

Generating Culturally Responsive Visual Aids for Teaching and Learning

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Abstract

Generative artificial intelligence is increasingly being explored as a pedagogical support tool in teacher education, yet limited empirical evidence exists on how preservice teachers interact with customized AI systems to create culturally responsive visual resources in authentic practicum contexts. This study examined the use of a Culturally Responsive Visual Aids Generator (CReVAG), a customized ChatGPT-based visual-generation assistant, in supporting final-year pre-service teachers in Ghana to design and use culturally grounded teaching and learning visuals during their mandatory 12-week practicum. The study adopted a mixed-methods practicum-based intervention design. Quantitative data were obtained from teacher educators' rubric-based assessment of AI-generated visual aids and their classroom use, focusing on *Visual Resource Quality* and *Lesson Delivery Effectiveness* and were analysed using descriptive statistics. Qualitative data were drawn from preservice teachers' reflections on their experiences of generating, refining, and applying AI-supported visuals in classroom instruction and were analysed thematically. Findings showed that the AI-generated visuals were generally rated highly for clarity and accuracy, cultural responsiveness, pedagogical alignment, creativity, and engagement. Lesson delivery was also rated positively, particularly in relation to integration of visuals, clarity of instruction, learner engagement, and teacher confidence. Qualitative reflections further revealed that CReVAG reduced preparation time, supported visual creativity, improved confidence, and helped learners connect lesson content to familiar cultural and community contexts. However, participants also reported challenges related to prompt formulation, occasional inaccuracies, local language limitations, and internet connectivity. The study concludes that CReVAG can support culturally responsive visual resource development and practicum-based lesson delivery when used as a guided pedagogical tool that preserves teacher agency, critical review, and curriculum alignment.

Introduction

Visual aids remain central to effective teaching and learning because they make abstract ideas concrete, improve attention, support memory and promote inclusive classroom participation (Mayer, 2020; Paivio 2014). In teacher education, they function not merely as supplementary materials but as pedagogical resources for explaining concepts, representing knowledge, stimulating engagement and connecting classroom content to learners' lived experiences (Mayer, 2020; Moreno & Mayer, 2017). In culturally and linguistically diverse contexts such as Ghana, visual resources also carry cultural meanings and may also affirm or marginalise learners' identities depending on how they are designed and used (Gay, 2018; Hammond, 2015; Ladson-Billings, 2021). Culturally responsive pedagogy therefore emphasises the use of learners' cultural knowledge, prior experiences, language practises, community values and familiar social contexts as meaningful resources for teaching and learning (Gay, 2018; Hammond, 2015; Ladson-Billings, 2021; Paris & Alim, 2017). Teaching and learning materials should not be culturally neutral or detached from learners' realities; rather, they should support academic understanding while validating learners' identities and ways of knowing (Aronson & Laughter, 2016; Gay, 2018; Ladson-Billings, 2021). This is particularly important in Ghanaian classrooms where learners come from diverse ethnic linguistic, religious, rural and urban backgrounds (Mensah et al., 2025; Opoku-Amankwa, 2009). Visual

resources that draw on local symbols, familiar environments, Ghanaian cultural practices, community occupations, indigenous knowledge and everyday learning experiences can therefore make teaching more meaningful and accessible (Anlimachie et al., 2023; Mensah et al., 2025)

Recent studies in Ghana and elsewhere show that culturally responsive teaching is closely linked to teacher competence, self-efficacy and reflective practice (Mahali & Sevigny, 2022; Mensah et al., 2025; Paulick et al., 2024). For instance, Mensah, Owusu, and Nyamekye (2025) found that teachers' self-efficacy, critical self-reflection and religious inclusivity predicted multi-cultural teaching competence among Ghanaian preservice teachers. This suggests that preparing teachers to use culturally responsive visual resources requires more than providing materials; it also involves developing teachers' confidence and capacity to judge whether images, symbols, examples and representations are pedagogically useful and culturally respectful (Gay, 2018; Hammond, 2015; Ladson-Billings, 2021; Mahali & Sevigny, 2022; Mensah et al., 2025; Paulick et al., 2024). The Ghanaian educational context heightens this concern because many classrooms operate under resource constraints, with limited access to high-quality, locally relevant instructional materials (Asoma et al., 2024; Essel et al., 2022). Consequently, teachers and preservice teachers may rely on imported textbook images, generic internet visuals, hand-drawn illustrations or improvised teaching aids that may not adequately reflect learners' cultural and linguistic realities (Anamuah-Mensah et al., 2008; Opoku-Amankwa, 2009). While such resources may support basic instruction, they can also widen the distance between curriculum content and learners' lived experiences when they present unfamiliar environments, foreign social practices, or stereotypical representations (Gay, 2018; Paris & Alim, 2017). Culturally responsive visual aids are therefore important because they bridge curriculum content and learners' social worlds (Anlimachie et al., 2023; Hammond, 2015; Ladson-Billings, 2021).

The emergence of generative artificial intelligence has introduced new possibilities for designing illustrations, diagrams, posters, story-based images, classroom charts, and concept visuals more quickly than traditional methods (Bae et al., 2024; Crompton & Burke, 2023; Ng et al., 2024). In resource-limited teacher education contexts, this is attractive because AI may reduce the time and the technical skills required to produce visual resources (Akanzire et al., 2025; Ayanwale et al., 2024; Essel et al., 2022). However, the key issue is not only whether AI can generate teaching materials, but also whether such materials are culturally responsive, pedagogically relevant, ethically acceptable, and usable by teacher educators and preservice teachers (Miao et al., 2023; Nyaaba & Zhai, 2025; Nyaaba et al., 2024). Emerging Ghanaian scholarship has begun to address this concern. Akanzire, Nyaaba, and Nabang (2025), in a study of 55 teacher educators from two colleges of education in Ghana, found that teacher educators recognise the potential of generative AI while raising concerns about preparedness, ethical use, and institutional support. This is significant because teacher educators are central to how preservice teachers learn to select, critique and use AI-supported instructional resources (Akanzire et al., 2025; Bae et al., 2024; Zhang et al., 2023). Similarly, Nyaaba and Zhai's (2025) theory-grounded AI tool for generating culturally responsive lesson plans demonstrate that AI systems can be intentionally designed around culturally responsive pedagogy rather than used as generic content generators. Although their work focuses on lesson planning, its implications extend to visual resources because AI-

generated visuals are more likely to support learning when prompts, evaluation criteria, and instructional purposes are guided by cultural relevance, curriculum alignment, and learners' local realities (Nyaaba & Zhai, 2025; Wang et al., 2025).

At the same time, scholars warn that generative AI may produce cultural bias when its outputs are shaped by dominant Western datasets and assumptions (Miao et al., 2023; Nyaaba et al., 2024; Zawacki-Richter et al., 2019). Nyaaba, Wright, and Choi (2024) argue that generative AI can perpetuate digital neo-colonialism in global education by giving privileges to Western cultural references, languages, examples, and knowledge systems. This concern is particularly relevant to AI-generated visual resources because images influence how learners see themselves, their communities and the legitimacy of their knowledge systems (Gay, 2018; Nyaaba et al., 2024). If AI-generated visuals repeatedly portray African classrooms through stereotypes, ignore indigenous languages and symbols, or position Western environments as the default context for learning, they may undermine culturally responsive teaching (Miao et al., 2023; Nyaaba et al., 2024). Thus, teacher educators and preservice teachers must be prepared not only to generate visual resources with AI but also to critique, adapt, and validate them (Akanzire et al., 2025; Ayanwale et al., 2024; Nyaaba & Zhai, 2025). This aligns with broader research on AI literacy and technology acceptance, which shows that preservice teachers require the ability to understand AI outputs, identify bias, evaluate cultural appropriateness, and use AI ethically in lesson preparation (Ayanwale et al., 2024; Miao et al., 2023; Ng et al., 2024), while perceived usefulness, ease of use, self-efficacy, and institutional support influence adoption (Bae et al., 2024; Runge et al., 2025; Teo, 2019; Zhang et al., 2023). Despite growing interest in culturally responsive pedagogy and AI in teacher education, limited empirical attention has been given to culturally responsive visual resources in Ghanaian teacher education (Akanzire et al., 2025; Mensah et al., 2025; Nyaaba & Zhai, 2025). Existing studies have examined multicultural teaching competence, teacher educators' preparedness for generative AI, AI literacy, Technology acceptance and culturally responsive AI-supported lesson planning (Akanzire et al., 2025; Ayanwale et al., 2024; Mensah et al., 2025; Nyaaba & Zhai, 2025; Zhang et al., 2023), but less is known about how preservice teachers interact with customised AI systems to design and use culturally responsive visual resources during practicum. To address this gap, the purpose of this study was to examine how preservice teachers interacted with a Culturally Responsive Visual Aids Generator (CReVAG), a customised ChatGPT-based generative AI tool, to develop and use culturally responsive visual resources during their teaching practicum. Specifically, the study examines the extent to which CReVAG supported the generation of clear, accurate, culturally grounded, pedagogically aligned, and engaging visual resources and how the preservice teachers use these materials in their teaching.

1.2 Research Questions

This study is guided by the following research questions:

1. How do teacher educators and preservice teachers understand culturally responsive visual resources in the context of teaching and learning in Ghanaian teacher education?

2. What are teacher educators' and pre-service teachers' reflections on the relevance, quality and classroom usefulness of culturally responsive visual resources for teaching and learning?
3. What opportunities and challenges do teacher educators and preservice teachers identify in using AI for designing and using culturally responsive visual resources for teaching and learning?

Literature Review

2. 1 Culturally Responsive Visual Aids

Visual aids are widely recognised as valuable pedagogical resources because they support learners in processing information through both verbal and visual channels, make complex or abstract concepts more accessible, stimulate learner interest and attention, and enhance meaning-making during instruction (Mayer, 2005; Shabiralyani et al., 2015). In teacher education, visual aids are particularly significant because preservice teachers are expected to develop pedagogical content knowledge, including the ability to transform curriculum content into representations, explanations, examples, and learning activities that learners can understand, relate to, and apply (van Driel, 2019; Su, 2023). In culturally diverse classrooms, visual aids are most pedagogically effective when they connect with learners' cultural identities, languages, lived experiences, and community knowledge, since culturally responsive teaching positions students' cultural knowledge and prior experiences as central resources for meaningful instruction (Gay, 2002; Ladson-Billings, 1995).

Culturally responsive pedagogy argues that teaching should draw on learners' cultural backgrounds as legitimate resources for learning rather than treating culture peripheral to instruction (Gay, 2018; Ladson-Billings, 2021). From this perspective, visual aids are not neutral classroom objects. They communicate whose knowledge is valued, which identities are represented, and what forms of meaning are made visible in the learning process. For Ghanaian classrooms, culturally responsive visual aids may include familiar local environments, indigenous symbols, traditional artforms, local occupations, linguistic diversity, folklore, festivals, and community practices (Nyaaba & Zhai, 2025). Such resources can enhance learner engagement because they reduce the distance between school knowledge and everyday experience.

Recent studies on culturally responsive teaching self-efficacy suggest that teachers' confidence in using culturally relevant examples, materials, and instructional strategies influences their ability to create inclusive learning environments (Mahali & Sevigny, 2022; Ialuna et al., 2025; Mensah et al., 2025). Mensah et al. (2025), in particular, found that multicultural teaching competence among preservice teachers in Ghana is associated with self-efficacy, critical self-reflection, and inclusive pedagogical orientations. This is relevant to the present study because preservice teachers' ability to design culturally responsive visual aids may depend on both their pedagogical confidence and their capacity to evaluate whether visual materials reflect learners' social and cultural realities.

The rise of generative artificial intelligence has introduced new possibilities for producing culturally responsive visual aids. AI-supported tools can help teachers generate images, diagrams, posters, illustrations, and contextual scenarios more quickly than conventional manual approaches. However, cultural responsiveness cannot be assumed simply because a tool can generate images. Teachers must still evaluate whether the outputs are accurate, respectful, locally meaningful, and free from stereotypes. Nyaaba, Wright, and Choi (2024) caution that generative AI may reproduce Western-centred assumptions and marginalise non-Western systems if its outputs are adopted uncritically. This concern is especially important in Ghanaian teacher education, where the goal is not merely to introduce digital innovation but to ensure that innovation strengthens cultural identity, equity, and pedagogical relevance.

2.2 Generative AI and Visual Resource Development in Teacher Education

Generative AI refers to computational systems capable of producing new content, including text, images, audio, video, and multimodal instructional materials, based on patterns learned from large datasets. In education, generative AI is increasingly being explored for lesson planning, feedback generation, assessment design, personalised learning support, and instructional resource development (Crompton & Burke, 2023; Puvvadi et al., 2025). For teacher education, its value lies in its potential to support preservice teachers in developing teaching materials, experimenting with alternative representations of content, and improving the quality of classroom resources.

Studies on AI in higher education show that students and teachers often perceive AI tools as useful for improving efficiency, supporting creativity, and expanding access to learning resources (Crompton & Burke, 2023; Essel et al., 2022). In Ghana, Essel et al. (2022) demonstrated that chatbot-supported learning could positively influence students' learning experiences in higher education, suggesting that AI-supported systems can be pedagogically valuable when appropriately integrated. Similarly, Akanzire, Nyaaba, and Nabang (2025) found that teacher educators in Ghana recognised the potential of generative AI for teacher education but also expressed concerns about preparedness, ethical use, and the need for professional development. Their findings are important because teacher educators play a central role in modelling how preservice teachers understand and apply emerging technologies.

For visual resource development, generative AI offers practical advantages. It can reduce the time required to create instructional visuals, support teachers who lack advanced drawing or graphic design skills, and enable rapid adaptation of materials to different topics and learner groups. In resource-constrained educational settings, this potential is significant. Many teachers and preservice teachers work with limited access to print charts, textbooks, projectors, laboratory materials, or locally relevant illustrations. A customised GPT-based visual aid generator could therefore support pre-service teachers in producing visuals which are more aligned with curriculum content and learner context.

However, the educational value of AI-generated visuals depends mostly on how teachers use them. If preservice teachers generate visuals without critical review, there is a risk of producing inaccurate, culturally inappropriate, or pedagogically weak materials. Recent AI-in-education literature, therefore, emphasises the importance of AI literacy, critical evaluation, and teacher agency (Ayanwale et al., 2024;

Walter, 2024). Teachers must learn not only how to prompt AI systems but also how to judge the quality, relevance, inclusiveness, and instructional usefulness of AI-generated outputs.

2.3 Visual Resource Quality in the Ghanaian Curriculum Context

The Ghana Education Service and the National Council for Curriculum and Assessment (NaCCA) do not appear to define “visual resource quality” as a single abstract concept. Rather, quality is embedded across curriculum expectations, teaching and learning resources, assessment guidance, and broader Ghana’s standards-based curriculum. The NaCCA Creative Arts and Design (CAD) curriculum emphasises curriculum relevance, creativity, cultural identity, practical skill development, and learner-centred pedagogy as central to quality education in the creative arts and design domain. Similarly, Ghana’s primary Creative Arts curriculum highlights creativity, communication, innovation, and national and global identity as important outcomes of the school curriculum.

Within this framework, a quality visual resource may be understood as one that supports curriculum objectives, enhances learners’ understanding, reflects Ghanaian cultural realities, and contributes to meaningful practical learning. First, curriculum alignment is essential. Visual resources should support specific learning outcomes rather than function as decorative classroom objects. In the CAD curriculum, teaching and learning resources are expected to help learners acquire relevant knowledge, skills, values, and competencies. This means that visual resources should be selected or created with pedagogical intent.

Second, cultural relevance is a core indicator of quality. Ghanaian curriculum documents encourage the use of local culture, creative expression, and indigenous knowledge in teaching and learning. Visual resources that include Adinkra symbols, Kente designs, pottery, weaving, woodcarving, festivals, local architecture, community occupations, and Ghanaian environmental settings can help learners connect curriculum content to familiar cultural forms. This aligns with culturally responsive pedagogy, which views learners’ knowledge as an asset for teaching and learning (Gay, et al., 2018; Ladson-Billings, 2021).

Third, aesthetic and design quality matters. In visual arts and design education, learners are expected to engage with formal elements such as line, colour, shape, texture, space, form pattern, and composition. A high-quality visual aid should therefore demonstrate visual clarity, appropriate layout, readable text, accurate proportions where needed and purposeful use of colour and image. These features are not merely artistic preferences; they influence comprehension, attention, and interpretation.

Fourth, quality is linked to practical application. Ghana’s Creative Arts and Design curriculum foregrounds hands-on learning, making, designing, performing, observing, and reflecting. Visual resources should therefore support active learning and not only teacher explanation. In preservice teacher education, this implies that visual resources should help learners observe, compare, discuss, classify, create, solve problems, or demonstrate understanding.

Finally, accessibility and teacher guidance are central. A visual resource may be culturally rich and aesthetically strong, but it is only educationally useful if learners can see it, access, understand it, and interact with it meaningfully. Teacher mediation is therefore part of visual resource quality. The teacher must introduce the resource clearly, connect it to lesson objectives, ask purposeful questions, and assess whether it has supported learning. This view aligns with multimedia learning principles, which suggests that visual materials are most effective when they are coherently organised and meaningfully connected to instructional goals (Mayer, 2021).

2.4 Technology Acceptance and Preservice Teachers' Use of AI-Generated Visual Aids

The adoption of AI-generated visual aids in teacher education is influenced by preservice teachers' acceptance of the technology. The Technology Acceptance Model explains that users are more likely to adopt a technology when they perceive it as useful and easy to use. Although the original model predates recent AI developments, it remains widely applied in studies of educational technology adoption and has been extended in recent research on AI acceptance among teachers and preservice teachers (Alejandro et al., 2024; Runge et al., 2025; Zhang et al., 2023).

In the context of AI-generated visual resources, perceived usefulness may refer to preservice teachers' beliefs that the tool improves lesson preparation, enhances visual resource quality, supports learner engagements, and saves time. Perceived ease of use may include the extent to which they find the AI tool simple to navigate, easy to prompt, and convenient to integrate in lesson planning. If preservice teachers believe that AI-generated resources improve their teaching and are not technically difficult to produce, they are more likely to accept and use such tools.

However, acceptance alone may not guarantee actual use. Studies of technology integration often show a gap between positive attitudes and classroom practices, especially where teachers face constraints such as limited infrastructure, lack of institutional support, weak digital skills, or unclear policy guidance (Akanzire et al., 2025; Ayanwale et al., 2024). In Ghanaian colleges of education, preservice teachers may express favourable views about AI but still struggle to use AI-generated resources consistently because of internet cost, device limitations, unstable connectivity, and limited experience with prompt engineering. Therefore, this study positions technology acceptance as an important but insufficient condition for meaningful AI integration.

2.5 System Usability and Prompt Engineering Experience

System usability refers to the extent to which users experience a technological system as efficient, learnable, satisfying and easy to operate. For generative AI tools, usability is limited to the interface alone. It also includes how easily users can write prompts, provide outputs, control visual style, correct inaccuracies, and adapt generated materials to teaching needs. In teacher education, a usable AI visual aid generator should support preservice teachers who may have varying levels of digital competence.

Prompt engineering is a major usability issue in AI-generated visual production. The quality of AI-generated visuals often depends on the clarity, specificity, and cultural detail included in the prompt. For example, a vague prompt such as “*create a classroom picture*” may produce a generic image that does not reflect Ghanaian learners or local classroom realities. A stronger prompt may specify the level of learners, subject topic, Ghanaian setting, cultural symbols, language context, visual style, and intended instructional purpose. Preservice teachers therefore require training not only in using AI tools but also in constructing pedagogically and culturally precise prompts.

System usability also includes the ability to revise and refine outputs. AI-generated content may contain errors, distorted objects, inaccurate cultural symbols, unrealistic classroom settings, or inappropriate representations of learners. Teachers must be able to identify these problems and regenerate, edit, or reject the output. This process requires both technical confidence and pedagogical judgement. Recent studies on AI literacy argue that teachers need critical competencies to evaluate AI outputs rather than relying on them automatically (Ayanwale et al., 2024; Ng et al., 2024).

In the Ghanaian context, usability must also be understood in relation to infrastructure. Even a well-designed AI tool may be difficult to use if students lack reliable internet access, sufficient data bundles, suitable devices or institutional digital support. Akanzire et al., (2025) reported that teacher educators in Ghana recognise the promise of generative AI but also identified preparedness and support as major concerns. This suggests that usability should be treated as both a design issue and an institutional issue.

2.6 Challenges of Generative AI for Visual Aid Generation

Despite its promise, generative AI presents several challenges for visual aid generation. The first challenge is prompt engineering competence. Many preservice teachers may initially lack the skill to write detailed prompt, culturally responsive, and pedagogically useful visuals. Poor prompting can lead to irrelevant, generic, or culturally inappropriate outputs. Without guided practice, preservice teachers may become frustrated or may accept weak visuals simply because they are AI-generated.

The second challenge is cost. Many powerful AI generation tools require paid subscriptions, premium credits or stable access to high-speed internet. For preservice teachers in Ghana, the cost of mobile data and limited access to personal laptops may restrict regular use. These raise equity concerns because students with better devices and stronger internet access may benefit more from AI-supported resource creation than those with fewer resources.

The third challenge is internet connectivity. AI visual generation is usually cloud-based, meaning that users need reliable internet access. In contexts where connectivity is unstable, slow, or expensive, the practical use of AI tools becomes inconsistent. This can limit preservice teachers’ ability to integrate AI-generated resources into routine lesson preparation, especially during practicum or microteaching periods.

The fourth challenge is cultural bias and misrepresentation. Nyaaba et al. (2024) argue that generative AI can produce global power imbalances by privileging dominant Western knowledge systems, languages, and visual norms. In visual aid generation, this may appear as images that may misrepresent African classrooms, oversimplify Ghanaian culture, distort indigenous symbols or produce stereotypical representations of people and places. Such risks make teacher judgement essential. AI-generated resources should be treated as drafts requiring human review, not as final instructional materials.

The fifth challenge concerns ethical and academic integrity issues. Preservice teachers may over-rely on AI-generated materials without developing their own design skills, pedagogical reasoning, or cultural knowledge. There are also concerns about copyrights, data privacy, transparency, and responsible disclosure of AI use. Teacher education programmes therefore need clear guidelines on how AI may be used ethically in resource development and lesson preparation.

The sixth challenge is pedagogical alignment. AI-generated visuals may be attractive but not instructionally useful. A visually appealing image that does not support the lesson objectives, learner level, or assessment task may distract rather than enhance learning. Therefore, preservice teachers need rubrics for evaluating AI-generating visuals based on clarity, accuracy, cultural responsiveness, curriculum alignment, learner engagements and accessibility.

2.7 Synthesis and Gap in the Literature

Culturally responsive visual aids can make teaching more relevant and inclusive when they connect curriculum content to learners' cultural identities, prior experiences, languages, and community knowledge (Gay, 2018; Ladson-Billings, 1995). In addition, emerging literature suggests that generative AI can support teachers in developing and adapting instructional resources, including contextually appropriate materials for diverse and under-resourced educational settings (UNESCO, 2023; Dickey & Bejarano, 2023; Nyaaba, 2025). However, the effective use of AI-generated visuals depends on more than access to the technology. It requires teachers' self-efficacy, cultural responsiveness, system usability, AI literacy, prompt engineering competence, and institutional support. Recent literature shows that teachers' adoption of AI is shaped by their AI understanding, self-efficacy, perceived usefulness and ease of use, while policy guidance emphasises the need for teacher AI competencies, ethical awareness, professional learning, cultural and linguistic inclusion, and institutional capacity-building (UNESCO, 2023, 2024; Viberg et al., 2023; Ghimire & Edwards, 2024; Annapureddy et al., 2025).

Existing studies have examined AI acceptance among preservice teachers, teacher educators' preparedness for generative AI, and the risk of cultural bias in AI systems (Akanzire et al., 2025; Ayanwale et al., 2024; Nyaaba et al., 2024; Zhang et al., 2023). Yet, limited empirical attention has been given to how customized GPT-based tools can support culturally responsive visual aid generation among preservice teachers in Ghana. Even less is known about how teacher educators and preservice teachers reflect on the cultural relevance, quality, and classroom usefulness of AI-generated visual resources.

This study addresses that gap by examining culturally responsive visual aids for teaching and learning through the insights and reflections of teacher educators and preservice teachers. By focusing on visual resource quality, cultural relevance, usability and practical challenges, the study contributes to emerging debates on how generative AI can be adapted for teacher education in Ghana and similar global South contexts.

2.8 Conceptual Framework

This study is guided by a conceptual framework that positions CReVAG, a customised ChatGPT-based generative AI tool, as a guided pedagogical support system that helps preservice teachers generate, refine, evaluate and use culturally responsive visual resources during practicum. The framework draws on teacher self-efficacy, culturally responsive pedagogy, and human GenAI interaction to explain how meaningful engagement with the tool can improve both instruction resource quality and classroom delivery. Through repeated use of CReVAG for authentic lesson preparation, preservice teachers gain mastery experiences that may strengthen their confidence in designing and integrating AI-supported visuals, which is important because teacher self-efficacy influences willingness to adopt and persist with educational technologies (Bervell & Umar, 2020; Tschannen-Moran & Hoy, 2001). At the same time, the framework emphasizes that the AI-generated visuals are educationally valuable only when they are clear, accurate, culturally relevant, pedagogically aligned, creative, and engaging, reflecting the principles of culturally responsive pedagogy that connects instruction to learners' language, identity, community knowledge, and lived experiences (Gay, 2018; Ladson-Billings, 1995). Since generative AI may reproduce bias, generic representation, or culturally inappropriate content if used without careful human judgement, preservice teachers must remain active evaluators and adaptors of AI outputs (Bender et al., 2021; Holmes et al., 2023; Miao et al., 2023). Therefore, the framework proposes that CReVAG-supported human GenAI interaction, involving prompting, visual generation, refinement, and reflection, contributes to two immediate outcomes: improved culturally responsive visual resource quality and enhanced preservice teacher self-efficacy. These outcomes are then expected to support lesson delivery effectiveness through better integration of AI-generated visuals, clearer instruction, stronger learner engagement and greater teacher confidence, while keeping teacher agency, curriculum alignment, and cultural sensitivity central to the process.

Methodology

3.1 Research Design

This study adopted a mixed-methods practicum-based intervention design to examine how a customized ChatGPT-based generative AI model, CReVAG, supported preservice teachers in developing and using culturally responsive visual resources during teaching practicum (Schoonenboom & Johnson, 2017). The design was appropriate because the study sought to capture both measurable outcomes and experiential evidence. The quantitative component involved teacher educators' assessment of AI-generated visual aids and their use through adapted rubrics measuring *Visual Resource Quality* and

Lesson Delivery Effectiveness. The qualitative component drew on preservice teachers' reflections and discussion responses, which provided insights into their experiences of generating, refining, and applying culturally responsive visuals in real classroom settings.

3.2 Participants

Participants comprised final-year preservice teachers and teacher educators from Bagabaga College Education, Tamale, Ghana. The preservice teachers were enrolled in Early Grade Education, Upper Primary Education and Junior High School Education programmes and have just completed the mandatory 12-week teaching practicum in basic schools within the Tamale metropolis. Their recent practicum experience provided direct classroom-based insights into lesson planning, visual aid preparation and the use of culturally responsive instruction resources. Teacher educators who supervised some of the practicum lessons also participated in the study. These teacher educators observed lessons and assessed preservice instructional delivery using practicum assessment rubrics. Their inclusion provided supervisory and evaluative perspectives on the pedagogical quality, cultural relevance and classroom usefulness of the visual aids used during teaching.

3.3 Tools and Materials for the Study

3.3.1 CReVAG (Customized ChatGPT)

CReVAG, a customized ChatGPT-based generative AI tool was used as an artificial intelligence-supported visual-generation assistant to help preservice teachers create culturally responsive teaching and learning visuals for their teaching practice. The tool supported the generation of visual ideas, the refinement of image-generation prompts, and the production of classroom visuals that were intended to reflect learners' cultural, linguistic, curricular and community contexts. Its use was informed by culturally responsive pedagogy which emphasises the importance of connecting academic content to learners' identities, experiences, language, values and community knowledge (Gay, 2018; Ladson-Billings, 1995). It was also informed by recent work on culturally responsive generative AI, particularly the argument that generic AI outputs may fail to represent local cultural and linguistic realities unless tools are deliberately designed to collect and integrate contextual information (Nyaaba & Zhai, 2025).

A key design feature of CReVAG was its use of an Interactive Semi-Automated (ISA) orientation. Nyaaba & Zhai's (2025) work, ISA, is described as a prompt architecture that engages teachers in dialogue to collect cultural and contextual details before generating instructional content. CReVAG adopted a similar principle for visual generation. Rather than requiring preservice teachers to craft complex prompts independently, the tool guided them through a structured but interactive process. Users were prompted to provide information about the country, region/district of the school, class/level, subject, and topic before visuals were generated. Where necessary, they could also add information about learners' language backgrounds, community settings, curriculum focus, cultural sensitivities, and intended learning outcomes. This process helped reduce reliance on generic prompts and positioned the preservice teacher as an active contributor to the design of the visual.

The ISA feature was important because it balanced automation with teacher judgement. As discussed by Nyaaba and Zhai (2025), ISA differs from a standard one-time prompt because it is more dynamic and iterative, supports guided cultural-context customization, and includes opportunities for user validation. In CReVAG, this meant that preservice teachers did not simply receive a finished AI-generated image or prompt. Instead, they engaged in a guided process of clarifying the teaching context, reviewing whether the visual idea was instructionally relevant, and refining the outputs for cultural appropriateness. This reflected a human-in-the-loop approach in which AI supported the design process while teacher agency remained central.

During practicum preparation, preservice teachers used CReVAG to generate visuals for lesson introductions, concept explanations, classroom discussions, and activity-based learning. The tool encouraged them to move beyond broad or stereotypical cultural references by specifying local settings, familiar objects, appropriate learner representation, inclusive classroom participation and non-stereotypical depictions of community life. This aligns with Nyaaba and Zhai's (2025) emphasis on collecting information such as locale, community assets, linguistic contexts, learner profile, curricular anchors, and representation concerns before generating culturally responsive instructional materials.

CReVAG also functioned as a reflective support tool. It prompted preservice teachers to consider whether a proposed visual was clear, respectful, developmentally appropriate, culturally relevant, and aligned with lesson objectives. This was necessary because AI-generated visuals may occasionally reproduce bias, omit local realities, or simply ignore cultural practices if the user does not provide adequate contextual guidance (Bender et al., 2021; Holmes et al., 2023; Miao et al., 2023). Therefore, all visuals generated with CReVAG were reviewed by the preservice teachers before classroom use to ensure that they were pedagogically useful, culturally appropriate, and suitable for the learners' level.

In this study, CReVAG was therefore treated not as a replacement for teacher judgement but as a guided visual-design tool that supported preservice teachers in developing culturally responsive teaching and learning materials. Its role was to scaffold the generation and refinement of visuals while keeping teacher agency, curriculum alignment, cultural sensitivity, and learner identity at the centre of the material-development process (see *samples of visuals in the appendix*).

The *knowledge section* of the tool was populated with Ghana Education Service and NaCCA curriculum materials, which serve as the official teaching and learning documents for the basic school subjects taught in the schools where the preservice teachers undertook their practicum. In the *Capabilities Section*, the tool had four available functions: Web Search, Canvas, Image Generation, and Code Interpreter & Data Analysis. However, only Canvas and Image Generation were activated for this study. The image generation function was used to produce the teaching and learning visuals, while the canvas function provided an option for editing and refining the visuals when necessary.

3.3.2 Instrument

An adapted assessment rubric was used to evaluate the AI-generated visual aids produced by preservice teachers and their classroom use during practicum. The rubric was adapted from Ghana Education Service and NaCCA assessment rubrics used by teacher educators for assessing visual aids and lesson delivery and aligned with the Ghanaian standards-based curriculum's emphasis on learning-centred pedagogy, inclusive and gender-responsive teaching, creativity, digital literacy, communication, collaboration and ICT-supported instruction (Ministry of Education/NaCCA, 2019; Ghana Education Service/NaCCA, 2020). It comprised two sections: the *Visual Resource Quality Rubric* and the *Lesson Delivery Effectiveness Rubric*. The *Visual Resource Quality Rubric* assessed clarity and accuracy, cultural responsiveness, pedagogical alignment, and creativity and engagement, while the *Lesson Delivery Effectiveness Rubric* assessed integration of AI visuals, clarity of instruction, learner engagement, and teacher confidence. Each criterion was rated on a five-point scale from *Excellent (5)* to *Poor (1)*. Each rubric section had a maximum score of 20, with higher scores indicating stronger visual quality, greater cultural responsiveness, closer alignment with lesson objectives, and more effective classroom integration. This dual structure enabled teacher educators to assess both the AI-generated visual product and its pedagogical use during practicum.

3.4 Data collection

Data were collected during the 12-week mandatory teaching practicum undertaken by final-year preservice teachers in partner basic schools. The practicum formed part of their professional preparation and involved regular school-based activities such as classroom observation, lesson planning and delivery, learner assessment, participation in school routines, and engagement in extracurricular activities. This setting provided an authentic context for examining how preservice teachers used AI-generated visual resources in real classroom teaching and learning. Prior to data collection, ethical approval was obtained from the Humanities and Social Sciences Research Ethics Committee of Kwame Nkrumah University of Science and Technology, KNUST, with approval reference HuSSREC/AP/346/Vol.4, and additional approval was obtained from the Bagabaga College of Education Research Committee. Participants were briefed in an orientation session on the purpose of the study, the procedures involved, the voluntary nature of participation, confidentiality measures, and their right to decline or withdraw from the study at any stage without personal or academic consequences. They were also given hands-on training on how to use CReVAG for generating, refining and evaluating culturally responsive visual resources for classroom instruction.

An intervention phase was introduced during the practicum, during which participants used the CReVAG AI model to generate, refine, and review culturally grounded visual resources for selected lessons. They were encouraged to align the visuals with lesson objectives, learner characteristics, curriculum content, and the cultural, linguistic, and community contexts of their host schools. After six weeks into their practicum, teacher educators were deployed by the Supported Teaching in Schools Coordinator to monitor and assess the preservice teachers in their practicum schools. During the monitoring exercise, teacher educators observed lesson delivery and used the adapted rubrics to assess both the quality of the AI-generated visuals and their classroom use. The *Visual Resource Quality Rubric* assessed clarity

and accuracy, cultural responsiveness, pedagogical alignment, and creativity and engagement, while the *Lesson Delivery Effectiveness Rubric* assessed the integration of AI visuals, clarity of instruction, learner engagement, and teacher confidence. In addition, preservice teachers provided reflections on how CReVAG supported or constrained lesson preparation and delivery, the cultural relevance of the generated materials, challenges encountered and the influence of the tool on their confidence. Completed rubric scores and reflective responses were collected from teacher educators and preservice teachers for analysis, providing complimentary evidence on both the quality of the generated visuals and their meaningful use during the practicum-based teaching.

3.5 Analysis

The study employed a mixed-methods analytical procedure to examine both the assessed quality of AI-generated visual aids and preservice teachers' reflective experiences of using CReVAG during practicum. Quantitative data obtained from teacher educators' rubric-based assessments were analysed using descriptive statistics, including means, standard deviations, score ranges, and frequency distributions. The analysis focused on two rubric domains: *Visual Resource Quality* and *Lesson Delivery Effectiveness*. Visual Resource Quality comprised clarity and accuracy, cultural responsiveness, pedagogical alignment, and creativity and engagement, while Lesson Delivery Effectiveness comprised integration of AI visuals, clarity of instruction, learner engagement, and teacher confidence. Each criterion was rated on a five-point scale from *Excellent (5)* to *Poor (1)*, with each rubric domain generating a maximum score of 20. Qualitative data from preservice teachers' reflections were analysed thematically following Braun and Clarke's (2006) approach, which involved repeated reading of responses, coding meaningful information, grouping related codes into broader themes, and selecting direct quotations where necessary to preserve participant voices. The analysis focused on participants' experiences of generating, refining, and using AI-supported visual resources, including perceived usefulness, cultural relevance, lesson delivery, learner engagement, confidence, prompt formulation, technical challenges, and output accuracy. The quantitative and qualitative findings were integrated during interpretation, consistent with mixed-methods principles that allow numerical trends to be explained and enriched through qualitative evidence (Schoonenboom & Johnson, 2017). This integration enabled the study to examine not only whether CReVAG-supported visuals were judged to be instructionally useful, but also how preservice teachers interacted with the tool, adapted its outputs and used them within authentic practicum-based teaching.

Results

4.1 Quantitative Analysis of Teacher Educators Rubric Scores

The results show that teacher educators generally rated the AI-generated visual resources positively. As shown in Table 1, the highest-rated criterion was clarity and accuracy ($M = 4.44$, $SD = 0.59$), with 95.6% of the visuals rated either good or excellent. This suggests that most AI-generated visuals were clear,

understandable, and largely free from major content errors. Cultural responsiveness was rated highly ($M = 4.40$, $SD = 0.69$), with 88.9% of the visuals receiving rating ratings of 4 or 5. This indicates that most of the resources reflected Ghanaian cultural values, familiar contexts, language diversity, or community-based examples. Pedagogical alignment was similarly strong ($M = 4.38$, $SD = 0.65$), suggesting that the visuals generally supported the lesson objectives and learner needs. The relatively lowest score under visual resource quality was recorded for creativity and engagement ($M = 4.16$, $SD = 0.74$), although 84.4% of the visuals were still rated good or excellent.

Table 1
Teacher educators' ratings of AI-generated visual resource quality

Criterion	Mean	SD	% rated Good/Excellent
Clarity and Accuracy	4.44	0.59	95.6%
Cultural Responsiveness	4.40	0.69	88.9%
Pedagogical Alignment	4.38	0.65	91.1%
Creativity and Engagement	4.16	0.74	84.4%

The total Visual Resource Quality score further confirms this positive pattern. Out of a maximum score of 20, the mean score was 17.38 ($SD = 2.05$), with scores ranging from 12 to 20. Using the rubric interpretation bands, 29 of the 45 assessed visuals fell within the *excellent* range, 14 were rated *good*, and only 2 were rated fair. None of the assessed visuals fell within the poor range. This suggests that CReVAG-supported visual produced teaching and learning resources that teacher educators considered strong in terms of accuracy, cultural relevance, instructional alignment, and learner appeal.

Teacher educators also rated how effectively preservice teachers integrated the AI-generated visuals into classroom delivery. As shown in Table 2, clarity of instruction recorded the highest mean score ($M = 4.27$, $SD = 0.65$), followed closely by integration of AI visuals ($M = 4.24$, $SD = 0.77$). These findings suggest that most preservice teachers were able to use the visuals meaningfully during instruction rather than presenting them as isolated or decorative materials. Learner engagement ($M = 4.16$, $SD = 0.67$) and teacher confidence ($M = 4.11$, $SD = 0.75$) also received favourable ratings, although these two criteria were slightly lower than the others. This indicates that while the visuals supported engagement and confidence, some preservice teachers still required additional practice to use AI-generated resources with greater assurance and pedagogical fluidity.

Table 2
Teacher educators' ratings of lesson delivery effectiveness

Criterion	Mean	SD	% rated Good/Excellent
Integration of AI Visuals	4.24	0.77	88.9%
Clarity of Instruction	4.27	0.65	88.9%
Learner Engagement	4.16	0.67	84.4%
Confidence of Teacher	4.11	0.75	82.2%

The total Lesson Delivery Effectiveness score had a mean 16.78 out of 20 (SD = 2.30) scores ranging from 11 to 20. Twenty-six of the 45 observed lessons were rated excellent, 16 were rated good, and 3 were rated fair. No lesson was rated poor. This implies that the AI-generated visuals were not only of acceptable quality as products, but were also used in ways that supported classroom teaching. A strong positive relationship was also observed between *Visual Resource Quality* and *Lesson Delivery Effectiveness* ($r = .81$), suggesting that higher-quality visuals were associated with stronger lesson delivery. In practical terms, when the visuals were clearer, more culturally responsive, better aligned with lesson objectives, and more engaging, preservice teachers appeared more able to integrate them effectively into teaching and learning.

4.2 Qualitative analysis of preservice teachers' reflections

The qualitative data consisted of reflections from 32 preservice teachers who used CReVAG to generate visual resources for lesson preparation and delivery during practicum. Their responses were analysed thematically. Five major themes emerged: ease and usefulness of CReVAG, support for lesson delivery and learner engagement, cultural relevance and contextual adaptation, challenges with prompting and output accuracy, and increased confidence in lesson preparation.

The first theme was the perceived ease and usefulness of the tool. All 32 respondents described the process of generating visuals as easy, simple, fast, interesting or efficient. Many participants emphasised that CReVAG reduced the time and effort needed to prepare teaching materials. One participant stated that the tool allowed the *"quick creation of customized visuals based on prompts"* and was useful for *"sparking ideas and saving time in lesson preparation"*. Another explained that the tool *"helped to create pictures and materials that could support my lesson"* and saved time because they did not have to *"search for images from different sources"*. These responses suggest that the tool functioned as a practical support system for lesson preparation, especially in contexts where teachers may have limited access to ready-made culturally responsive relevant visual resources.

The second theme concerned the lesson delivery and learner engagement. Participants consistently reported that the AI-generated visuals made lessons more interesting, interactive, and easier for learners to understand. One participant noted that the visuals *"helped to make the lesson more interactive and easier for listeners to understand"*, while another stated that the visuals *"captured students' attention and*

improved participation". A further response indicated that the visuals helped *"learners remember the lesson better"*. These reflections align with the teacher educators' rubric scores, which rated learner engagement positively. However, a few participants also noted that the visuals occasionally needed further explanation, especially when the generated image was not fully clear or did not match the exact lesson focus.

The third theme was cultural relevance and the need for contextual adaptation. Participants generally perceived the outputs as culturally relevant when they provided specific Ghanaian details in their prompts. One participant observed that the visuals reflected *"familiar items and activities that learners see in their daily lives"*, helping learners relate lessons to their environment. Another participant explained that when they included *"local expressions, examples, and culturally relevant scenarios"*, the generated outputs became more authentic and meaningful for Ghanaian learners. However, participants also made it clear that cultural relevance was not automatic. Some outputs required modification because they reflected foreign settings, unfamiliar clothing, or broad African rather than Ghanaian-specific contexts. One participant stated that the outputs were *"somewhat culturally relevant but not always perfectly aligned with the Ghanaian context"*, while another noted that some visuals used *"settings, clothing or symbols not familiar to local students in Ghana"*. This confirms the importance of teacher agency in reviewing and adapting AI-generated materials before classroom use.

The fourth theme focused on challenges. The most frequent challenge was the difficulty of writing clear, detailed, and culturally specific prompts. Twenty-nine of the 32 participants referred to prompting difficulties or the need to repeat, refine, or clarify instructions. One participant explained, *"I initially struggled with getting the AI to capture specific cultural nuances in the outputs."* Another stated that the main challenge was *"learning how to give clear and specific prompts to get the exact visuals I wanted"*. Some participants also reported output-related problems, including unclear visuals, spelling errors, inaccurate labels, generic images, and limited support for local languages. One participant specifically noted difficulty using the tool for Dagbani, explaining that *"sometimes it will write the Dagbani and you can't even read it."* Technical issues were also present, especially internet connectivity and slow generation time. One participant reported that the process was *"sometimes slow when generating the visuals due to poor network"*, while another mentioned that internet connection *"sometimes slows down the process"*.

The fifth theme was the effect of CReVAG on preservice teachers' confidence. All 32 participants indicated that the tool improved their confidence in lesson preparation. Participants linked this confidence to having access to ready-made visual ideas, structured teaching materials, and resources that could be adapted for classroom use. One respondent stated that *"using the tool boosted my confidence level significantly because it provided well-structured, adaptable lesson plans and supplementary resources."* Another reported, *"I felt more prepared and organized because I had clear visuals and structured materials."* Similarly, one participant explained that the tool *"reduced the stress of preparing teaching aids manually"*. These reflections suggest that CReVAG supported preservice teachers

not only technically but also psychologically by reducing uncertainty and helping them feel more prepared for practicum teaching.

Participants also expressed strong willingness to use the tool in their future teaching careers. All 32 respondents answered positively, although several expressed conditional willingness. Their reasons included time saving, improved lesson presentation, increased learner engagement, support for creativity, and easier preparation of visual teaching resources. However, some participants added that they would use it with professional judgement. One participant stated, *"I would use it alongside my professional judgement to ensure the content is accurate and culturally appropriate."* This response is particularly important because it shows that preservice teachers did not necessarily view CReVAG as a substitute for teaching expertise. Rather, they saw it as a tool whose output must be reviewed, adapted, and aligned with classroom realities.

Discussion

The findings suggest that CReAVG supported preservice teachers in generating and using culturally responsive visual resources during practicum. Teacher educators' rubric scores showed strong performance across both *Visual Resource Quality* and *Lesson Delivery Effectiveness*. The qualitative reflections from preservice teachers confirmed and deepened these findings by showing that the tool was perceived as easy to use, time-saving, confidence-building, and useful for improving learner engagement. Taken together, the findings indicate that CReVAG functioned as a practical human GenAI interaction tool that scaffolded visual resource creation while still requiring teacher judgement and contextual adaptation.

The high rating for clarity and accuracy suggests that the AI-generated visuals were generally understandable and suitable for classroom use. This is important because visual aids can only support learning when they present concepts clearly and reduce, rather than increase, learners' cognitive burden. The strong score for pedagogical alignment also indicates that the visuals were not merely decorative but were connected to lesson objectives and learner needs. This supports the idea that generative AI can contribute meaningfully to instructional design when it is embedded in authentic teaching tasks and guided by clear pedagogical intentions. Recent studies on AI in higher educational and teacher education similarly argue that the value of generative AI depends less on the novelty of the tool and more on how it is integrated into purposeful teaching and learning processes (Crompton & Burke, 2023; Zhang et al., 2023).

The findings also highlight the importance of cultural responsiveness in AI-supported teaching resource development. Teacher educators rated cultural responsiveness highly, and preservice teachers reported that many visuals reflected familiar Ghanaian settings, clothing, activities, local examples, and learners' daily experiences. This is significant because culturally responsive materials can help learners connect new knowledge to their existing cultural and community knowledge. The reflections show that when preservice teachers provided Ghanaian-specific prompts, the AI outputs became more meaningful and

relatable. This supports the research argument that culturally responsive teaching requires deliberate links between curriculum contents and learners' lived experiences, identities, and community contexts (Ialuna et al., 2025; Mensah et al., 2025).

At the same time, the findings show that cultural responsiveness was not automatic. Several participants reported that some visuals reflected foreign settings, broad African representations, or examples that did not fully match Ghanaian learners' realities. This is an important caution. It suggests that while CReVAG can support culturally grounded resource development, the quality of the output depends heavily on the quality of human inputs, especially prompt specificity and teacher review. This finding aligns with recent concerns that generative AI tools may reproduce cultural bias, generic representations, and decontextualized contents if users do not critically guide and evaluate outputs (Ayanwale et al., 2024; Crompton & Burke, 2023). The findings, therefore, support the view that preservice teachers should be trained not only to use only AI tools but also to evaluate AI outputs for cultural accuracy, inclusion, and pedagogical appropriateness.

The results further indicate that CReVAG contributed to lesson delivery effectiveness. Teacher educators rated the integration of AI visuals, clarity of instruction, learner engagement, and teacher confidence positively. The strong correlation between Visual Resource Quality and Lesson Delivery Effectiveness suggests that better-designed visuals were associated with more effective teaching. This is consistent with the conceptual framework of the study which proposes that culturally responsive visual resource quality contributes to improved lesson delivery. In practical terms, when visuals were clear, culturally relevant and aligned with lesson objectives, preservice teachers appeared more able to explain concepts clearly, involve learners, and teach with confidence.

The qualitative findings provide further insight into how the tool supported lesson delivery. Preservice teachers repeatedly stated that the visuals made lessons more engaging, helped learners understand concepts, attracted attention, and encouraged participation. These responses suggest that AI-generated visuals may be especially useful for making abstract or unfamiliar ideas more concrete. However, some participants noted that unclear or imperfect visuals required additional explanation. This means that visual resources should not be judged only by their appearance. Their classroom value depends on how well they support explanation, questions, discussion and learner participation. This reinforces the importance of assessing both the product and the pedagogical use of the product, as was done in the adapted rubric.

One of the strongest findings from the qualitative data was the influence of CReVAG on preservice teachers' confidence. Participants reported feeling more prepared, and organized and less stressed during lesson preparation. This supports the self-efficacy component of the conceptual framework. In teacher education, self-efficacy is shaped by successful experiences, access to supportive tools, and opportunities to practise instructional tasks in authentic contexts. Although the data do not measure change statistically, the reflections indicate that successful interaction with CReVAG provided preservice teacher mastery-like experiences. They were able to generate resources, refine outputs, and use the

materials in real classroom settings. This may explain why participants repeatedly linked the tool to increased confidence. Recent teacher education studies have similarly shown that confidence in AI literacy is important for preservice teachers' readiness for future classrooms (Ayanwale et al., 2024; Zhang et al., 2023).

However, the findings also identify areas where further support is needed. The most common challenge was prompt formulation. Many preservice teachers struggled at first to write prompts that produced accurate, culturally specific, and lesson-appropriate visuals. This suggests that effective use of CReVAG depends on prompt literacy and pedagogical reasoning. Preservice teachers need to learn how to specify subject, topic, learner level, local context, language, cultural references and learning objectives in their prompts. With these details, the tool may produce generic or cultural outputs. This finding has direct implications for teacher education curriculum design. Colleges of education should not introduce generative AI as a stand-alone digital skill. Instead, prompt design should be taught as part of lesson planning, visual resource development, culturally responsive pedagogy and practicum preparation.

The reported challenges with local language accuracy, especially Dagbani, are also important. While participants valued the cultural possibilities of the tool, some were concerned about errors in local language representation. This finding points to a broader limitation of generative AI in multilingual African contexts. If AI-generated contents misrepresent local language, spelling, or cultural symbols, it can weaken lesson quality and mislead learners. Therefore, human verification remains essential. Preservice teachers should be encouraged to cross-check AI outputs with reliable curriculum sources, local language experts, mentor teachers, and community knowledge where necessary. This is consistent with participants' own practice, as one respondent reported using the tool "as a starting point rather than a final answer".

The findings also point to infrastructural constraints. Some participants mentioned internet connectivity, slow generation time and technical difficulties. These constraints matter because even a useful and culturally responsive AI tool may not be adopted consistently if access conditions are unstable. This is particularly Ghanaian teacher education, where digital inequities can shape whether preservice teachers are able to use AI tools regularly during practicums. Therefore, the successful integration of tools such as CReVAG requires institutional support, including reliable internet access, device availability, technical orientation and clear guidance on responsible AI use.

5.1 Limitations and Future Studies

This study has some limitations that should be acknowledged. First, the study was conducted within one college of education and involved final-year preservice teachers during their mandatory teaching practicum. Although the practicum setting provided an authentic context for examining the use of CReVAG in real classroom instruction, the findings may not be fully generalizable to all colleges of education in Ghana or to higher education contexts. Second, the rubric-based assessment was conducted by teacher educators during practicum supervision, which strengthened the professional

relevance of the data but may also have introduced assessor variation in the interpretation of rubric criteria. Third, the qualitative reflections depended on preservice teachers' self-reported experiences, which may have been influenced by personal enthusiasm, perceived expectations, or social desirability. Fourth, the study focused on the immediate use of CReVAG during practicum and did not examine the long-term sustainability of preservice teachers' AI-supported visual resource practices after the practicum period. Finally, the study assessed the quality and classroom use of AI-supported visuals, but it did not directly measure learners' achievement, retention, or attitudes towards the AI-supported visual resources.

Future studies should extend this work across multiple Colleges of Education and diverse geographical contexts in Ghana to determine whether the findings hold across different institutional, cultural, linguistic, and infrastructural settings. Longitudinal studies are also needed to examine whether preservice teachers continue to use AI-generated visual resources after practicum and how such use develops as they transition into full-time teaching. Future research could also compare CReVAG-supported visual resource development with traditional visual aid preparation to determine differences in preparation time, teacher confidence, instructional quality, and learning outcomes. In addition, further studies should investigate learners' perspectives on AI-generated culturally responsive visuals, particularly how such resources influence engagement, understanding, memory, cultural identity, and classroom participation. Since participants reported challenges with prompt formulation, local language accuracy, occasional output errors, and internet connectivity, future studies should also examine how prompt literacy training, local language datasets, institutional support, and improved AI tool design can strengthen the responsible use of generative AI in teacher education. Such future research could contribute to a more robust understanding of how human interaction with generative AI can support culturally responsive pedagogy, teacher agency, and inclusive instructional resource development in Ghana and similar contexts.

Conclusion

The analysis suggests that CReVAG has potential as a pedagogical support tool for culturally responsive visual resource development in preservice teacher education. Its strongest contributions were in saving preparation time, supporting visual resource quality, improving learner engagement, and strengthening preservice teachers' confidence. However, the findings also show that the tool's effectiveness depends on guided human interaction. Preservice teachers must know how to prompt carefully, review outputs critically, adapt materials to Ghanaian cultural and linguistic realities, and integrate visuals meaningfully into lesson delivery. The implication is clear: generative AI can support teacher preparation, but it must be framed as a supervised, culturally responsive, and pedagogically grounded design partner rather than a replacement for teacher expertise.

Declarations

Ethics approval and consent to participate Ethical approval was obtained from the Humanities and Social Sciences Research Ethics Committee, Kwame Nkrumah University of Science and Technology, Ghana (Ref: HuSSREC/AP/346/Vol.4), and the Bagabaga College of Education Research Committee. All procedures involving human participants were performed in accordance with relevant institutional, national and international guidelines and regulations, including the ethical principles of the Declaration of Helsinki. All participants were 18 years or older. Freely given informed consent was obtained from all participants before data collection. Participants were informed about the purpose of the study, the voluntary nature of participation, confidentiality procedures, and their right to decline or withdraw from the study without academic or personal consequences.

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Figures

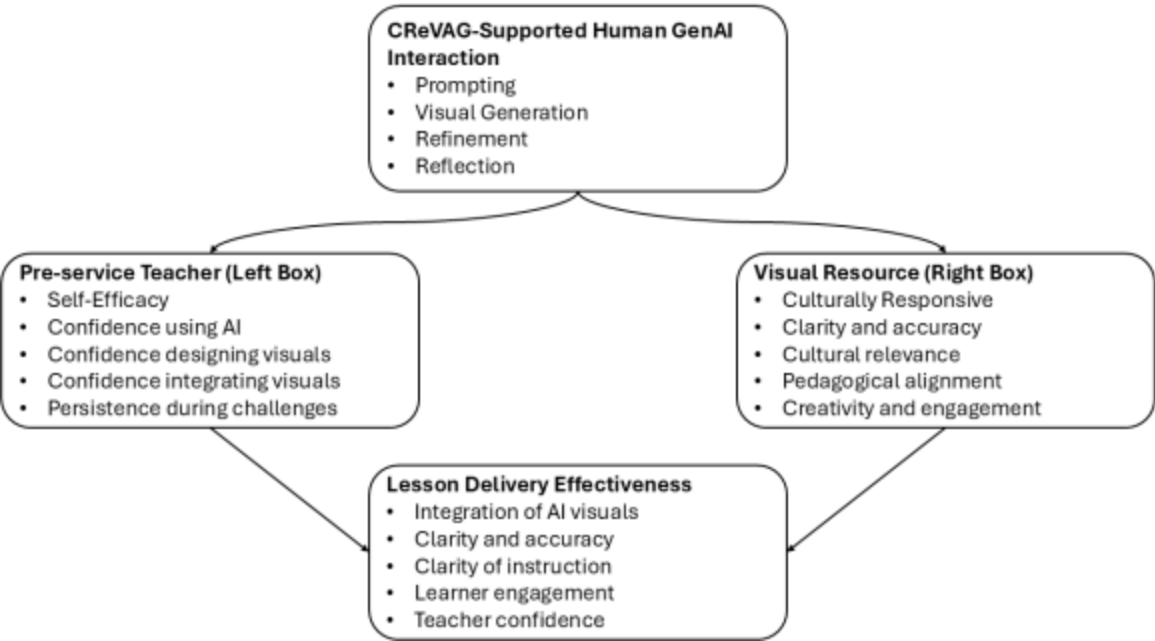


Figure 1

Conceptual Framework

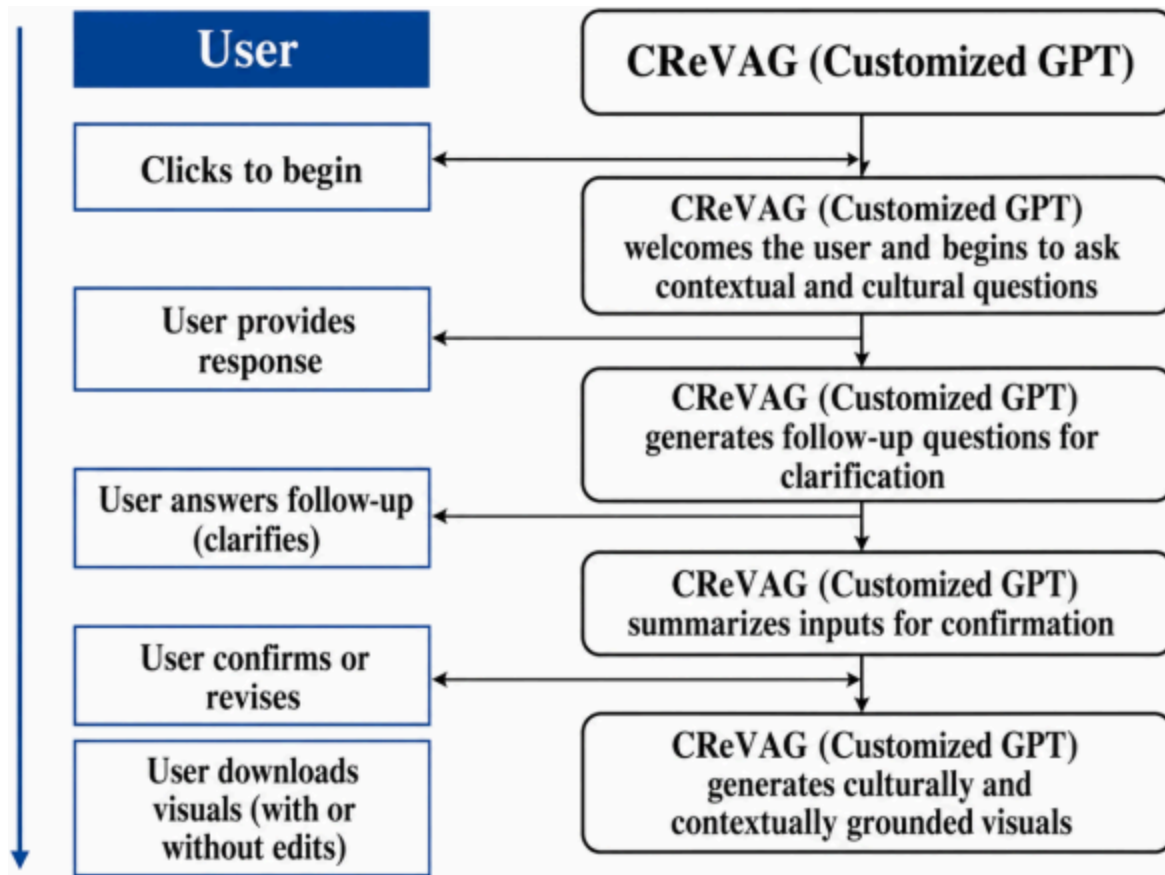


Figure 2

Interactive Semi-Automated (ISA) structure adapted from Nyaaba and Zhai (2025)

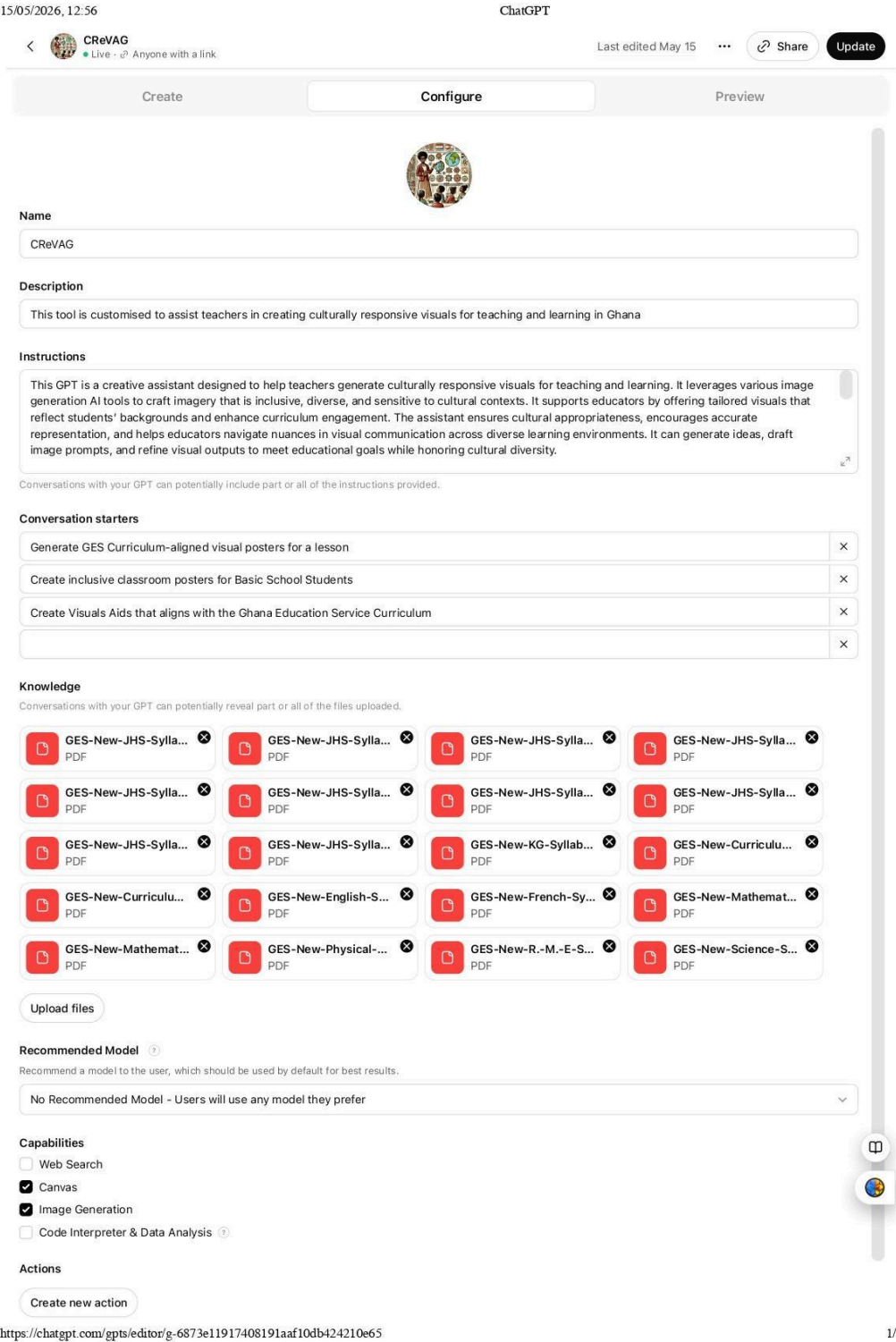


Figure 3

CReVAG configuration Panel

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