Journal of Research Studies in Education,* 5(2), 105-116.

Alpizar, D., Adesope, O. O., & Wong, R. M. (2020). A meta-analysis of signaling principle in multimedia learning environments. *Educational Technology Research and Development*, *68*(5), 2095-2119.

Anggraeni, A. D., Pentury, J., & Tanamal, A. (2019). Blending humour and animation in english learning for students of english education programs in universities. *International Journal of Innovation, Creativity and Change. www. ijicc. net*, *5*(6).

Anggraeni, C. W., & Indriani, L. (2018). Teachers' perceptions toward TED-ED in Listening Class insight the Era of Disruptive Technology. *Metathesis: Journal of English Language, Literature, and Teaching, 2(2),* 222-235.

Asseel, D. A. (2020). Seeing the Unseen: Euphemism in Animated Films. A Multimodal and Critical Discourse Study (Doctoral dissertation, Lancaster University (United Kingdom)).

Azmi, N. (2017). The benefits of using ICT in the EFL classroom: From perceived utility to potential challenges. *Journal of Educational and Social Research, 7*(1), 111-118.

Bazerman, C. (2009). Genre and cognitive development: Beyond writing to learn. *Pratiques. Linguistique, littérature, didactique*, (143-144), 127-138.

Berney, S., & Betrancourt, M. (2016). Does animation enhance learning? A meta-analysis. *Computers & Education, 101*, 150-167.

Bolgun, M. A., & McCaw, T. (2019). Toward a neuroscience-informed evaluation of language technology. *Computer Assisted Language Learning, 32*(3), 294-321. https://doi.org/10.1080/09588221.2018.1516675.

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE Life Sciences Education, 15*(4). https://doi.org/10.1187/cbe.16-03-0125

Bredo, G. (2023). Language Learning Applications. A Study on Their Advantages and Disadvantages from the Learners' Perspective.

Bryce, E. (2015, August). *Buffalo buffalo buffalo: One-word sentences and how they work - emma bryce*. TED. https://ed.ted.com/lessons/buffalo-buffalo-buffalo-one-word-sentences-and-how-they-work-emma-bryce

Bryce, E. (2015, July). *How to use a semicolon.* TED. https://www.ted.com/talks/emma_bryce_how_to_use_a_semicolon?trigger=15s.

Bryce, E. (2015, September). *How misused modifiers can hurt your writing - Emma Bryce.* TED. https://ed.ted.com/lessons/how-misused-modifiers-can-hurt-your-writing-emma-bryce.

Bryce, E. (2015, September). *When to use "me", "myself" and "I" - Emma Bryce.* TED. https://ed.ted.com/lessons/when-to-use-me-myself-and-i-emma-bryce/watch.

Carmichael, M., Reid, A., & Karpicke, J. D. (2018). Assessing the impact of educational video on student engagement, critical thinking and learning. *Sage Publishing.*

Catrambone, R., & Seay, A. F. (2002). Using animation to help students learn computer algorithms. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 44*(3), 495-511. https://doi.org/10.1518/0018720024497637.

Chapple, L., & Curtis, A. (2000). Content-based instruction in Hong Kong: Student responses to film. *System, 28*, 419-423.

Chen, Y. C., Hong, Z. R., & Lin, H. S. (2020). Exploring Students' Scientific Competency Performance on PISA Paper-Based Assessment and Computer-Based Assessment. *In Learning from Animations in Science Education* . Springer, Cham. pp. 279-300.

Chiou, C., Tien, L., & Lee, L. (2015). Effects on learning of multimedia animation combined with multidimensional concept maps. *Computers & Education, 80*, 221-223. https://doi.org/10.1016/j.compedu.2014.09.002.

Choi, H. J., & Johnson, S. D. (2007). The effect of problem-based video instruction on learner satisfaction, comprehension and retention in college courses. *British Journal of Educational Technology*, *38*(5), 885-895.

Clark, R. C. (2015). *Evidence-based training methods: A guide for training professionals*. Alexandria, VA: American Society for Training and Development.

D'Angelo, L. (2018). PowerPoint presentations in the classroom: Re-evaluating the genre. *Language Value, 10*(1), 29-44. doi:http://dx.doi.org/10.6035/LanguageV.2018.10.3.

Dasdemir, I., & Doymuş, K. (2016). The effect of using animation on primary science and technology course students' academic achievement, retention of knowledge and scientific process skills. *Pegem Journal of Education and Instruction, 2*(3), 33-42.

Dźwigoł, H. (2020). Pilot study in the research procedure. *Organization & Management Scientific Quartely*, *2020*(50). https://doi.org/10.29119/1899-6116.2020.50.1

Farooq, F., Rathore, F. A., & Mansoor, S. N. (2020). Challenges of online medical education in Pakistan during COVID-19 pandemic. *J Coll Physicians Surg Pak, 30(6),* 67-9.

Feng, H. (2021). A systemic functional multimodal discourse analysis of English microlectures. Journal of Higher Education Research, 2(5). https://doi.org/10.32629/jher.v2i5.508.

Fern, A., Givan, R., & Siskind, J. M. (2011). Specific-to-general learning for temporal events with application to learning event definitions from video. *Journal of Artificial Intelligence Research, 17*, 379–449.

Garden, S. (2013, November). *Punctuation explained (by Punctuation!).* TED. https://ed.ted.com/best_of_web/aKSwXYUd

Ghilzai, S. A., Alam, R., Ahmad, Z., Shaukat, A., & Noor, S. S. (2017). Impact of cartoon programs on children's language and behavior. *Insights in Language, Society, and Culture, (2)*, 104-126.

Grech, V. (2018). The application of the Mayer multimedia learning theory to medical.

Hakkarainen, P., Saarelainen, T., & Ruokamo, H. (2007). Towards meaningful learning through digital video supported, case based teaching. *Australasian Journal of Educational Technology*, *23*(1).

Hastings, N. B., & Tracey, M. W. (2005). Does media affect learning: Where are we now? *TechTrends, 49*(2), 28-30.

Hodam, H., Rienow, A., & Juergens, C. (2021). Creating and testing explainer videos for earth observation. *Remote Sensing*, *13*(20), 4178.

Homer, B. D., Plass, J. L., & Blake, L. (2008). The effects of video on cognitive load and social presence in multimedia-learning. *Computers in Human Behavior, 24*(3), 786-797.

Huang, M.S., Hsiao, W.H., Chang, T.S., & Hu, M.H. (2012). Design and implementation of a cooperative learning system for digital content design curriculum: Investigation on learning effectiveness and social presence. *The Turkish Online Journal of Educational Technology*, 11(4), 94-107.

Huang, R. (2023). The Magic of Cartoons? How English-Learning Animations Enhance Child L2 Acquisition. https://doi.org/10.31234/osf.io/nkbr7

Hui, W., Hu, P.J.H., Clark, T.H.K., Tam, K.Y., & Milton J. (2008). Technology-assisted learning: A longitudinal field study of knowledge category, learning effectiveness and satisfaction in language learning. *Journal of Computer Assisted Learning, 24(3),* 245–259.

Hussein, G. (2010). The attitudes of undergraduate students towards motivation and technology in a foreign language classroom. *International Journal of Learning and Teaching, 2(2),* 14-24.

Isabella, A. J., & Horne-Badovinac, S. (2016). Rab10-mediated secretion synergizes with tissue movement to build a polarized basement membrane architecture for organ morphogenesis. *Developmental cell*, *38*(1), 47-60.

Islam, B., Ahmed, A., Islam, K., & Shamsuddin, A. K. (2014). Child education through animation: An experimental study. *International Journal of Computer Graphics & Animation, 4*(4), 43-52. https://doi.org/10.5121/ijcga.2014.4404.

Jackman, W. M., & Roberts, P. (2014). Students' perspectives on YouTube video usage as an e-resource in the university classroom. *Journal of Educational Technology Systems*, *42*(3), 273-296.

Jahanlou, A., Odom, W., & Chilana, P. (2021). Challenges in getting started in motion graphic design: Perspectives from casual and professional motion designers. In *Graphics Interface 2021*.

Jiang, D., Renandya, W. A., & Zhang, L. J. (2017). Evaluating ELT multimedia courseware from the perspective of cognitive theory of multimedia learning. *Computer Assisted Language Learning*, *30*(7), 726–744. https://doi.org/10.1080/09588221.2017.1359187

Johnson, C. I., & Mayer, R. E. (2012). An eye movement analysis of the spatial contiguity effect in multimedia learning. *Journal of Experimental Psychology: Applied*, *18*(2), 178–191. https://doi.org/10.1037/a0026923.

Johnson, D. W., & Johnson, R. T. (2019). Cooperative learning in diverse classrooms. *Annual Review of Psychology, 70*, 625-651.

Jonassen, D. H. (2004). Handbook of research on educational communications and te chnology: Taylor & Francis.

Kalyuga, S., Chandler, P., & Sweller, J. (2004). When redundant on-screen text in multimedia technical instruction can interfere with learning. *Human factors*, *46*(3), 567-581.

Kay, R., & Kletskin, I. (2012). Evaluating the use of problem-based video podcasts to teach mathematics in higher education. *Computers & education*, *59*(2), 619-627.

Khiyabani, H., Ghonsooly, B., & Ghabanchi, Z. (2014). Using multimedia in teaching vocabulary in high school classes. *Journal of Advances in English Language Teaching, 2*(1), 1-13. Retrieved from https://www.european-science.com/jaelt.

Klein, P. D., & Boscolo, P. (2016). Trends in research on writing as a learning activity. *Journal of Writing Research*, 7(3), 311–350.

Klepsch, M. (2020). Professional development for teachers: A review of the literature. *International Journal of Educational Research, 98*, 101-113.

Kuo, F. O., Yu, P. T., & Hsiao, W. H. (2015). Develop and evaluate the effects of multimodal presentation system on elementary student learning effectiveness: within classroom English learning activity. *Procedia-Social and Behavioral Sciences*, *176*, 227-235.

Kuppens, A. H. (2009). Incidental foreign language acquisition from media exposure. *Learning, Media and Technology, 35*(1), 65-85. https://doi.org/10.1080/17439880903561876.

Lee, H. C. (2014). Using an Arts-Integrated Multimodal Approach to Promote English Learning: A Case Study of Two Taiwanese Junior College Students. *English Teaching: Practice and Critique*, *13*(2), 55-75.

Li, X. (2018). Teaching English oral presentations as a situated task in an EFL classroom: A quasi-experimental study of the effect of video-assisted self-reflection. *Revista Signos*, *51*(98), 359–381. https://doi.org/10.4067/s0718-09342018000300359

Liu, C. and Long, F. (2014) 'The discussion of traditional teaching and multimedia teaching approach in college English teaching', *Proceedings of the 2014 International Conference on Management, Education and Social Science* [Preprint]. doi:10.2991/icmess-14.2014.9.

Lodhi, M. A., Ibrar, S. N., Shamim, M., & Naz, S. (2018). Linguistic analysis of selected TV cartoons and its impact on language learning. *International Journal of English Linguistics, 8*(5), 247-258.

Mahboob, A. (2009). English as an Islamic language: A case study of Pakistani English. *World Englishes*, 28(2), 175-189.

Malik, S., & Agarwal, A. (2012). Use of multimedia as a new educational technology tool—A study. *International Journal of Information and Education Technology, 2*(5), 468.

Mayer, R. E. (2001). What good is educational psychology? the case of cognition and instruction. *Educational Psychologist*, *36*(2), 83–88. https://doi.org/10.1207/s15326985ep3602_3

Mayer, R. E. (2002). Multimedia learning. In J. L. Mestre & B. H. Ross (Eds.), *Psychology of Learning and Motivation,* Academic Press, *41*, 85-139.

Mayer, R. E. (2005). *The Cambridge Handbook of Multimedia Learning*. University of Cambridge.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). New York, NY: Cambridge University Press.

Mayer, R. E. (2019). How multimedia can improve learning and instruction. *The Cambridge Handbook of Cognition and Education*, 460–479. https://doi.org/10.1017/9781108235631.019.

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational psychologist*, *38*(1), 43-52.

Mayer, R. E., Dow, G., & Mayer, S. (2003). Multimedia learning in an interactive self-explaining environment: What works in the design of agent-based microworlds. *Journal of Educational Psychology, 95*(4), 806-813.

Mayer, R., & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational Psychology Review, 14*, 87-100.

McClure, L. (2015, July). *When to use apostrophes - Laura McClure*. TED. https://ed.ted.com/lessons/when-to-use-apostrophes-laura-mcclure

Mekheimer, M. A. A. G. (2011). The impact of using videos on whole language learning in EFL context. *Arab World English Journal*, *2*(2), 5-39.

Meskill, C., & Anthony, N. (2015). *Teaching languages online* (Vol. 12). Multilingual matters.

Mitra, B., Lewin-Jones, J., Barrett, H., & Williamson, S. (2010). The use of video to enable deep learning. *Research in Post-Compulsory Education*, *15*(4), 405-414.

Moreno, R. (2004). Decreasing cognitive load for novice students: Effects of explanatory versus corrective feedback in discovery-based multimedia. *Instructional Science, 32*(1/2), 99-113.

Neumajer, O. (2016). The role of digital technologies in foreign language teaching - educational content. *RVP - Rada vysokých podnikov*. Retrieved June 15, 2024, from https://clanky.rvp.cz/clanek/c/z/20605/ROLE-

Onal, N. T., & Sondur, D. G. (2017). I like technology usage in lessons and animations in science! *The Journal of Academic Science Studies, (55)*, 97-118.

Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, 25(4), 401-426.

Plailek, T. (2012). *The development of English final consonant pronunciation skills of Prathomsuksa 6 students at demonstration school, Suan Sunandha Rajabhat University* [Research Report]. Suan Sunandha Rajabhat University.

Ploetzner, R., & Lowe, R. (2017). Looking across instead of back and forth: How the simultaneous presentation of multiple animation episodes facilitates learning. In R. Lowe (Ed.), *Learning from dynamic visualization* (pp. 51-68). Springer. https://doi.org/10.1007/978-3-319-42174-2

PowerPoint slide show presentations. *Journal of visual communication in medicine, 41*(1), 36-41.

Qiu, J. (2017). The effect of English movies on college English listening teaching. *Theory and Practice in Language Studies, 7*(11), 1011-1024. https://doi.org/10.17507/tpls.0711.10.

Ramlogan, S., Raman, V., & Sweet, J. (2014). A comparison of two forms of teaching instruction: video vs. live lecture for education in clinical periodontology. *European Journal of Dental Education*, *18*(1), 31-38.

Rao, P. S. (2019). The role of English as a global language. *Research Journal of English,* 4(1), 65-79. https://www.rjoe.org.in/Files/vol4issue1/new/OK%20RJOE-Srinu%20sir(65- 79).pdf.

Rashtchi, M., & Afzali, M. (2011). Spoken grammar awareness raising: Does it affect the listening ability of Iranian EFL learners? *Studies in Second Language Learning and Teaching, 1*(4), 515-531. https://doi.org/10.14746/ssllt.2011.1.4.4.

Rashtchi, M., & Mazraehno, M. R. T. (2019). Exploring Iranian EFL learners' listening skills via TED Talks: Does medium make a difference? *Journal of Language and Education, 5*(4), 81-97.

Rashtchi, M., Khoshnevisan, B., & Shirvani, M. (2021). Integration of Audiovisual Input via TED-ED Videos and Language Skills to Enhance Vocabulary Learning. *MEXTESOL Journal, 45(1*).

Rasi, P. M., & Poikela, S. (2016). A review of video triggers and video production in higher education and continuing education PBL settings. *Interdisciplinary Journal of Problem-Based Learning*, *10*(1), 7.

Rosen, Y. (2009). The effects of an animation-based online learning environment on transfer of knowledge and on motivation for science and technology learning. *Journal of Educational Computing Research, 40*(4), 451-467. https://doi.org/10.2190/ec.40.4.d.

Safranj, J. (2015). Advancing listening comprehension through movies. *Procedia Social and Behavioral Sciences, 191*, 169-173. https://doi.org/10.1016/j.sbspro.2015.04.513.

Sanchez, C. (2017). English language learners: How your state is doing. *NPR*. Retrieved May 20, 2024, from https://www.npr.org/sections/ed/2017/02/23/512451228/5-million-english-language-learners-a-vast-pool-of-talent-at-risk.

Sanjmyatav, G., & Sumiya, S. (2020). Using TED-ED as authentic aids to promote EFL acquisition. *Mandakh Research, 03*, 66–74.

Sanjmyatav, G., & Sumiya, S. (2020). Using TED-ED as Authentic Aids to Promote EFL Acquisition. Mandakh Research, 3, 66-74.

Scagnoli, N. I., Choo, J., & Tian, J. (2019). Students' insights on the use of video lectures in online classes. *British Journal of Educational Technology*, *50*(1), 399-414.

Schlosser, R. W., Shane, H., Sorce, J., Koul, R., Bloomfield, E., Debrowski, L., DeLuca, T., Miller, S., Schneider, D., & Neff, A. (2012). Animation of graphic symbols representing verbs and prepositions: Effects on transparency, name agreement, and identification. *Journal of Speech, Language, and Hearing Research, 55*, 342-358. https://search.proquest.com/docview/1024420626?accountid=14667.

Seo, K. (2002). The effect of visuals on listening comprehension: A study of Japanese learners' listening strategies. *International Journal of Listening, 15*, 57–81.

Shafique, H., Zulqarnain, A., & Zulqarnain, W. (2022). EFL students' attitudes towards the use of new media in classrooms: An analysis of Pakistani university. *Global Digital & Print Media Review*, *V*(II), 158–171. https://doi.org/10.31703/gdpmr.2022(v-ii).15.

Shih, Y.C., Huang, P.R., Hsu, Y.C., & Chen, S.Y. (2012). A complete understanding of disorientation problems in Web-based learning. *The Turkish Online Journal of Educational Technology, 11(*3), 1-13.

Smetana, L. K., & Bell, R. L. (2014). Which setting to choose: Comparison of whole-class vs. small-group computer simulation use. *Journal of Science Education and Technology*, *23*(4), 481-495.

South, J. B., Gabbitas, B., & Merrill, P. F. (2008). Designing video narratives to contextualize content for ESL learners: A design process case study. *Interactive Learning Environments*, *16*(3), 231-243.

Stebner, F., Kühl, T., Höffler, T. N., & Wirth, J. (2017). The role of process information in narrations while learning with animations and static pictures. *Computers & Education, 104*, 34-48. http://dx.doi.org/10.1016/j.compedu.2016.11.001.

Sulaiman, N., Muhammad, A. M., Ganapathy, N. N. D. F., Khairuddin, Z., & Othman, S. (2017). A comparison of students' performances using audio only and video media methods. *English Language Teaching, 10*(70), 210-215. https://doi.org/10.5539/elt.v10n7p210.

Swaffar, J., & Vlatten, A. (1997). A sequential model for video viewing in the foreign language curriculum. *Modern Language Journal, 81*, 175-188.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285. https://doi.org/10.1016/0364-0213(88)90023-7

Sweller, J. (2011). Cognitive load theory. *Psychology of Learning and Motivation, 55*, 37–76. https://doi.org/10.1016/b978-0-12-387691-1.00002-8

Sykes, J. M. (2014). Emerging technological contexts for teaching Spanish. In K. Potowski (Ed.), *The Routledge handbook of Hispanic applied linguistics* (pp. 238-257). Routledge.

Tahira, S. & Batool, H. A. R. (2021). Animation based learning and traditional method of teaching in English subject: A comparative study. *Pakistan Social Sciences Review, 5*(II), 848–858. https://doi.org/10.35484/pssr.2021(5-ii)65.

Takaesu, A. (2013). TED Talks as an extensive learning source for EAP students. *Language Education in Asia, 4*(2), 150-162. http://dx.doi.org/10.5746/LEiA/13/V4/I2/A05/Takaesu.

Thomas, L. (2024). Quasi-experimental design: Definition, types & examples. *Scribbr*. Retrieved June 10, 2024, from https://www.scribbr.com/methodology/quasi-experimental-design/#:~:text=Like%20a%20true%20experiment%2C%20a,based%20on%20non%2Drandom%20criteria.

Tytler, R., Prain, V., & Hubber, P. (2018). Representation construction as a Core science disciplinary literacy. *Global developments in literacy research for science education, Cham, Switzerland: Springer*, pp. 301–318.

Unsworth, L. (2001). *Teaching multiliteracies across the curriculum: Changing contexts of text and image in classroom practice*. Buckingham, UK: Open University Press.

Unsworth, L. (2020). A Multidisciplinary Perspective on Animation Design and Use in Science Education. *In Learning from Animations in Science Education* Springer, Cham. pp. 3-22.

Valencia, J. (2018). Integration of TED-Ed Lessons and TED and TEDx Talks to Enhance College Classroom Instruction. In 4th International Conference on Higher Education Advances (HEAD'18). *Editorial Universitat Politècnica de València*. pp. 817-825.

Vanderplank, R. (2010). Déjà vu? A decade of research on language laboratories, television and video in language learning. *Language Teaching, 43*(1), 1–37. https://doi.org/10.1017/S0261444809990267.

Venable, R. (2018). *Online trends in education report*. Best Colleges. Retrieved June 15, 2024, from https://www.bestcolleges.com/research/annual-trends-in-online-education/.

Verhallen, M., Bus, A., & de Jong, M. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology, 98*(2), 410-419. https://doi.org/10.1037/0022-0663.98.2.410.

Wijaya, T. T., Zhou, Y., Purnama, A., & Hermita, N. (2020). Indonesian students' learning attitude towards online learning during the coronavirus pandemic. *Psychology, Evaluation, and Technology in Educational Research, 3*(1), 17–25. https://doi.org/10.33292/petier.v3i1.56

Williams, H., & Thorne, D. (2000). The value of Teletext subtitling as a medium for language learning. *System, 28*, 217-228.

Yang, K. T., Wang, T. H., & Chiu, M. H. (2014). How technology fosters learning: Inspiration from the "Media Debate". *Creative Education, 5*(12), 1086.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014). Video-based learning: A critical analysis of the research published in 2003-2013 and future visions. In *eLmL 2014, The Sixth International Conference on Mobile, Hybrid, and On-line Learning*.

Zhao, Y. (2003). Recent developments in technology and language learning: A literature review and meta-analysis. *CALICO Journal, 21*(1), 7–27. https://proxy.lib.umich.edu/login?url=https://search-proquestcom.proxy.lib.umich.edu/docview/750477643?accountid=14667.

APPENDIX A

Questionnaire Survey Instructions: Pre-test

Dear respondents,

I, Saera Gul, am a MPhil English Linguistics student at NUML, Islamabad. This questionnaire has been structured to be part of the research undertaken for my thesis paper. The aim of the research is to *investigate the teaching of English grammar through TED-Ed videos amongst English undergraduate Pakistani students.*

Please read the following instructions:

1. You will be asked to answer 6 questionnaires consisting of 5 questions each, regarding a topic about English grammar.
2. You will be given 6 minutes to answer the short questionnaire.
3. You must not discuss the answers with your seatmates. Try to answer all the questions to the best of your abilities.
4. After answering, without standing up from your seat, pass your completed questionnaires to the person in front.

Your response will be kept strictly confidential and used for academic purposes only. I sincerely appreciate your cooperation and valuable time spent on answering this questionnaire. If you have any inquiries pertaining to this survey, please do not hesitate to reach me at saera.8e@gmail.com.

APPENDIX B

Questionnaire Survey Instructions: Treatment and Post-Test

Dear respondents, this is the second questionnaire of the research undertaken for my thesis paper.

Please read the following instructions:

1. A short, animated TED-Ed video will be played on the projector. The video will be played only once, so please pay attention.
2. You will be asked to answer a questionnaire consisting of 5 questions regarding a topic about English grammar.
3. You will be given 6 minutes to answer the short questionnaire.
4. You must not discuss the answers with your seatmates. Try to answer all the questions to the best of your abilities.
5. After answering, without standing up from your seat, pass your completed questionnaires to the person in front.

Your response will be kept strictly confidential and used for academic purposes only. I sincerely appreciate your cooperation and valuable time spent on answering this questionnaire. If you have any inquiries pertaining to this survey, please do not hesitate to reach me at saera.8e@gmail.com.

APPENDIX C

Questionnaire 1

Video Title: When to use "me", "myself" and "I" - Emma Bryce

Video Link: https://ed.ted.com/lessons/when-to-use-me-myself-and-i-emma-bryce

Questions:

1.Which pronoun among **Me, Myself** and **I**, is the subject pronoun?

2.Which pronoun among **Me, Myself** and **I**, is the object pronoun?

3.Which pronoun among **Me, Myself** and **I,** is the reflexive/intensive pronoun?

4. Write a sentence where the pronoun '**myself**' is used as a reflexive pronoun?

5. Write a sentence where the pronoun '**myself**' is used as an intensive pronoun?

APPENDIX D

Questionnaire 2

Video title: Punctuation explained (by Punctuation!)

Video Link: https://ed.ted.com/best_of_web/aKSwXYUd

Questions:

1. When is a period used?

2.When is a question mark used?

3.When is an exclamation mark used?

4. When is a comma used?

5. What was the punctuation that was shown but not discussed in the video?

APPENDIX E

Questionnaire 3

Video title: How to use a semicolon - Emma Bryce

Video Link: https://ed.ted.com/lessons/how-to-use-a-semicolon-emma-bryce

Questions:

1.What does a semicolon look like? (please write down the punctuation)

2.What is one objective of the semicolon?

3.How many rules that govern the use of semicolons are stated in the video?

4.When used in lists, do semicolons need to connect clauses that are related in some way?

5.What punctuation mark would you use after the connecting conjunction "But"?

APPENDIX F

Questionnaire 4

Video title: Buffalo buffalo buffalo: One-word sentences and how they work - Emma Bryce

Video Link: https://ed.ted.com/lessons/buffalo-buffalo-buffalo-one-word-sentences-and-how-they-work-emma-bryce

Questions:

1. What is lexical ambiguity?

2. What is the meaning of the verb 'buffalo'?

3. How can punctuation be used in lexical ambiguity?

4. How do lexical ambiguities contribute to grammar?

5. Can you write down a lexical ambiguity that was stated in the video?

APPENDIX G

Questionnaire 5

Video title: How misused modifiers can hurt your writing

Video Link: https://ed.ted.com/lessons/how-misused-modifiers-can-hurt-your-writing-emma-bryce

Questions:

1. In grammar, what are modifiers?

2. How can misplaced modifiers be corrected?

3. What is a dangling modifier?

4. What is a squinting modifier?

5. Why do misplaced modifiers need to be addressed?

APPENDIX H

Questionnaire 6

Video title: When to use apostrophes - Laura McClure

Video Link: https://ed.ted.com/lessons/when-to-use-apostrophes-laura-mcclure

Questions:

1. What does an apostrophe look like? Please write down the punctuation mark.

2. What are the 3 ways an apostrophe can be used?

3. Please write a sentence using the word "its".

4. Please write a sentence using the word "it's".

5. When can double apostrophes or double contractions be used?

APPENDIX I

Learning Satisfaction Survey Questionnaire

Instructions:

For each of the questions below, circle the answer that best characterises how you feel about the statement. Where ***1****= Strongly Disagree,* ***2****= Disagree,* ***3****= Agree,* ***4****= Strongly Agree.*

No.		Strongly Disagree	Disagree	Agree	Strongly Agree
1	I like the idea of learning English grammar in my class using animated TED-Ed videos as a learning material.	1	2	3	4
2	My learning experience with using animated TED-Ed videos as a method of English language learning was positive.	1	2	3	4
3	Learning English in a class with animated TED-Ed videos was enjoyable.	1	2	3	4
4	Overall, I found learning from animated videos easy.	1	2	3	4
5	The use of animated TED-Ed videos allowed me to improve my understanding of English grammar.	1	2	3	4
6	Using animated videos supported my learning of English grammar by providing more resources and tools.	1	2	3	4
7	I had no difficulty understanding the video content delivered in class through the animated TED-Ed videos.	1	2	3	4
8	As a whole, learning from animated TED-Ed videos in classrooms was effective for my English language learning overall.	1	2	3	4
9	Overall, I am satisfied with the method of English grammar learning with animated TED-Ed videos as teaching materials in class.	1	2	3	4

APPENDIX J

TED-Ed Video Transcripts

Transcript J1

Video 1: When to use "me", "myself" and "I" - Emma Bryce

0:07: Me, myself, and I.

0:09: You may be tempted to use these words interchangeably

0:13: because they all refer to the same thing,

0:15: but in fact, each one has a specific role in a sentence.

0:19: "I" is a subject pronoun,

0:21: "me" is an object pronoun,

0:24: and "myself" is a reflexive or intensive pronoun.

0:28: So, what does that reveal about where each word belongs?

0:31: Let's start with the difference between subject and object.

0:35: Imagine the subject as the actor in a sentence

0:38: and the object as the word that is acted upon.

0:42: "I invited her but she invited me."

0:46: The object can also be the object of a preposition.

0:49: "She danced around me, while he shimmied up to me."

0:54: In some languages, like Latin and Russian,

0:57: most nouns have different forms that distinguish subjects from objects.

1:01: However, in English, that's only true of pronouns.

1:05: But so long as you know how to distinguish subjects from objects,

1:08: you can figure out what belongs where.

1:11: And when you encounter a more complicated sentence,

1:14: say one that involves multiple subjects or objects,

1:17: and you're not sure whether to use "I" or "me,"

1:21: just temporarily eliminate the other person,

1:24: and once again distinguish subject from object.

1:28: Here's another.

1:30: You wouldn't say, "Me heard gossip," but sub in "I" and you're good to go.

1:35: Then what about "myself?"

1:38: This grand character is often substituted for "me" and "I"

1:42: because it seems more impressive.

1:44: "Please tell Jack or myself" may sound elegant,

1:48: but in fact, "me" is the right pronoun here.

1:52: So where should you use "myself"?

1:54: In its function as a reflexive pronoun,

1:57: "myself" only works if it's the object of a sentence

2:00: whose subject is "I."

2:03: "I consider myself the most important pronoun at this year's party."

2:09: "Myself" can also add emphasis as an intensive pronoun.

2:14: "I, myself, have heard others agree."

2:18: The sentence works without it,

2:19: but that extra pronoun gives it oomph.

2:22: To check if "myself" belongs in a sentence,

2:25: simply ensure that there's also an "I" that it's reflecting or intensifying.

2:30: So that's "me," "myself," and "I,"

2:32: ever ready to represent you, yourself, and you.

Transcript J2

Video 2: How misused modifiers can hurt your writing

0:10: This just in:

0:11: "Thief robs town with world's largest chocolate bunny."

0:16: Wait, so are we talking about this,

0:19: or this?

0:21: That's a classic case of a misplaced modifier,

0:25: a common grammatical mistake

0:27: that can dramatically change the meaning of a sentence.

0:30: And lest you think this is a bit far-fetched,

0:33: confusing headlines like this appear all the time.

0:37: Modifiers are words, phrases, and clauses

0:41: that add information about other parts of a sentence,

0:45: which is usually helpful.

0:47: But when modifiers aren't linked clearly enough

0:50: to the words they're actually referring to,

0:52: they can create unintentional ambiguity.

0:55: That happens because the modifying words,

0:58: in this case, "with world's largest chocolate bunny,"

1:01: modify the wrong thing, the robber's actions instead of the town.

1:06: To correct this particular sentence, we simply rephrase

1:09: to make it clearer what the modifying phrase is talking about.

1:13: "Town with world's largest chocolate bunny robbed by thief."

1:18: Now, at least it's clear

1:20: that the thief wasn't armed with a giant chocolate animal.

1:24: Sometimes, modifying words, phrases, or clauses

1:27: don't appear to be modifying anything at all.

1:30: That's called a dangling modifier.

1:33: "Having robbed the bank in record time,

1:35: it was possible to make off with the town's chocolate rabbit as well."

1:41: The modifying phrase in this sentence seems unrelated to anything else,

1:45: and so we're clueless about

1:47: who the chocolate-loving criminal could possibly be.

1:51: Giving the modifier something to modify will solve the problem.

1:55: Then there's another group called the squinting modifiers

1:59: because they're stuck between two things and could feasibly refer to either.

2:05: Often, these modifiers are adverbs, like the one in this sentence:

2:09: "Robbers who steal chocolate bunnies rapidly attract the outrage of onlookers."

2:15: "Rapidly" is the modifier, here, but what's not clear

2:18: is whether it's referring to the speed of the chocolate thievery,

2:22: or how quickly it alerts the furious onlookers.

2:25: To clarify, we can either put the modifier closer to its intended phrase,

2:31: which works in some cases,

2:33: or we can entirely reword the sentence so that the modifier no longer squints,

2:38: but clearly applies to only one part.

2:42: "Chocolate bunny-thieving robbers rapidly attract the outrage of onlookers."

2:48: Justice will eventually come to the chocolate thief,

2:51: but in the meantime,

2:52: our task is to avoid verbal ambiguity

2:55: by making it clear which parts of the sentences modifiers belong to.

3:00: That way, we can at least maintain grammatical law and order.

Transcript J3

Video 3: Punctuation explained (by Punctuation!)

0:03: Hi, I am a period. I am used at the end of a complete thought.

0:19: I am a question mark, right? Does anyone have any questions?

0:34: I am an exclamation mark! I am used for strong feelings! I am excited! Woohoo!

0:49: I am a comma. I am used to make a pause between thoughts, and also to list things.

0:56: I like cookies, cupcakes, and cucumbers.

1:10: Yikes!

1:12: What is that?

1:15: I have no idea.

1:19: I like cookies, cupcakes, and cucumbers.

Transcript J4

Video 4: How to use a semicolon - Emma Bryce

0:07: It may seem like the semicolon is struggling with an identity crisis.

0:12: It looks like a comma crossed with a period.

0:15: Maybe that's why we toss these punctuation marks around like grammatical confetti.

0:20: We're confused about how to use them properly.

0:23: In fact, it's the semicolon's half-half status that makes it useful.

0:29: It's stronger than a comma, and less final than a period.

0:33: It fills the spaces in between, and for that reason,

0:36: it has some specific and important tasks.

0:40: For one, it can clarify ideas in a sentence

0:43: that's already festooned with commas.

0:46: "Semicolons: At first, they may seem frightening,

0:50: then, they become enlightening,

0:52: finally, you'll find yourself falling for these delightful punctuation marks."

0:57: Even though the commas separate different parts of the sentence,

1:00: it's easy to lose track of what belongs where.

1:04: But then the semicolon edges in to the rescue.

1:07: In list-like sentences, it can exert more force than commas do,

1:12: cutting sentences into compartments and grouping items that belong together.

1:17: The semicolon breaks things up, but it also builds connections.

1:22: Another of its tasks is to link together independent clauses.

1:26: These are sentences that can stand on their own,

1:29: but when connected by semicolons,

1:31: look and sound better because they're related in some way.

1:35: "Semicolons were once a great mystery to me.

1:38: I had no idea where to put them."

1:41: Technically, there's nothing wrong with that.

1:43: These two sentences can stand alone.

1:46: But imagine they appeared in a long list of other sentences,

1:49: all of the same length, each separated by periods.

1:54: Things would get monotonous very fast.

1:57: In that situation,

1:59: semicolons bring fluidity and variation to writing

2:02: by connecting related clauses.

2:04: But as beneficial as they are, semicolons don't belong just anywhere.

2:09: There are two main rules that govern their use.

2:12: Firstly, unless they're being used in lists,

2:15: semicolons should only connect clauses that are related in some way.

2:20: You wouldn't use one here, for instance:

2:22: "Semicolons were once a great mystery to me;

2:25: I'd really like a sandwich."

2:29: Periods work best here because these are two totally different ideas.

2:33: A semicolon's job is to reunite two independent clauses

2:37: that will benefit from one another's company

2:40: because they refer to the same thing.

2:42: Secondly, you'll almost never find a semicolon willingly stationed

2:46: before coordinating conjunctions:

2:49: the words, "and," "but," "for," "nor," "or," "so," and "yet."

2:55: That's a comma's place, in fact.

2:57: But a semicolon can replace a conjunction to shorten a sentence

3:02: or to give it some variety.

3:04: Ultimately, this underappreciated punctuation mark

3:08: can give writing clarity, force, and style,

3:11: all encompassed in one tiny dot and squiggle

3:15: that's just waiting to be put in the right place.

Transcript J5

Video 5: Buffalo buffalo buffalo: One-word sentences and how they work - Emma Bryce

0:06: You may think you know the words that sit plainly in black on your page,

0:13: but don't be fooled.

0:14: Some words are capable of taking on different guises,

0:18: masquerading as nouns, verbs and adjectives

0:22: that alter their meanings entirely.

0:25: This seeming superpower is called lexical ambiguity.

0:29: It can turn words and sentences into mazes that mess with our minds.

0:34: For example, consider the following:

0:38: Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo.

0:43: That may sound like nonsense,

0:46: but it's actually a grammatically correct sentence.

0:49: How? Well, Buffalo is proper noun, a noun, and a verb.

0:55: It refers to an animal also known as a bison,

0:58: an American city,

1:00: and it can also mean to bully.

1:03: These different interpretations create a sequence of words

1:06: that is grammatically correct as it stands,

1:10: though it helps to add in a few implied phrases

1:12: and punctuation marks to reveal what's really going on.

1:17: Buffalo buffalo are bison from the city of Buffalo,

1:20: and this sentence has three groups of them.

1:22: Group A, which is bullied by Group B, bullies Group C.

1:27: In other words, bison from Buffalo that other bison from Buffalo bully

1:31: also bully bison from Buffalo.

1:34: If you let each buffalo perform its role, the meaning becomes apparent.

1:38: What if the bunch of bullying buffalo decides to cross the ocean?

1:42: Not just on any ship,

1:44: but a ship-shipping ship shipping shipping-ships?

1:47: That sentence sounds just as outrageous, but there's logic to the babble.

1:52: Ship can mean a vessel and to transport.

1:56: When we sub in those meanings, a clearer picture emerges.

1:59: Here we have a huge ship-carrying vessel

2:02: transporting ships that themselves are designed to carry goods across the sea.

2:07: A ship-shipping ship, shipping shipping-ships.

2:10: How about some entertainment on board this unusual vessel

2:14: to offset the scuffling buffalo?

2:17: Consider the can-can.

2:19: Can-can can-can can can can can can-can.

2:24: Here, the word can comes in many guises.

2:27: There's can-can, the flamboyant dance,

2:29: can, that means able to,

2:31: and can, figuratively meaning to outperform.

2:35: By sticking in a comma and including the implied meanings,

2:39: this sentence becomes clearer.

2:41: Can-can dances that can-can dances are able to outperform,

2:46: can also outperform other can-can dances.

2:49: You wouldn't necessarily use any of these sentences in a conversation.

2:53: They're just too ridiculous.

2:55: Yet they serve as an extreme example

2:57: on just how tangled everyday language can be.

3:01: Lexical ambiguities sail into our speech and writing all the time,

3:06: spreading confusion and misunderstanding wherever they can-can.

Transcript J6

Video 6: When to use apostrophes - Laura McClure

0:08: Is it a flying comma, or a quotation mark chopped in half?

0:13: Either way, you may already be well-versed in how to use the apostrophe,

0:17: but here's a quick refresher on its usage.

0:20: The apostrophe can be used in three ways:

0:23: to mark possession,

0:25: to mark contraction,

0:27: to mark the plural of single letters.

0:31: Most of the time, if you see an apostrophe hovering helpfully near a word,

0:35: it's trying to mark possession or contraction.

0:38: First, let's look at how the apostrophe marks possession.

0:42: As you can see, the placement of this punctuation mark

0:45: can really change the meaning of a sentence.

0:49: "Those robots in the sand are my sister's."

0:52: "Those robots in the sand are my sisters.'"

0:56: "Those robots in the sand are my sisters."

1:00: When showing possession, the apostrophe belongs next to the noun

1:04: that owns or possesses something.

1:07: The noun can be singular or plural.

1:09: Proper nouns work, too.

1:12: So if Lucy needs to get her robots under control before they cause mayhem,

1:16: those dangerous creatures would be "Lucy's robots."

1:20: But what if Lucy was Lucas?

1:22: Would we write "Lucas' robots" or "Lucas's robots"?

1:26: And what if Lucas gave his robots to the Robinsons family?

1:30: Would it be "The Robinsons' robots," or "The Robinsons's robots"?

1:35: The truth is, even grammar nerds disagree on the right thing to do.

1:40: The use of 's after a proper noun ending in s is a style issue,

1:46: not a hard and fast grammar rule.

1:48: It's a conundrum without a simple answer.

1:51: Professional writers solve this problem by learning what's considered correct

1:54: for a publication, and doing that.

1:57: The important thing is to pick one style

1:59: and stick with it throughout a piece of writing.

2:03: One more wrinkle.

2:04: Certain pronouns already have possession built in

2:07: and don't need an apostrophe.

2:10: Remembering that will help you avoid one of the trickiest snags in English grammar:

2:14: its vs. it's.

2:17: "It's" only take an apostrophe when it's a contraction for "it is" or "it has."

2:22: If you can replace "it's" with one of those two phrases,

2:25: use the apostrophe.

2:27: If you're showing possession, leave it out.

2:30: Otherwise, contractions are pretty straightforward.

2:33: The apostrophe stands in for missing letters,

2:36: and lets common phrases squash into a single word.

2:40: In rare cases, you can have a double contraction,

2:43: though those generally aren't accepted in writing,

2:46: with the exception of dialogue.

2:48: So it's possessive, it's often followed by s's,

2:52: and it's sometimes tricky when it comes to its usage.

2:56: It's the apostrophe.