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Prompts, Textbooks, Maps: AI-Crafted Tools Grammar for SEN Students in an Italian High School

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ABSTRACT

Artificial Intelligence (AI) is increasingly reshaping English language teaching through adaptive, learner-centred, and multimodal pedagogies, with particular relevance for inclusive education and students with Special Educational Needs. Within this framework, concerns regarding cognitive offloading, algorithmic hallucinations, and teacher overreliance call for balanced human–Artificial Intelligence collaboration. Grounded in Constructivism, Sociocultural Theory, Cognitive Load Theory, Adaptive Learning Theory, Self-Determination Theory, and the Technological Pedagogical Content Knowledge model, this study investigates how prompt engineering and generative Artificial Intelligence can support grammar instruction in a secondary school context. This article aims to explore the pedagogical potential of Artificial Intelligence-crafted tools for personalised English grammar instruction, examining how structured prompts, digital textbook resources, and multimodal outputs can support a student with special educational needs while preserving cognitive engagement and teacher mediation. A qualitative case study methodology was adopted in an Italian high school English classroom through a three-phase prompt engineering framework: (1) selection of instructional input resources, including textbook excerpts and cropped portable network graphics images; (2) structured prompt construction through role, context, instructions, and rule-based components; and (3) analysis of Artificial Intelligence outputs, including grammar exercises, conceptual maps, and interdisciplinary listening tasks. The study examined iterative prompt refinement and multimodal resource generation using open-access large language model systems and image-generating Artificial Intelligence tools. Particular attention was given to how prompt modifications influenced output complexity, accessibility, and pedagogical suitability for inclusive grammar teaching. Findings indicate that structured prompt engineering can support the generation of personalised, scaffolded learning materials aligned with inclusive didactic objectives. Artificial Intelligence-generated exercises and conceptual maps promoted simplification, visual support, and differentiated instruction, while prompt refinement improved output clarity and adaptability. Results also suggest that combining textual prompts with digital resources enhances specificity and supports multimodal learning. At the same time, the study highlights risks linked to excessive automation, including cognitive offloading and reduced critical engagement when teacher mediation is absent. Artificial Intelligence can function as a valuable didactic enhancer rather than a substitute for pedagogical expertise,

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particularly when integrated through reflective prompt design and theoretically grounded instructional practices. Effective implementation depends on balancing innovation with teacher judgment, ethical awareness, and student cognitive autonomy. The study suggests that prompt engineering may represent an emerging pedagogical competence for inclusive language teaching and calls for further research on the long-term cognitive and educational implications of Artificial Intelligence-supported instruction.

KEY WORDS: Artificial Intelligence (AI), Cognitive Load Theory, Cognitive Offloading, English Teaching, Learning Analytics, Prompt Engineering.

INTRODUCTION

Artificial Intelligence (AI) is profoundly reshaping high school English instruction by enhancing pedagogical practices (Kristiawan, D., Y., Bashar, K., & Pradana, D. A., 2024, page 208) and improving student learning outcomes, in alignment with broader trends toward digitalization and learner-centred education. AI-driven tools contribute to instructional effectiveness by supporting processes such as writing, vocabulary acquisition, and idea development, while also facilitating cognitive load management, enabling learners to devote greater attention to meaningful, higher-order learning activities.

Nonetheless, the effective integration of AI depends on addressing key structural and pedagogical challenges, including inadequate technological infrastructure and insufficient teacher training. The discussion also underscores several critical risks: the increasing incorporation of AI into educational contexts may erode teachers' expertise and professional autonomy, potentially leading to deskilling and an overreliance on opaque algorithmic systems. Despite these concerns, AI should not be regarded as a monolithic entity but rather as a heterogeneous assemblage of tools with distinct pedagogical affordances. Its potential can be effectively harnessed if educators develop a nuanced understanding of its applications and limitations assuring proper technological integration in teaching (Mishra, P., & Koehler, M. J., 2006, page 3).

A key strategy could be adopting a balanced model of human–machine collaboration, in which AI augments rather than supplants the teacher's role, thereby preserving professional judgment and fostering students' active, reflective, and critical engagement.

METHODOLOGY

This study adopted a qualitative case study design aimed at exploring the pedagogical integration of Artificial Intelligence (AI) tools in English grammar instruction for a student with Special Educational Needs (SEN) in an Italian high school context. The methodology was structured to document and analyse a reproducible prompt engineering workflow, the materials employed, and the outputs generated through human–Artificial Intelligence interaction. The instructional materials consisted of three main categories. First, conventional teaching resources included selected grammar content from a secondary school English textbook focused on comparative and superlative adjectives and modal verbs. Relevant textbook sections were digitized and, where necessary, cropped into Portable Network Graphics (PNG) images to isolate target grammatical structures before upload into the Artificial Intelligence systems. Second, researcher-developed textual prompts served as the principal experimental input. Prompts were constructed following a three-phase framework: input resource selection, structured prompt engineering, and output generation. The technological instruments employed included open-access generative Artificial Intelligence tools based on Large Language Models (LLMs) for text generation and multimodal image-generating systems for visual conceptual map production. Conversational Artificial Intelligence systems were used to generate grammar explanations, fill-in-the-gap exercises, simplified schemes, and prompt conversions for concept maps. Image-generation functionality within multimodal systems was activated to produce diagrammatic visual maps from both text-only prompts and prompts combined with uploaded PNG textbook material. Outputs were compared after iterative prompt refinement to examine the influence of prompt specificity on pedagogical suitability.
Data collection consisted of documenting each interaction cycle, including original prompts, prompt revisions, generated responses, and visual outputs. Comparative observation focused on output simplicity, grammatical accuracy, accessibility for the target learner, and alignment with inclusive didactic objectives.

Analysis followed a qualitative descriptive approach grounded in educational theory, and outputs were examined for evidence of scaffolding, personalisation, multimodal support, and risks such as cognitive offloading or excessive complexity. Iterative prompt editing functioned as a replicable methodological variable, enabling systematic observation of how sequential instruction design shaped Artificial Intelligence performance. No chemical reagents or laboratory materials were involved, as the study was educational and digital in nature. Reproducibility is ensured through the explicit reporting of materials, prompt structures, interaction phases, and analytic criteria, enabling replication in comparable language teaching settings.

1. Understanding AI types

When reading instruction and prompts, AI technologies facilitate the expansion and integration of learning resources, enabling teachers to curate diverse, multimodal and multidisciplinary materials that respond to students' varying proficiency levels and needs. In this regard, AI tools support personalised instructional design by adapting content, pacing, and feedback (JinLan & XuJingying, 2026, page 65) to individual learners, thereby also fostering more inclusivity and differentiation in classrooms. However, not all types of AI have been implemented into readily accessible tools. Therefore, it can be useful to explore the different types of AI (Dhokare & Gaikwad, 2021).

AI types in language education range from basic rule-followers to more adaptive systems, each enhancing learning in distinct ways. Reactive Machines AI delivers instant, fixed-rule feedback like Grammarly's grammar checks or Google Translate's algorithm-driven translations, processing inputs independently without memory or adaptation.

Limited Memory AI builds on this by using short-term history for personalisation, as in Duolingo's performance-adjusted lessons or

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Replika's evolving conversations, making practice more responsive yet still temporary.

Theory of Mind AI, though emerging, aims to foster emotional awareness to create human-like interactions, promising tailored support for diverse learners but raising ethical debates about feelings and intentions.

Artificial Narrow Intelligence (ANI), the dominant form today, specialises in tasks like speech tools (Google Speech-to-Text) for pronunciation or Memrise's repetition for vocabulary, often blending with others in apps like Duolingo for free, focused access.

2. Theoretical Framework: Educational Theories Supporting AI in English Language Teaching

The integration of AI in English language teaching marks a shift from teacher-centred instruction toward more flexible, learner-centred models, supported by constructivist and adaptive learning theories that emphasize autonomy, interaction, and meaningful learning. AI also reflects broader trends in education focused on personalisation, digital transformation, and data-driven decision-making, though its effectiveness depends on a coherent ecosystem combining technology, pedagogy, and policy (Ramírez Morán et al., 2026, page 8).

Tabla 4: *Teorías educativas asociadas a IA y AA en la enseñanza del inglés*

Teoría/Modelo	Aporte a la enseñanza del inglés con IA
Constructivismo	Conocimiento como construcción activa con mediación tecnológica
Enfoque sociocultural	Aprendizaje como interacción social mediada por tecnología
Aprendizaje adaptativo	Rutas personalizadas de instrucción con IA
Teoría de la autodeterminación	Motivación intrínseca a través del juego y la autonomía
Analítica de aprendizaje	Uso de datos educativos para optimizar la enseñanza
Inteligencia Artificial educativa	Simulación cognitiva para adaptación del contenido
Modelo TPACK	Integración efectiva de tecnología, pedagogía y contenido
Aprendizaje situado	Aplicación del conocimiento en contextos reales mediante tecnología

Ramírez Morán et al. (2026)

The framework synthesizes key theories and models that explain the pedagogical value of AI-supported instruction:

- Rooted in the work of Piaget (1952) and Vygotsky (1978), constructivism posits that learners actively construct knowledge through interaction with their environment. In the context of AI, it is reflected in interactive platforms that allow learners to engage with content dynamically: AI-driven tools provide personalised tasks and feedback, enabling learners to build linguistic competence through active exploration and continuous adjustment of their understanding.
- The sociocultural approach, primarily associated with Vygotsky's 1978 "Mind in society", highlights the importance of social interaction and cultural context in learning (Vygotsky, L. S., 1978, page 34). AI enhances this dimension by enabling communication through virtual environments, chatbots, and collaborative platforms, simulating authentic interaction, supporting the development of communicative competence and scaffolding learning through guided digital mediation.
- Adaptive learning theory focuses on tailoring instruction to individual learner needs, preferences, and performance. This theory draws on a body of research in adaptive instruction and intelligent tutoring systems. AI systems operationalise it by analysing user data and dynamically adjusting content, difficulty levels, and feedback, creating personalised learning paths that optimise language acquisition addressing specific weaknesses and reinforcing strengths. This approach is particularly effective in heterogeneous classrooms where learners exhibit diverse proficiency levels.
- Self-Determination Theory, developed by Deci and Ryan, explains motivation in terms of autonomy, competence, and relatedness (Deci, E. L., & Ryan, R. M., 2000). AI-based learning environments incorporate gamification and interactive elements that foster intrinsic motivation. Gamification strategies introduce game-like elements into the learning process (Deterding, S., Dixon, D., Khaled, R., & Nacke, L.,2011, page 10), such as rewards, challenges, and progress tracking, increasing engagement and making learning more enjoyable, thereby improving retention and performance.
- Learning analytics refers to the use of data to understand and improve learning processes. AI technologies collect and analyse large datasets on student performance, enabling educators to make informed decisions. This data-driven approach allows continuous monitoring and personalised feedback, supporting both learners and teachers. It also facilitates early identification of learning difficulties and targeted interventions.
- Situated learning theory, associated with Lave and Wenger, argues that knowledge is best acquired in authentic contexts (Wenger, E., 1998, page 188). AI facilitates situated learning by creating immersive environments where learners can practice in realistic scenarios. Virtual simulations and interactive platforms enable the transfer of linguistic skills to real-world situations, enhancing both fluency and confidence.

3. AI integration in didactics

Multiple AI types are already embedded in English language learning tools. Reactive Machines and ANI are the most prevalent, underpinning platforms such as Google Translate, DeepL, Grammarly, and Duolingo, which provide free, real-time feedback. Limited Memory AI is also employed in adaptive systems like Replika and Woebot, which adjust to user progress. More broadly, these tools integrate technologies such as natural language processing (NLP), large language models (LLMs), speech systems (ASR, TTS), intelligent tutoring systems (ITS), chatbots, multimodal AI, XR (VR/AR), affective computing, and retrieval-augmented methods. As of 2026, Artificial General Intelligence (AGI), Artificial Superintelligence (ASI), and fully developed Theory of Mind AI remain theoretical, though limited affective capabilities are emerging. AI is increasingly embedded in accessible platforms such as Canva, Gamma, Tome, SlidesAI, Visme, and Beautiful.ai, which support content generation, organisation, and visual communication. From a didactic perspective, while accessibility enhances participation, it also increases the risk of over-reliance and cognitive offloading. (Gerlich, M., 2025). Thus, although AI fosters efficiency, creativity, and engagement, its integration must preserve students' cognitive agency and higher-order thinking. Given the global role of English and the limits of traditional methods, AI offers adaptive, real-time learning solutions, making it essential for educators to remain informed about emerging open-access tools.

3.1 Didactical prompt engineering for AIs

Effective AI integration requires structured, learner-centred prompt design to preserve pedagogical value. This process follows three phases (Serra & Oliveira, 2025, page 12): (1) input of source material, (2) prompt construction, and (3) combined processing to generate outputs. Phase 2 is central, as prompts guide AI behaviour

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through defined components. Key elements include role delegation (<role>), which shapes tone and pedagogical stance; target audience (<target_age_group>), which calibrates complexity and language; and feedback level (<feedback_level>), which promotes formative, reflective learning aligned with constructivist principles. Additional components further structure interaction: <context> and <instructions> ensure coherence and guided reasoning; <rules> maintain consistency; <output_format> organizes responses into step-by-step instructional sequences; and <user_input> personalizes engagement. These components can prove particularly fruitful when interacting with NLP (Natural Language Processing) such as ChatGPT or PerplexityAI and LLM (large language models) AI systems, as well as RAG (Retrieval-Augmented Generation) and conversational AI tools, or multimodal AIs in more advanced systems.

3.2 Case study of didactical prompt engineering

Let us make a brief and practical analysis of how a prompt serves the teacher's needs when well structured. The material to be observed is that of three grammatical exercises elaborated by an AI tool for a special needs high school pupil. The open access AI tool used will be an LLM tool. The teacher's aim was to elaborate a set of exercises regarding a previously explained grammatical topic, in this case, the formation of comparative and superlative adjectives. In Phase 1, instead of providing the AI tool with a digital resource, the tool itself was asked to give a brief explanation of the topic autonomously. Importantly, when structuring the prompt, a number of components were specified during Phase 2: <Role> Act as a high school teacher of English grammar. <Target_age_group> The student is attending the fourth year of secondary school.

<Context> Your core task is to elaborate a brief and simple explanation of comparative and superlative adjectives' formation for a student with special needs. Then, generate three fill-in-the-gaps exercises.

<Instructions> Prioritize guided reasoning in accordance with the topic's explanation. Provide a set of grammatical rules that the student can refer to while completing the exercises. <Rules> Insert irregular adjectives "good" and "bad" only in one exercise. The components were then fed to the AI tool, thus generating the following response in Phase 3. Firstly, the AI generated a short and simple explanation of the topic as required:

Topic: Comparative and Superlative Adjectives (Simple Explanation)

When we talk about things, we sometimes want to **compare** them or say which one is the **best or the worst**.

Then, it automatically divided in two "steps" some explanatory tips and the formation rules themselves. The AI generates the "step n.2" guidelines regarding the grammatical formation. It divides the explanation according to "adjective length", referring to monosyllabic adjectives as "short adjectives" and to multisyllabic ones as "long adjectives". Finally, the AI tool also inserts a brief explanation of the only two irregular adjectives mentioned in the prompt, as they will be present in one of the exercises it shall generate. Interestingly, the tool concludes the explanatory part of its response automatically deciding to provide the student with an extra tip:

📌 **Useful rules to remember**

- Use "**than**" with comparatives → *bigger than*
- Use "**the**" with superlatives → *the biggest*
- Always ask yourself:

  👉 "Am I comparing 2 things or many things?"

Finally, the tool generates three fill-in-the-gaps exercises as asked for. Furthermore, it concludes its answer with an extra recommendation.

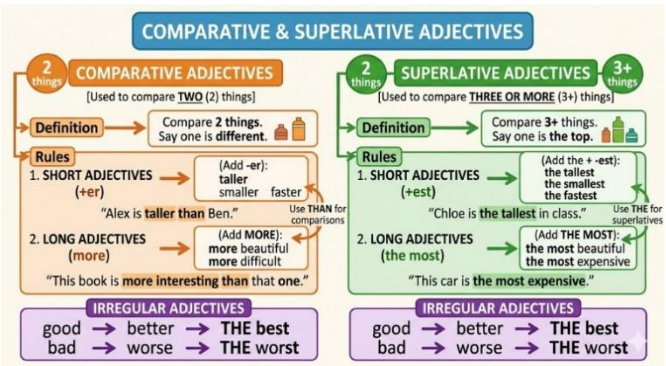
Considering the non-specificity of the prompt with regards to the student's specific needs, the AI response was satisfactory although elaborated according to a few pieces of information.

3.3 Prompt conversion to conceptual maps

One further use of the prompts engineered according to didactical guidelines is to generate diverse products. Let us suppose the teacher wishes to produce a conceptual map to guide the previous student in studying the topic developed above. The teacher will have to manually select which components to keep, which to eliminate, and which to edit. In this process, the previously analyzed prompt will be edited into the following:

<Role> Act as a high school teacher of English grammar. <Target_age_group> The student is attending the fourth year of secondary school. <Context> Your core task is to elaborate a prompt for a brief and simple conceptual map of comparative and superlative adjectives' formation for a student with special needs. <Instructions> Provide a prompt that will allow the generation of a simple, explanatory conceptual map. <Rules> Insert irregular adjectives "good" and "bad". As a result, the tool generates a new prompt (in the image below). which can be used to ask the AI to produce the conceptual map in question. However, in this case study, the teacher wishes to obtain visual material, a scheme or a conceptual map. For this purpose, several generative AI models can be used.

The prompt has then been inserted in Phase 1 in a different AI tool. This system has a specific button for image generation, which was clicked specifically for this purpose. The result was the following:



Probably, the reason for the number of boxes, colours, and visual symbols presented in the scheme is that they were words specifically mentioned in the prompt's text. To achieve a simpler outcome, the teacher will need to insert a shorter yet more specific prompt. Another method is to feed the AI tool a digital resource (see Phase 1), e.g., a picture of a grammatical explanation or scheme from the student's manual. The following sub-paragraph will scrutinize the result of such a tentative.

3.4 Conceptual maps from digital resources

In this case study, a digital resource is in use: a picture from a grammar book, fed to the system in "PNG" format. To ensure a

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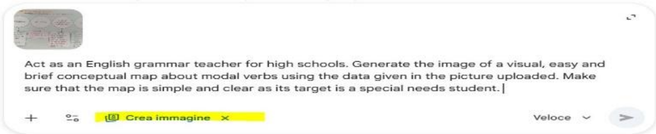
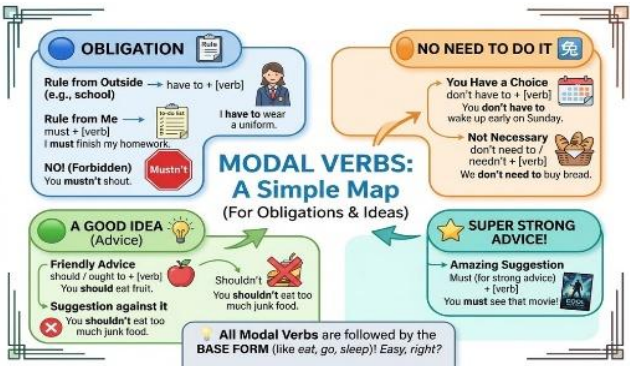
certain level of specificity, the book page's picture has been digitally cropped to zoom in on the required materials. Once the picture is uploaded to the AI tool, the "send" action will necessarily be accompanied by a manually digitized prompt. Let us suppose to use a shorter and more colloquial prompt, which can be read below: *Act as an English grammar teacher for high schools. Elaborate an easy and brief conceptual map about modal verbs using the data given in the picture uploaded. Make sure that the map is simple and clear, as its target is a special needs student.* As evident, the <role>, <Target_age_group>, <context>, and <Instructions> components have been inserted in the prompt. Furthermore, the <rule> component in this prompt will be referring to the inserted digital resource ("using the data given in the picture uploaded").

As a response, the AI tool develops an answer which is not in PNG format, yet. The answer includes a scheme which can be copy-pasted on a digital document; the table presents an overly simplified design, yet it effectively represents the topic. Nevertheless, the main point was to create a conceptual map rather than a table. Let us see what happens once we feed the resource and an edited prompt to the AI, this time specifying the request of generating an image. Furthermore, to receive a more specific outcome, it is paramount to not forget clicking on the "Generate image" button (highlighted below) before sending in the materials:



Consequently, the generated picture will look as appears below:



It is color-coded, uses boxes and arrows, and includes some symbols that help clarify its written content. Importantly, modifying the prompt to request a specific image-generation action has completely altered the outcome's format as desired. The step of prompt editing should be underlined, as it is necessary to remember that the algorithmic fundamentals of Informatics work on sequences. In the same way, AI tools might need sequential instructions to ensure the request is comprehensible and to perform well-defined actions one after the other. In doing so, a pattern is followed as the question is unrolled.

Summary of Findings

This qualitative case study shows that structured prompt engineering (phases: input resources, prompt construction, output generation) produces fill-in-the-gap exercises on comparatives/superlatives and modal verbs, plus visual conceptual maps from textbook texts or PNG images.

These outputs promote simplification, visual support, and multimodality, enhancing accessibility and scaffolding for SEN STUDENTS (or special educational needs) students, with iterative refinements boosting clarity and adaptability. Integrating digital resources with textual prompts strengthens specificity, aligning with inclusive objectives without excessive complexity.

Discussion

AI offers transformative potential for personalised, inclusive teaching, grounded in theories like constructivism, sociocultural theory, and Cognitive Load Theory, optimizing cognitive load (Sweller, 1988, page 265) and learner autonomy. However, risks include cognitive offloading, erosion of teacher autonomy, and algorithmic biases (Greengard, S. 2025, page 10); AI acts as an enhancer—not a substitute—requiring teacher mediation and ethical prompts.

Recommendations include training in prompt engineering as an emerging skill, plus future research on long-term cognitive impacts and human-machine collaboration models.

Conclusions

The integration of Artificial Intelligence (AI) in high school English language teaching offers transformative potential, enabling personalised, inclusive, and student-centred instruction grounded in established theories like constructivism, sociocultural learning, adaptive models, and Self-Determination Theory. Tools leveraging Reactive Machines, ANI, and Limited Memory AI empower educators to create tailored resources like grammar exercises, conceptual maps, and real-time feedback, optimizing cognitive load and fostering learner autonomy.

The presented case studies on prompt engineering, from comparative/superlative adjectives and some modals exercises for special needs students to image-generated conceptual maps from digital resources, illustrate how structured prompts turn AI into a versatile didactic ally. Iterative refinements ensure outputs align with pedagogical goals, avoiding overly complex results and emphasizing sequential clarity in AI interactions. Yet challenges persist, including cognitive offloading that risks eroding critical thinking and teacher autonomy, as well as ethical issues such as data privacy, algorithmic bias, and infrastructure disparities. To harness AI effectively, educators must embrace a human-machine collaboration model that augments (not supplants) professional judgment and promotes students' reflective, critical engagement.

AI serves best as an enhancer: through ongoing training, open-access tool selection, and ethical prompt design, English teachers can deliver meaningful, adaptive learning, equipping students for a digital future without compromising creativity or agency. Given the diversity of AI systems, effective use depends on informed selection and pedagogical alignment, with prompt engineering emerging as a key teacher competence. Overall, successful implementation requires a balanced, reflective approach based on human–machine collaboration, supported by training, infrastructure, and policy. Future research should further explore AI's long-term cognitive and educational impacts while maintaining the balance between efficiency and human intellectual development.

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