CiteSaga: Conceptualisation of a Serious Game for Citation and Reference Styles

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Abstract: This article asserts that serious games (SGs) are effective tools for teaching citation and referencing styles in higher education. The proposed SG aims to enhance students' understanding and application of these styles through an engaging, game-based approach. We use an agile design cycle combined with educational design and design science research methodologies. The SG's key elements include objectives, rules, mechanics, learning outcomes, and assessment strategies, all integrated into higher education curricula.

1. Introduction

Students must demonstrate their capacity to connect with current knowledge, prevent plagiarism, and contribute to academic debate through proper citation and reference (Duff, Rogers and Harris, 2006; Adhikari, 2018). However, students typically struggle to learn the several citation and reference formats (Lanning, 2016; Hamzaoui, 2021). To solve this difficulty, educators explore creative and engaging ways to teach and reinforce these abilities (Nilson, 2016). Serious games (SGs) can motivate and improve learning by combining enjoyment and teaching (Camilleri and Camilleri, 2019). Using SGs to teach citation and referencing styles can improve student understanding and application, motivation, critical thinking, and academic writing and research. This article describes the conceptualization of an SG to teach and reinforce higher education citation and reference styles. This method uses board games to make studying fun and improve students' citation and reference abilities.

2. The Reasons for Using Serious Games in Education

Over the past few decades, serious games (SGs) have been recognized for significantly improving learning outcomes across various courses (Yu, Gao, and Wang, 2021). They enhance student involvement, promote active and experiential learning, and foster essential skills such as problem-solving, critical thinking, cooperation, and decision-making (Westera, 2019; Rosa et al., 2021). Research indicates that SGs surpass traditional self-regulated learning by increasing participation and facilitating experiential learning (Power, Lynch, and McGarr, 2020). Their application extends to military, healthcare, and educational fields (Amod and Roodt, 2020).

SGs are employed in social marketing to boost engagement and learning outcomes (Dietrich, Mulcahy, and Knox, 2018) and offer unique educational benefits for dyslexic children (Bhatti and Shabbir, 2022). In healthcare, SGs aid novice professionals in understanding risk assessment and management (Mason and Loader, 2019) and promote learning and innovation in global health education (Smith et al., 2020). They also facilitate social learning in sustainable land and resource management by promoting collaboration (Den Haan and Van der Voort, 2018). Furthermore, SGs are effective in professional development, creating engaging environments for skill enhancement (Barnabé et al., 2017). Their growing integration into education and business training underscores their increasing importance and effectiveness across various domains (Cohard, 2019).

Incorporating SGs into higher education curricula, especially in research-focused modules, can significantly enhance student engagement, comprehension, and retention of complex subject matter and research skills. SGs can complement traditional instructional methods (Ferro et al., 2021) and provide dynamic platforms for students to apply theoretical knowledge in practical contexts (Barianos, Papadakis, and Vidakis, 2022). They promote active learning and problem-solving skills (Peña Miguel, Corral Lage, and Mata Galindez, 2020) and simulate real-world research environments, offering a controlled and supportive setting for experiencing academic research challenges (Leendertz and Matthew, 2022; Linderoth and Sjöblom, 2019). SGs also encourage collaborative learning and cooperation, mirroring the collaborative nature of academic research projects (Rodríguez-Rivera et al., 2023).

Aligning with constructivist learning theories like those of Vygotsky and Jean Piaget, SGs promote active engagement, reflection, and knowledge construction through experience (Young et al., 2012). They can motivate students to engage in self-directed learning by encouraging exploration and mastery. Strategically integrating SGs into research-centric topics can foster engaging and experiential learning, thereby enhancing students' research skills, critical thinking abilities, and overall academic performance. SGs prepare students for the rigorous research demands of higher education and beyond. Specifically, for teaching citation and reference styles, SGs offer practical and interactive learning environments that complement traditional classroom instruction.

3. Problem Statement

Students in higher education struggle with citation and reference formats. This makes it harder for them to interact with research, prevent plagiarism, and contribute to academic conversation. Traditional teaching techniques cannot address the variety of citation and reference types, making proficiency difficult. This poor teaching method can cause students to commit reference errors, which harm academic journals and raise expenses for publishers and universities. To address the complexity of referencing styles, educators should emphasise skills like as citation assistance and proofreading (Goodman et al, 2018; Kratochvíl et al, 2022; Rozell, 2022). In other circumstances, students only see reference modules in their first year, which is insufficient to develop and improve these abilities. North-West University (NWU) only teaches citation and reference in the first year (ALDE 111 and ALDE 121), and students first encounter it in their third year in a research methodology curriculum or module that needs a research report. The talent is still needed for postgraduate studies, but not all students have it because it's not part of their curriculum in other courses. These conditions highlight the need for new and interesting strategies to improve students' citation and reference abilities for academic success and postgraduate courses.

In addition to classroom education, an SG that clarifies and improves citation and reference methods may make learning fun and remembered. Integrating an SG into research-focused programmes allows students to effortlessly apply theoretical knowledge to practical situations, bridging the gap between abstract concepts and real-world applications. Since students actively participate in learning, this integration can also boost active learning. This engagement helps kids build problem-solving abilities by forcing them to think critically and find answers. This article suggests that strategically integrating SGs into research or other academic modules might increase students' research (citation and reference), critical thinking, and academic achievement (Ifenthaler and Yau, 2020).

4. Research Objective and Question

The objective of this research is to determine the best approaches to create and implement an SG to assist in learning citation- and referencing skills. The research question derived from that objective is "What are the most effective approaches for designing and implementing a SG to improve citation- and referencing skills among learners?"

5. Methodology

5.1 Educational Design and Design Science Research

The authors address the study question above by suggesting that project goals, context, and needs determine the appropriate SG design methodologies. Design science research (DSR) and instructional design are unique pedagogies. Their aims, techniques, and outcomes differ, although they have several traits (Fahd et al., 2021). Instructional design and DSR both promote problem-solving (Delaney, 2022). They examine and solve challenging educational issues. They aim to fix education. Second, both methods need iteration. Designers and researchers in these paradigms use feedback and assessment to refine ideas through iterative development (Ødegaard et al, 2021). Iteration promotes instructional flexibility. Educational design and DSR are interdisciplinary (Molle and Huang, 2021). Collaboration across education, instructional design, psychology, computer science, and other fields is common for these paradigms. Collaboration is essential to overcome complicated educational challenges. Educational design and DSR prioritise practicality and application (Han, 2022). They propose realistic, reasonable, and implementable ideas to enhance educational processes and outcomes using pragmatic educational practice. Combining education and research can improve results. Both approaches prioritise practical application, but their aims, techniques, and results differ. Educational design

focuses on successful learning experiences and products for varied educational contexts (McKenney and Reeves, 2018). It develops pedagogically sound courses, programmes, and material (McKenney and Reeves, 2021). DSR stresses practical application but also develops theoretical underpinnings (Vom Brocke, Hevner and Maedche, 2020). It creates and assesses new approaches, models, and frameworks to address educational difficulties and improve academic comprehension (Iivari, 2020). Thus, DSR integrates theory and practice (De Sordi, 2021). Educational design assesses learning outcomes (McKenney and Reeves, 2021). Formative evaluation improves design throughout development to achieve educational goals. DSR examines the theoretical and practical impacts of intentional artefacts beyond efficacy assessments (De Sordi, 2021). This multidimensional analysis shows artefacts' domain-wide consequences (Vom Brocke, Hevner and Maedche, 2020). The following were found based on each approach. Educational design that highlights pedagogical principles and learning objectives is essential for structured, successful SG education. However, DSR is effective when adopting a thorough and rigorous research technique to find a novel solution. Following features of these techniques support the claim: (i) DSR research solves educational problems and advances theory. DSR designs products and provides theoretical insights to increase academic comprehension. Educational design develops instructional materials, courses, and experiences for direct deployment in educational contexts to improve learning. Educational design improves learning with real products. (iii) Educational design and DSR share problem-solving, iterative methodologies, interdisciplinary cooperation, and practical emphasis, but their major goals, research-development balance, assessment focus, and outcomes differ.

Combining these two strategies requires choosing the most relevant characteristics. These methods may be combined with the agile design cycle's iterative and incremental reflections (Section 5.2) to create methodological variety and affect educational SG development.

5.2 Agile Iterative Design Reflection Cycle

Agile design, first employed in software development, is being applied in different sectors (Sutherland and Schwaber, 2010). The Agile Manifesto encourages flexibility, teamwork, and customer-centricity. Agile design involves cross-functional teams designing, building, and testing products or components in one- to four-week "sprints" or "iterations" (Sassa et al., 2023). Iterative design adaptation and modification based on end user or stakeholder feedback improves responsiveness to changing demands and market dynamics (Sassa et al., 2023). Agile design cycles encourage frequent communication, openness, and rapid MVP delivery, helping companies respond to changing consumer demands and competitive environments. Agile design works well for projects that need frequent input, fast prototyping, and flexibility to adapt to user needs and market conditions. This study advocates combining design methods to create a user-centered, technologically suitable, and purpose-driven SG (Figure 1).

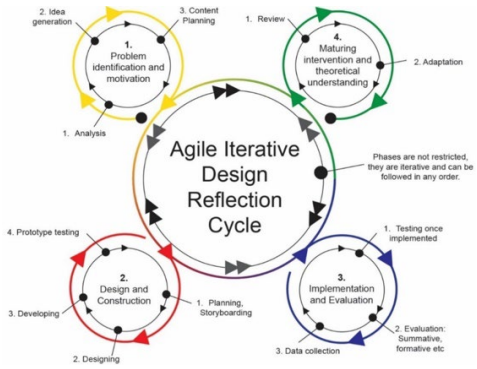

Figure 1: Methodological pluralism between educational design, DSR and agile design

(Source: Own research)

The authors used a mixed-method approach (methodological pluralism between educational design, DSR and agile design) (Figure 1) that encapsulate:

1. Educational design: Start by identifying the learning outcomes you want to achieve with the SG. Then, conceptualise and design the game mechanics and user interface to support these outcomes. This process should be iterative and involve prototyping and testing with users (Mor et al, 2015) at multiple stages of development.

2. DSR: Use DSR to develop new artefacts that can be used in the SG. For example, you could develop a new algorithm for generating game content or a new scoring system that incentivises certain behaviours in the game (Fahd et al, 2021).
3. Agile design: Use agile design to ensure that the development of the SG is collaborative in nature. This fosters a cooperative atmosphere between stakeholders and fosters an environment where the game is developed efficiently and team members work towards the same goals (Bunt, 2020).

6. Details of Agile Iterative Design Reflection Cycle for CiteSaga Serious Game

Effectively teaching citation needs detailed explanation and frequent rehearsal, which may be challenging and time-consuming (Andrianatos and Coetzee, 2023). The NWU Library in Potchefstroom, South Africa, started the Referella initiative to help students learn citations. An animated figure called Referella provides video courses on the university library website (Andrianatos and Coetzee, 2023). Referella assists students with Harvard, APA 7th edition, and footnote styles (Andrianatos and Coetzee, 2023). Thirty free Referella video tutorials on YouTube show how the developers evaluated and reframed the citation manual to make it more user-friendly and understandable (Andrianatos and Coetzee, 2023). Students can also take related quizzes (Andrianatos and Coetzee, 2023). The CiteSaga SG is a subproject of the Referella project. The following discussion covers CiteSaga SG's conception, design, and development. The SG development process iterated and incremented four phases (see Figure 1): problem identification and motivation, design and construction, implementation and evaluation, and maturing intervention and theoretical understanding. These phases are detailed below.

6.1 Phase 1: Problem Identification and Motivations

As with other problem-solving processes, several factors must be addressed before growth. These involve identifying and assessing the problem, producing and selecting solutions, and planning academic content for the answer. Phase 1 (Figure 1) shows several iterations of potential ideas until the most feasible and successful one is determined. We recognised the problem previously in the essay that higher education students fail to understand and use citation and reference styles. Academic writing follows rules like citations. This phase focuses on the stakeholders and target audience engaged in producing and assessing the SG, the learning results (matched with the curriculum and a roadmap for what the game seeks to accomplish), and the development outcomes (game design blueprint) needed to construct the SG. SG conversations and considerations should also include the resources (administration, finance, time, etc.) that would affect alternative solutions. Three NWU faculty members form the project's main development team. The stakeholder map below lists the stakeholders who should be involved in the development of an academic-related SG, along with their roles, activities, and specialisations (Table 1). These parties must collaborate to keep the game exciting, instructional, and produced and delivered.

Table 1: Serious game stakeholder roles, activities, and specialisations

Stakeholder(s)	Role	Activities	Specialisations
Educators	Content advisers	Curriculum alignment, learning objective definition	Subject matter expertise, pedagogy
Game designers	Game development	Concept design, rule creation, playtesting	Game design, mechanics, interaction
Graphic designers	Visual development	Artwork, component design, visual theme	Graphic design, illustration
Developers / Engineers	Production	Prototype creation, manufacturing coordination	Engineering, production
Project managers	Coordination & Planning	Timeline management, resource allocation	Project management, organisation
Students	End users	Playtesting, feedback provision	End-user experience
Investors	Financial support	Funding, investment oversight	Finance, investment
Publishers/ Distributors	Marketing & distribution	Marketing, sales, distribution	Marketing, sales, logistics
Regulatory bodies	Compliance oversight	Ensure compliance with educational standards	Educational regulations, standards
Accessibility experts	Accessibility guidance	Ensure the game is accessible to users	Accessibility design
Legal advisers	Legal oversight	Contracts, intellectual property, compliance	Legal regulations, contracts
Quality assurance	Testing & Quality control	Testing for quality and consistency	Quality control, testing

6.1.1 Learning and Development Outcomes

Most SGs are academic, therefore learning outcomes must be considered. The educational aims and learning results of SGs in an academic or instructional environment are their objectives (Fokides et al., 2019). These

objectives are tailored to the target audience's educational requirements and the content (Dimitriadou et al., 2021). Traditional games focus on amusement, whereas SG emphasises learning, skills, and attitudes (Altomari, Altomari and Iazzolino, 2023). Problem-solving, critical thinking, domain-specific knowledge, cooperation, and decision-making are common goals. Measurable and adaptable SG objectives enable educators and instructional designers to evaluate game effectiveness and optimise learning experience (Perna, 2022; Correia and Simões-Marques, 2023). SG goals show how to use games' immersive and engaging characteristics to create meaningful and purposeful learning experiences (Escudeiro and Gouveia, 2023). CiteSaga's learning objectives emphasise academic writing, citation, and honesty, helping players understand citation and its complexities. Table 2 lists the game's learning goals.

Table 2: Learning objectives of CiteSaga

Learning objectives	Delineation
Recognising citation styles	Teach players how to identify and apply the rules of the three citation styles (Harvard, APA, and Footnote) in a variety of academic contexts.
Academic integrity promotion	Develop an understanding of plagiarism, proper attribution, and the ethical principles that guide academic writing.
Improving critical thinking skills	Improve players' ability to evaluate and synthesise information from a variety of sources while also recognising the relevance and credibility of academic literature.
Improving research capabilities	Improve players' skills in locating, interpreting, and using academic articles, as well as fostering effective research strategies and information literacy.
Promoting collaborative learning	Promote collaborative problem-solving and peer learning while also developing teamwork and communication skills in an academic setting.
Putting knowledge into action	Allow players to apply their theoretical knowledge of citation styles to real world academic articles, bridging the gap between theory and practice.
Encouraging self-assessment and reflection	Encourage self-assessment and continuous improvement in scholarly endeavours by facilitating reflection on players' academic writing skills.

Source: Own research

These learning objectives lay out a path for what the game aims to accomplish, which includes not only the technical aspects of citation but also the broader competencies that contribute to effective academic writing and ethical scholarship. CiteSaga also aims to achieve the following learning outcomes: (a) Improved knowledge of reference styles and citation styles; (b) Enhanced problem-solving and critical thinking skills related to citation challenges; and (c) Increased familiarity with academic resources and reference materials. Educators and developers who follow this blueprint are enabled to create an engaging and educationally meaningful experience by aligning the game's design, challenges, and interactions with these objectives. In order to achieve the SG goals and learning objectives, the following development objectives are established (Table 3).

Table 3: Conceptualising objectives for the development of *CiteSaga*

Development	Delineation
Vision alignment	This ensures that all team members, stakeholders, and potential collaborators understand the concept, mechanics, objectives, and overall vision of the game, therefore aligning everyone's efforts.
Planning & organisation	It functions as a development roadmap, detailing the game's components, rules, mechanics, and more, allowing for efficient planning and organisation.
Communication tool	The game design document (GDD) facilitates clear communication between team members and other stakeholders, such as investors, publishers or subject matter experts. It serves as a common reference point that everyone can refer to and edit.
Risk mitigation	By outlining the game's requirements and constraints in detail, the document aids in the early identification of potential risks and challenges, allowing for proactive solutions.
Educational alignment	The GDD ensures alignment with learning objectives, educational standards, and pedagogical approaches for an SG aimed at education. It serves as a guide to ensure that the game is not only engaging but also effective in meeting its educational objectives.
Resource allocation	It helps to estimate the budget, resources, and time required for development, facilitating informed decision-making and resource allocation.
Quality assurance	GDD helps maintain quality control throughout the development process by defining standards, rules, and objectives.
Research tool	Provides guidelines for playtesting and collecting feedback, ensuring that the game evolves to meet the expectations of the target audience.
Documentation & archiving	The GDD serves as a historical record of the game's development, preserving decisions, designs, and insights for future reference or for use in other projects.

Source: Own research

After determining the stakeholders that are involved in creating and evaluating the SG, creating a path that is aligned with the curriculum and that indicates what the game aims to accomplish (learning outcomes) and creating a blueprint of how the SG is going to be developed (development outcomes), the next phase is to design and construct the components of the SG board game.

6.2 Phase 2: Design and Construction

The design and construction of an SG board game start with planning the design and storyboarding to determine how the game is going to look (e.g. components, look and feel, game setting, etc.) and be played (e.g. gameplay, mechanics, rounds, etc.). This is followed by designing, developing, and prototype testing of everything to evaluate what works and how it needs to be changed. Like the other phases in the agile iterative design reflection cycle, this phase can be iterated multiple times until a final agreement or satisfaction has been reached (see Phase 2 as indicated in Figure 1).

6.2.1 Serious Game Components

SG components serve a fundamental purpose in facilitating effective and engaging learning experiences within educational contexts (Moizer et al, 2019; Fitzgerald and Ratcliffe, 2020). These components, such as game boards, tokens, cards, rules, play pieces, and digital interfaces, should be designed to support and drive the educational objectives of the game (Huang et al, 2021). They provide a tangible or virtual environment that immerses players in a specific learning context, making abstract concepts more concrete and relatable (Van Beek et al, 2022). Components can represent real world scenarios, challenges, and resources, therefore promoting experiential learning and problem-solving (Beatty, Chen and Klein, 2021). Additionally, game components can be used to structure the gameplay, guide player actions, and create opportunities for interaction and collaboration, fostering a dynamic learning process (Wang and Huang, 2021). In essence, the purpose of the SG components is to transform learning into an engaging, interactive, and memorable experience, reinforcing the acquisition of knowledge and skills while aligning with pedagogical goals (Lamrani and Abdelwahed, 2020). Researchers posit that their use is essential in leveraging the potential of SG as effective tools for education, training, and skill development across domains and disciplines (Mittal, Scholten and Kapelan, 2022).

6.2.2 Board Game Design

With the recent emergence of AI and AI-generated content, the design team made use of ChatGPT to generate names for characters, factions, and environments that fit the genre of the game. The designers also used *Fotor* an online AI text-to-image generator where you can choose the style of your images and give a description of the environment you want to generate. The designers used *Fotor* to generate character profiles and different environments in which the players can play the game (Figure 2).

Figure 2: Examples of AI-generated images using *Fotor* text-to-image generator

(Source: Own research)

By using AI to help with the design of the characters and environment allows for multiple iterations of the designs in a short period of time. This also excels in the development process and gives more time to develop other, sometimes more important, aspects that need attention.

6.2.3 Gameplay Mechanics

SG mechanics, which regulate a game's behaviour and structure, impact player engagement and instructional content (Pelser-Carstens, 2022; Correia and Simões-Marques, 2023). The game's mechanics are intentionally developed to meet instructional aims (Platz, Jüttler and Schumann, 2021). Scoring, feedback, resource management, decision-making, and riddles are SG mechanics (Akhtar et al., 2020). These mechanics are carefully interwoven into the game's design for balance and engagement (Jost and Divitini, 2021; Escudeiro and Campos, 2023). Aligning SG mechanics with instructional goals is purposeful (Krath, Schürmann and Von Korflesch, 2021). A scoring system can reinforce right responses and foster mastery, while feedback systems can give quick direction and enhance learning. Prioritisation and allocation may be taught, and decision-making can imitate real-world events that need critical thinking and problem-solving. Players may learn and improve by making challenges and puzzles more difficult. SG use these mechanics to create a structured, dynamic learning environment that promotes active engagement, skill development, and information retention (Pelser-Carstens and Matthew, 2023). SG gaming must be interesting and educationally purposeful, therefore mechanisms are crucial (Czauderna and Guardiola, 2019). To ensure that a serious board game meets educational goals, learning outcomes must be carefully considered throughout design and development (Jääskä, Aaltonen and Kujala, 2021). Designers start by defining clear and measurable learning outcomes based on the knowledge and skills they want players to learn, which guide the game's development (Jääskä, Aaltonen and Kujala, 2021). The game's content, mechanics, obstacles, and situations are then designed to target these learning goals (Neset et al., 2020; Checa, Miguel-Alonso and Bustillo, 2021). If the aim is to increase citation and reference problem-solving, the game may include challenges that require players to accurately recognise and apply citation styles in diverse contexts (Zhang and Lu, 2021). The game progression system scaffolds learning by increasing complexity to help players learn (Plass and Pawar, 2020). The game's design and development incorporate learning objectives to provide a purposeful and engaging learning experience that motivates and entertains players (Jayalath & Esichaikul, 2022).

6.3 Phase 3: Implementation and Evaluation

After planning, designing, and developing the SG's objectives and components, the agile iterative design reflection cycle continues with combining and implementing all significant game elements into a prototype (see Phase 3 in Figure 1). To improve the SG till developers are pleased, this prototype must be tested and refined several times. In this phase, gather as much information as possible on gameplay, components, fun-factor, etc. Determine the game's flaws and what has to be changed to meet unmet learning objectives. Playtesting the game with a sample of the intended population is typical in SG development. Developers highlight issues during playtesting and ask players on what they liked or disliked. Before finalising or commercialising the game, concepts, mechanics, and gameplay may be tested in real life. Despite being the last, this step is crucial to SG growth.

6.4 Phase 4: Maturing Intervention and Theoretical Understanding

The fourth phase (Phase 4 in Figure 1) of the development process involves defined SG objectives and a thorough theoretical understanding of the key ideas and concepts. Based on the intervention aims and theoretical foundations, a high-level conceptual framework is created. Agile design techniques encourage iterative development, which requires a prototype to test conceptual design and theoretical understanding. The design is refined and iterated using playtest and user assessment input. User input is collected through regular testing and assessment, enabling design changes. After a satisfactory iteration, the SG is developed and deployed, with user feedback and intervention evolution informing improvements. SG designers use agile design concepts and a focus on intervention and theoretical comprehension to develop their designs and meet objectives and maximise learning outcomes.

7. Conclusion

In conclusion, the novelty of this work lies in its innovative integration of agile design principles with educational design and design science research (DSR) methodologies to develop a serious game (SG) specifically aimed at teaching citation and referencing styles. This unique combination ensures a dynamic and iterative development process, which is both user-centered and theoretically robust. Additionally, the rapid prototyping using AI tools, such as Fotor for character and environment generation, highlights a forward-thinking approach to educational

game design. This paper not only addresses a critical gap in current educational practices but also sets a precedent for the use of SGs to enhance academic writing skills.

Future research should extend into several key areas to fully realize the potential of the CiteSaga serious game. Firstly, a comprehensive evaluation of the game's impact on students' citation and referencing skills across diverse educational contexts is essential. This includes longitudinal studies to assess retention and application of these skills over time. Secondly, further development of AI-enhanced features within the game could explore adaptive learning pathways tailored to individual student's progress and learning styles. Thirdly, the scalability of the game for different academic disciplines and its integration with various educational technologies, such as Learning Management Systems (LMS), should be investigated. Finally, exploring the potential for multiplayer and collaborative features within the game could provide insights into peer learning dynamics and further enhance the educational experience. These research directions will not only validate the efficacy of CiteSaga but also contribute to the broader field of educational technology and serious games.

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