Voice of Academia

Academic Series of Universiti Teknologi MARA Kedah

VOLUME 22
ISSUE 1
2026
eISSN: : 2682-7840

ADVISORY BOARD MEMBER
PROFESSOR DR. ROSHIMA HAJI. SAID ASSOCIATE
PROFESSOR DR MOHD RIZAIMY SHAHRUDDIN

CHIEF EDITOR
DR. JUNAIDA ISMAIL

MANAGING EDITOR
MOHD NAZIR RABUN

COPY EDITOR
SYAHRINI SHAWALLUDIN

EDITORIAL TEAM
SAMSIAH BIDIN
ETTY HARNIZA HARUN
INTAN SYAHRIZA AZIZAN

EDITORIAL TECHNICAL TEAM
KHAIRUL WANIS AHMAD
MAZURIAH AHMAD

EDITORIAL BOARD

PROFESSOR DR. DIANA KOPEVA,
UNIVERSITY OF NATIONAL AND WORLD ECONOMY,
SOFIA, BULGARIA

PROFESSOR DR. KIYMET TUNCA CALIYURT,
FACULTY OF ACCOUNTANCY,
TRAKYA UNIVERSITY, EDIRNE, TURKEY

PROFESSOR DR. M. NAUMAN FAROOQI,
FACULTY OF BUSINESS & SOCIAL SCIENCES,
MOUNT ALLISON UNIVERSITY, NEW BRUNSWICK, CANADA

PROFESSOR DR. SIVAMURUGAN PANDIAN,
SCHOOL OF SOCIAL SCIENCE,
UNIVERSITI SAINS MALAYSIA (USM), PULAU PINANG

PROF. DR SULIKAH ASMOROWATI,
FISIP, UNIVERSITAS AIRLANGGA (UNAIR),
SURABAYA, INDONESIA

DR. IRA PATRIANI,
FISIP, UNIVERSITAS TANJUNGPURA (UNTAN),
PONTIANAK, INDONESIA

DR. RIZAL ZAMANI IDRIS,
FACULTY OF SOCIAL SCIENCE & HUMANITIES,
UNIVERSITI MALAYSIA SABAH (UMS), SABAH

DR. SIMON JACKSON,
FACULTY OF HEALTH, ARTS AND DESIGN,
SWINBURNE UNIVERSITY OF TECHNOLOGY MELBOURNE, AUST

DR. AZYYATI ANUAR,
FACULTY OF BUSINESS MANAGEMENT,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR. FARYNA MOHD KHALIS,
COLLEGE OF CREATIVE ARTS,
UNIVERSITI TEKNOLOGI MARA (UITM) SHAH ALAM, MALAYSIA

DR IDA NORMAYA MOHD NASIR,
FACULTY COMPUTER SCIENCE AND MATHEMATICS,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR MOHD FAIZAL JAMALUDIN,
FACULTY OF ACCOUNTANCY,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR. MUHAMAD KHAIRUL ANUAR ZULKEPLI,
ACADEMY OF LANGUAGE STUDIES,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR NOR ARDIYANTI AHMAD,
FACULTY OF ADMINISTRATIVE SCIENCES & POLICY STUDIES,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

e-ISSN:2682-7840

Copyright © 2026 by the Universiti Teknologi MARA Press

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission, in writing, from the publisher.

© Voice of Academia is jointly published by the Universiti Teknologi MARA Caawangan Kedah, Malaysia and Penerbit UiTM (UiTM Press), Universiti Teknologi MARA Malaysia, Shah Alam, Selangor.

The views, opinions and technical recommendations expressed by the contributors and authors are entirely their own and do not necessarily reflect the views of the editors, the Faculty or the University.

TABLE of CONTENTS

Voice of Academia

Academic Series of Universiti Teknologi MARA Kedah

Voice of Academia Vol.22 Issue (1) 2026

Voice of Academia

e-ISSN: 2682-7840

TOWARDS INCLUSIVE GAMIFIED LITERACY INTERFACES FOR MALAYSIAN STUDENTS WITH DYSLEXIA: INTEGRATING THE DELONE AND MCLEAN INFORMATION SYSTEMS SUCCESS MODEL

Safura Adeela Sukiman[1]*

[1] *Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Johor, Kampus Segamat*

ARTICLE INFO

Article history:

Received Aug 2025
Accepted Oct 2025
Published Jan 2026

Keywords:

Dyslexia, Gamification, Literacy Interface Design, DeLone and McLean IS Success Model, Educational Technology Design

Corresponding Author:
*safur185@uitm.edu.my

ABSTRACT

Dyslexia presents persistent challenges in reading fluency, spelling and decoding, which negatively impact primary school students' academic outcomes and self-esteem. Students from low-income (B40) households in Malaysia face additional challenges owing to limited access to specialised support and assistive technologies. Gamification has emerged as an effective instructional method for increasing motivation, engagement and retention. However, most gamified literacy applications are intended for neurotypical users and lack a theoretical foundation. This study synthesises recent literature (2020–2025) on gamified literacy interfaces for students with dyslexia to identify key design components and integrate them with DeLone and McLean Information Systems (IS) Success Model. A structured search of Scopus, Web of Science, IEEE Xplore and Google Scholar yielded 17 studies that met the inclusion criteria. Through literature synthesis and content categorisation, the analysis revealed common design features such as dyslexia-friendly fonts, multimodal content, reward mechanisms, storytelling and cultural adaptation. These components were systematically aligned with the six DeLone and McLean IS Success dimensions to propose a pre-implementation conceptual framework for inclusive gamified literacy tools. The findings also underscore the importance of lightweight, accessible and culturally adaptive interfaces to address digital inequalities among Malaysia's B40 students. By situating these interfaces within the Malaysian context and the global sustainability agenda—particularly Sustainable Development Goal 4 (quality education)—this study contributes a theoretically informed and contextually relevant framework

for promoting equality and digital transformation in primary education for Malaysian students with dyslexia.

©2026 UiTM Kedah. All rights reserved.

1. Introduction

Sustainable Development Goal (SDG) 4 (quality education) is founded on the principle of ensuring equitable access to literacy. However, many students with dyslexia continue to face systemic barriers that hinder their learning potential. These students may experience daily frustration, anxiety and diminished self-esteem owing to reading difficulties, which are often overlooked by their peers. Without targeted interventions, these challenges impede academic success and impact social belonging and long-term opportunities, particularly for students in under-resourced contexts.

Dyslexia is a neurodevelopmental learning disorder distinguished by persistent challenges in reading fluency, writing ability, decoding and word recognition despite educational opportunities. These difficulties often affect academic performance and self-esteem, particularly among primary school students, where literacy-based tasks are central to the curriculum. In Malaysia, the standard national curriculum is often challenging for students with dyslexia to follow. Traditional teaching methods and standard digital materials—typically designed for neurotypical students—are particularly challenging in literacy-based subjects that emphasise reading accuracy and comprehension, leaving students with dyslexia at a disadvantage (Jaramillo-Alcázar et al., 2021).

Gamification has emerged as a promising strategy to address these challenges. Defined as the use of game features in non-game environments, gamification has been shown to improve learning outcomes by enhancing motivation, engagement and retention (Allafi et al., 2022). Gamified interfaces can support students with dyslexia in vocabulary development, phonological awareness and reading fluency by incorporating features such as feedback loops, incremental difficulty levels and reward systems. Several studies have found that gamified tools improve cognitive performance and emotional resilience in students with reading difficulties (Piki & Markou, 2023; Sarah Abu Bakar et al., 2022). However, most gamified applications are designed for neurotypical users. These designs often feature visually complex interfaces, fast-paced navigation and limited adaptivity, which can overwhelm students with dyslexia and undermine desired learning outcomes (Dela Cruz, 2024). This limitation is especially evident in Malaysia, where students from low-income (B40) households often have limited access to specialised support services and assistive technologies (Ali et al., 2024). Therefore, students with dyslexia from disadvantaged households are at increased risk of falling behind or disengaging from school owing to the dual burden of cognitive and socioeconomic barriers.

Moreover, existing studies predominantly focus on usability and engagement but rarely evaluate these aspects within a theoretical framework that includes information quality, user satisfaction and educational impact. The lack of a theoretical foundation limits comprehension of how gamified literacy tools might enhance inclusivity and sustained learning effectiveness across diverse learner populations. Thus, ensuring design consistency or evaluating educational efficacy may be unfeasible (Jamshidifarsani et al., 2021).

To address these shortcomings, this study proposes integrating the synthesis of the literature on gamified literacy design with an established IS framework. By incorporating the DeLone and McLean IS Success Model, this study develops a theoretically grounded perspective on evaluating and contextualising gamified literacy interfaces for the inclusive education of Malaysian students with dyslexia. Based on these aims, the study pursues the following objectives:

1. To synthesise existing literature on gamified learning interfaces tailored to students with dyslexia in primary education. This objective addresses the need to consolidate fragmented studies and provide a holistic understanding of design trends and their educational implications.
2. To identify key gamified design elements that support cognitive accessibility for students with dyslexia. This objective investigates the impact of design elements on motivation, comprehension and engagement, thereby bridging the gap between cognitive and technical perspectives.
3. To align the synthesised findings with the DeLone and McLean IS Success Model, thereby proposing a theoretically grounded conceptual framework for inclusive gamified literacy tools. This objective ensures that the study contributes practically and theoretically by offering a pre-implementation conceptual framework.

By pursuing these objectives, this study contributes a context-sensitive pre-implementation conceptual framework that connects global best practices in gamified learning with the Malaysian educational context. Consequently, it advances the discourse on inclusive digital literacy for students with dyslexia and supports the broader objectives of SDG 4 (quality education).

2. Literature Review

2.1 *Prevalence of Dyslexia and Literacy Challenges in Malaysia*

Dyslexia is a learning disorder characterised by persistent challenges in word recognition, spelling and decoding despite adequate intelligence and education (Leseyane et al., 2018). Research on cognitive processes also emphasises that dyslexia's fundamental characteristics—including working memory limitations and phonological processing deficits—exacerbate challenges in decoding, retaining and reproducing written material (Ghazzai Alsulami, 2019). These challenges manifest as persistent spelling errors, slow reading fluency and poor comprehension, which perpetuate cycles of academic disadvantage.

Socioeconomic disparities further exacerbate these difficulties. Students from low-income (B40) households, defined as the bottom 40% of Malaysian households, face compounded obstacles to literacy development. Families in this category often lack the necessary resources to access private assessments, specialised tutoring or digital assistive tools. Additionally, literacy support opportunities may be restricted by the restricted technological infrastructure of schools serving B40 communities. The COVID-19 pandemic exposed and intensified this digital divide as many students in low-income households struggled with unreliable internet access or shared devices, limiting participation in online learning innovations (Ali et al., 2024; Devisakti et al., 2023). Consequently, B40 students with dyslexia are at increased risk of academic exclusion owing to neurobiological and structural disadvantages.

Addressing these challenges necessitates ongoing policy commitment and alignment with global development goals. More integration of dyslexia-sensitive pedagogies into mainstream classrooms is urgently required. Such programmes directly contribute to the United Nations' SDG 4

(quality education) by promoting inclusive and equitable learning while furthering SDG 10 (reduced inequalities) by providing targeted assistance to underprivileged students. Furthermore, incorporating dyslexia support into Malaysia's digital education programmes aligns with SDG 9 (industry, innovation and infrastructure), which encourages innovative, accessible technical solutions. Framing dyslexia within this sustainability agenda highlights the importance of ensuring that no student is left behind in the pursuit of literacy and lifelong learning.

2.2 *The DeLone and McLean IS Success Model in Educational Technology*

The DeLone and McLean IS Success Model is a theoretical framework that scholars are increasingly adopting to effectively evaluate and structure gamified learning tools. Originally developed in 1992, the model aimed to assess IS effectiveness across six dimensions (DeLone & McLean, 1992):

1. *System Quality*: assessing the IS's performance regarding functionality, usability and reliability.
2. *Information Quality*: measuring the quality of system outputs, including accuracy, relevance and timeliness.
3. *Use*: referring to the degree and way users utilise the system.
4. *User Satisfaction*: capturing users' opinions and experiences of system interaction.
5. *Individual Impact*: evaluating the influence of the IS on users' performance.
6. *Organisational Impact*: gauging how the IS contributes to broader organisational performance and outcomes.

This initial formulation underscored the importance of technical and outcome-oriented factors in assessing IS efficacy. However, the model was refined in 2003 to reflect more dynamic and interconnected relationships in response to evolving digital ecosystems and user-centred design practices. DeLone and McLean updated the model by replacing the individual and organisational impacts with a unified 'net benefits' and introducing 'service quality' as a new construct, acknowledging the growing importance of service interactions in digital platforms (DeLone & McLean, 2003). They also clarified the cyclical nature of user experience and feedback among the variables. The differences between the models are illustrated in Figure 1.

1. *Net Benefits*: replacing the separate constructs of individual and organisational impact to capture the holistic value of IS in terms of learning outcomes, productivity or societal impact.
2. *Service Quality*: added as a third quality dimension to acknowledge the importance of support and maintenance services in IS effectiveness.
3. *Use and Intention to Use*: differentiated to accommodate both mandatory and voluntary system adoption contexts.

This updated model has proven beneficial for evaluating the efficacy of gamified applications, mobile learning platforms and e-learning systems in educational contexts. Several of its constructs can serve as forward-looking design indicators in pre-implementation studies, such as this one. For instance, system quality may include offline accessibility, interface simplicity and usability, whereas information quality may address the veracity, relevance and clarity of instructional content. Although service quality is not fully realised until after implementation, it can be inferred through design planning that incorporates educator, parent and administrator support systems.

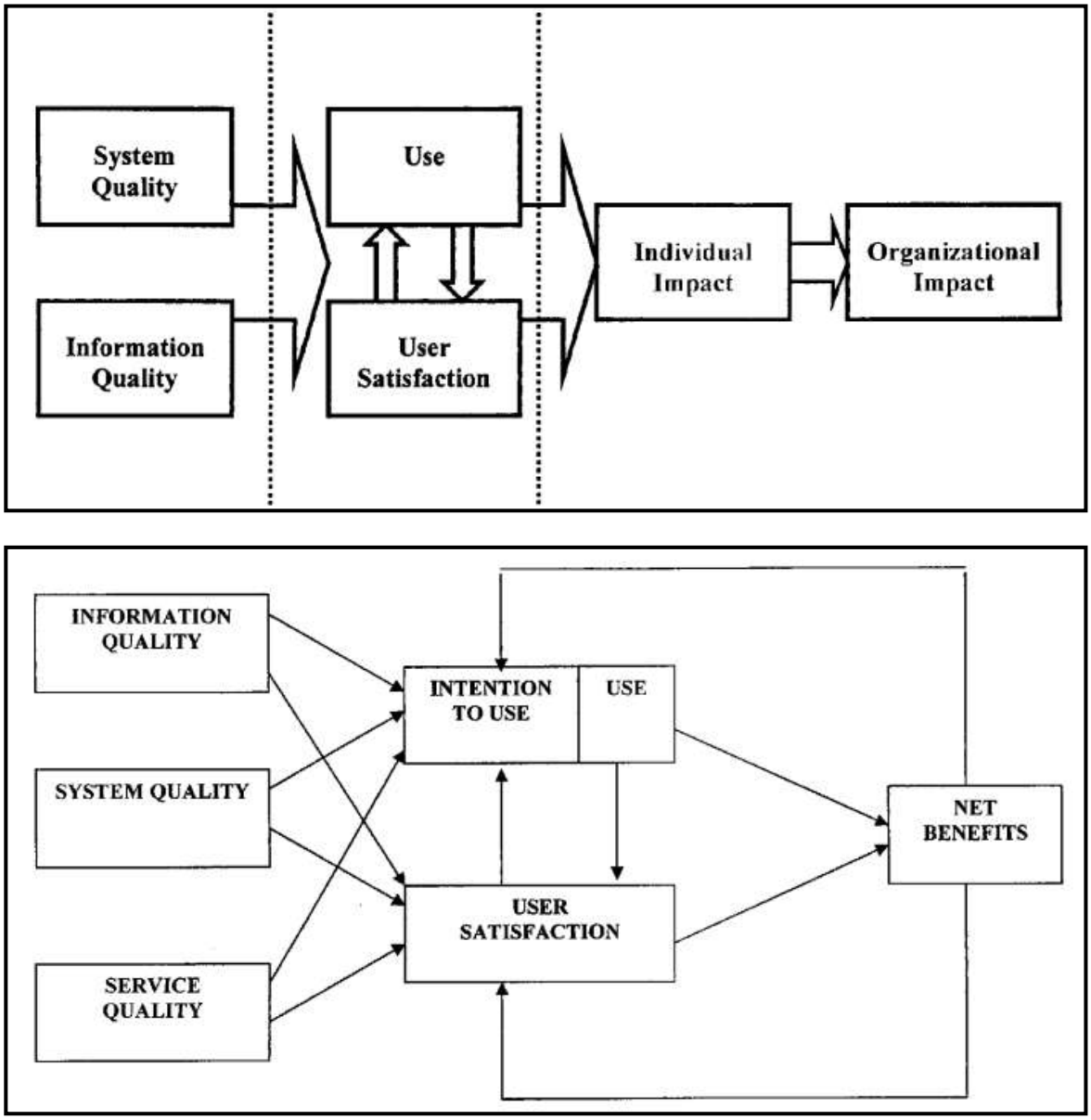

Figure 1. Differences between the Original (Top) and Updated (Bottom) DeLone and McLean IS Success Model (Source: DeLone & McLean, 1992; DeLone & McLean, 2003)

Finally, participatory design input, wireframes and prototypes can be employed to investigate user satisfaction and anticipated use. Literacy gains, motivation enhancement and equitable access for B40 learners conceptualise the projected net benefits. By integrating these six dimensions, the model ensures that the interface design aligns with pedagogical requirements and socioeconomic contexts, providing a comprehensive perspective for evaluating the technical and social aspects of gamified literacy tools.

2.3 *Gamified Literacy Interface Design for Students with Dyslexia*

Recent studies have indicated that gamified literacy applications are increasingly popular as supporting interventions for students with dyslexia, with research conducted in Asia, Europe and the Middle East. Central to these initiatives is enhancing application quality by developing simple, intuitive and accessible interfaces for students with reading impairments. Table 1 summarises noteworthy, gamified literacy interventions developed between 2020 and 2025, including their country context, focus area and gamified literacy interface design elements.

Table 1
Summary of Prior Gamified Literacy Interface Studies (2020–2025) and Their Design Implications for Students with Dyslexia

Reference	Focus Area	Gamified Literacy Interface Design
Weerasinghe et al. (2025)	• Country: India. • Introduce LexiLearn, a gamified mobile application designed to support Sinhala-speaking students with dyslexia. • A preliminary user study involving eight students with dyslexia.	• Interface—font style, font size, line spacing and dark-coloured text on a light-coloured background. • Features—reward/incentive approach, that is, users earn coins for completing tasks or unlocking new avatars; game level/stage menu; audio and visual feedback after each task; and clear auditory instructions. • Nature of games—letter-mapping, jumbled words and reading along.
Dela Cruz (2024)	• Country: Philippines. • Investigate factors influencing the engagement of exceptional learners, including those with learning disabilities, in gamified education.	• Students' perspectives—immersive game design, rewards/incentive approach and customisation. • Educators' perspectives—feedback mechanism, interactivity and educational alignment. • Administrator's perspective—technical support and collaborations.
Cahyani et al. (2024)	• Country: Indonesia. • Develop a gamified, multisensory learning application for students with dyslexia. • Development was made using Figma.	• Clear instructions. • Gradual content—complete the easy stage first before proceeding to the next stage. • Intuitive interface—clear font size, audio, audio repetition feature and images (visual). • Has features that praise and appreciate students' achievements. • Rewards/incentive approach based on scores. • Ranking. • Nature of games—guessing letters, guessing words, guessing numbers and counting.
Yeratziotis et al. (2024)	• Country: Cyprus • Design and develop the ReaDi-STANCE project, a game-based cognitive intervention tool for young learners	• Avatars—to enhance the sense of ownership and engagement. • Detailed instructions. • Real-time performance metrics. • Game level/stage menu with multiple difficulty levels.

	with reading difficulties.	• Participants must achieve an 80% success rate to progress to the next difficulty level. • Put a certain amount of time into completing each level. • Receive feedback for each correct/incorrect answer. • Nature of games—joining shapes, window sequencing, tracking, related memory, shape design, connecting letters, matrix and transportation matrices.
Piki and Markou (2023)	• Country: Cyprus • Explore the functional role, affordances and constraints of a gamification platform when educating students with learning disabilities from the perspectives of special education teachers.	• Nature of the games—memory games and word games, such as finding hidden words or missing letters. • Repetition of tasks. • Game mechanics—touch-based interfaces that allow students to drag-and-drop virtual items or sort items into categories. • Customisation—can adjust the level or difficulty, text size, audio on/off and restart the game. • Reward/incentive approach. • Students get a response—either a smile or a joyful sound. • Multimodality—incorporate images, video or animation and sound.
Ramli and Purba (2023)	• Country: Malaysia • Game development to improve cognitive skills among children with learning disabilities, including memory, attention and problem-solving.	• Game mechanics—movement, tap action and time keeping. • Interface—realistic pictures, built-in sound effects and show instructions. • Variety objectives based on the game's activity. • Game level/stage menu with multiple difficulty levels. • Automatically save each student's progress.
Khaleghi et al. (2022)	• Country: Iran. • Games as therapeutic tools for students with dyslexia in Iran to improve their learning process and motivation. • Target students with dyslexia aged 6–8.	• Appropriate colour pairs for background and font colours—pure red fonts with pure white backgrounds should be avoided. • Clear, simple and accessible font style to increase visual attention and visual memory—Arial, Comic Sans, Helvetica, Verdana and Courier. • Reward/incentive approach to maintain children's motivation and attention in the long-term. • Game level/stage menu. • Generate positive sound when the child's score increases and negative sound when they make a mistake. • Storytelling elements that include children's favourite characters, such as Super Mario. • Attach a stop menu.

Sarah Abu Bakar et al. (2022)	• Country: Malaysia. • Design a two-dimensional digital game-based application as a new learning alternative to cater for the needs of students with dyslexia. • Target students with dyslexia aged 7–12.	• Use of familiar pets as main characters, for example, an orange cat called *Oyen*. • Storytelling elements—action-packed adventure. • Word puzzle elements. • Clear instructions on the goals students need to achieve. • Game level/stage menu with multiple difficulty levels. • Drag-and-drop activities. • Friendly font to decrease visual discomfort. • Graphics and vector images. • Dark-coloured texts on a plain and light-coloured background.
ChePa et al. (2022)	• Country: Malaysia • Design games for students with dyslexia that require careful consideration of their special needs to maximise their learning experience and overcome their difficulties.	• Interface—simple, font and background colours, font style, font size and small caps • Features—audio, video, still picture, animation, background music, letter with phonics, letter arrangement and attractive images • Gameplay—exercises, different difficulty levels, competition, hints, help, tutorial, rewards, scoreboard, replay, auditory feedback, different categories, real images and levels managed alphabetically.
Cahyono (2022)	• Country: Indonesia (where the experiment was conducted). • Examine how the gamification aspects of LexiPal, a learning programme for students with dyslexia, stimulate both intrinsic and extrinsic motivation. • Target students with dyslexia aged 7–12.	• Intrinsic motivation—levelling/progress bar, leaderboard/ranking, animation and audio. • Extrinsic motivation—avatar, praises/appreciations and reward/incentive approach, that is, badges, points, money and stars.
Bhatti and Shabbir (2022)	• Country: Pakistan • Propose a serious gaming model to address the issue of standard application design for children with special needs.	• Divide large, complex sections into small tasks to reduce cognitive fatigue. • Avoid crowded action bars. • Remove technical terms, acronyms and phrases that are difficult to understand. • Dark-coloured texts and moderate text size. • Functionally and visually consistent layout. • Avoid instant alert messages that can distract the child. • Remove background stimuli—crowded graphics and textures. • Repetition of tasks. • Motivate the child after achieving good scores—congratulatory text and audio.

Brennan et al. (2022)	• Country: Ireland • Develop a suite of games to support phonological awareness skills for children with dyslexia • Involves 20 primary school students with dyslexia aged 9–12	• Storytelling elements, that is, adventure: a main character with a main role and several helper characters. • Audio. • Game mechanics—movement and click. • Interface—sound, warm background colour, dark font colour, bigger font size and realistic three-dimensional graphics. • Reward/incentive approach—coins and stars. • Receive feedback and clues for incorrect answers. • Does not include any celebrity images.
Jamshidifarsani et al. (2021)	• Propose a gamified intelligent approach for the remediation of dyslexia.	• Time-pressure technique to push the user to answer the questions faster. • Themes—Christmas, Halloween, Easter and Thanksgiving. • Clear instructions on the goals students need to achieve. • Levelling/progress bar. • Obtain feedback. • Scores, leaderboard/ranking. • Syllabus—two modules: fluency and vocabulary. • An integration with speech recognition and text-to-speech technologies to answer the provided questions. • Questions are arranged by difficulty level, from lowest to highest.
Jaramillo-Alcázar et al. (2021)	• Country: Spain • Present an approach to the development of accessible serious games as a means of improving treatment for children with dyslexia.	• Use simple language. • Put sub-titles. • Game level/stage menu. • Training level—allow the player to function in an environment free from all the complexities of the video game. • Reward/incentive approach—recommended in a visual format. • Repetition of tasks. • Pause while text is being read. • Interface—dark font colour, grey-scale background colour, larger font size, justified text, clear font style, space between characters and lines, phrases must be maintained between 15 and 20 words and keep information grouped in a single area. • Storytelling elements. • Offers visual feedback for each challenge. • Game mechanics—drag appropriate elements.
Larco et al. (2021)	• Country: Ecuador. • Strive to create a web	• Three user types: guest, teacher and student.

	and mobile application for diagnosing and treating children with dyslexia. • Application includes didactic educational games and activities to improve literacy skills. • Target students with dyslexia aged 7–10.	• Colours—blue, black and white. • Font style—sans serif and Helvetica Neue. • Has nine attempts for each game. • Contain supporting materials—videos, tales and images. • Audio-based instructions.
Ansari et al. (2020)	• Country: India • Android game-based intervention to teach word-level reading and boost enthusiasm.	• Game level/stage menu with multiple difficulty levels. • Automated progress. The students can only move to the next stage when they score perfectly.
Mastropavlou et al. (2020)	• An European project. • Develop iRead software for personalised teaching and enhancement of reading skills. • Constructed in four languages—English, Greek, German and Spanish. • Navigo Games is one of the modules in this software. • Targets children aged 7–12.	• Nature of games—select correct answers, match sounds to visual stimuli and rearrange different parts of a word or a sentence. • Games involve questions at both the word and sentence levels. • Time-pressure technique to make students read words or sentences quickly and accurately.

Building on the evidence reported in Table 1, the subsequent review synthesises common interface design elements and theoretical foundations, highlighting how these interventions align with the dimensions of the DeLone and McLean IS Success Model.

Scholars consistently highlight the importance of dyslexia-friendly fonts—including Comic Sans, Verdana and Arial—along with larger text sizes, clear line spacing and dark-coloured text on light backgrounds. These features mitigate visual strain and enhance readability. Overly intricate visuals and congested layouts should be avoided as they can impede comprehension and overwhelm cognitive processing. Applications developed in India, Malaysia and Indonesia illustrate how these interface design principles directly contribute to literacy development and usability, thereby enhancing the quality of the applications for students with dyslexia.

Beyond interface considerations, gamified literacy tools embed features that improve information quality by presenting content that is clear, structured and gradually challenging. Many applications use staged difficulty levels, requiring students to complete easier exercises before moving on to more challenging tasks, thus ensuring scaffolding and gradual literacy development. Clear instructions, immediate feedback and opportunities for repetition are key design elements that reinforce comprehension. Multisensory features—such as auditory repetition, drag-and-drop mechanics and visual clues that help students associate sounds with letters or words—have also been shown to be effective. By combining text with auditory and

visual supports, these tools improve comprehension and retention, making information increasingly accurate and accessible.

Gamification mechanics are essential for promoting engagement and utilisation of literacy tasks. Extrinsic motivation is generated through reward mechanisms, such as coins, badges, stars and ranking boards, whereas intrinsic motivation is stimulated by immersive elements, such as avatars and narrative. For example, the ReaDi-STANCE initiative in Cyprus (Yeratziotis et al., 2024) requires students to attain an 80% success rate before progressing, thereby balancing motivation with challenge. Similarly, the iRead project in Europe (Mastropavlou et al., 2020) incorporates time-pressure features to encourage fluency, prompting children to read words and sentences more rapidly and accurately. These mechanics illustrate how gamified platforms foster meaningful interaction between students and content as well as sustained use.

Service quality is also highlighted, particularly in applications involving active participation from educators, parents and administrators. Findings from the Philippines (Dela Cruz, 2024) indicate that instructors appreciate gamified technologies that align with curriculum goals and emphasise feedback, whereas administrators prioritise technical assistance and cross-sector collaboration to ensure long-term success. Such viewpoints underscore the broader ecosystem required to sustain gamified interventions beyond the students' immediate involvement with the application.

Furthermore, a consistent finding across several studies is that user satisfaction is directly impacted by positive student experiences. Localised narrative icons or well-known avatars increase relatability and enjoyment, while real-time feedback, compliments and uplifting messages boost confidence. For instance, Malaysian applications frequently incorporate culturally famous characters such as 'Oyen' the cat to keep users motivated, while Iranian interventions use well-known characters such as Super Mario. These cultural adjustments highlight the importance of creating user interfaces that resonate with students' social and cultural backgrounds as this increases acceptance and happiness.

Finally, gamified literacy applications demonstrate promising net benefits by addressing the literacy challenges faced by students with dyslexia, improving cognitive skills and fostering engagement. Early studies suggest the potential of these tools as inclusive learning solutions, reporting improvements in motivation and literacy skills. However, the literature identifies some gaps. The scalability and long-term efficacy of numerous interventions remain uncertain as they have been tested only in short-term trials with small sample sizes. Furthermore, while accessibility and customisation are recognised as critical, few studies explore participatory design approaches in which students with dyslexia contribute to shaping inclusive gamified literacy interfaces. Addressing these gaps through longitudinal research and codesign practices could strengthen the educational and societal impact of gamified literacy interfaces.

Overall, these studies demonstrate that gamified literacy interfaces can improve engagement, motivation and reading outcomes among students with dyslexia. They also reveal repeating design patterns—including system usability, multimodal features, reward approach and cultural adaptations—which provide useful insights for future research. Building on this foundation, the next Results section aligns these findings with the DeLone and McLean IS Success Model, providing a structured pre-evaluation of system quality, information quality, service quality, use, user satisfaction and net benefits.

3. Methodology

This study employed a literature synthesis methodology to consolidate research findings on gamified literacy interfaces for students with dyslexia. Literature synthesis differs from systematic reviews in that its aim is intellectual integration rather than comprehensive aggregation. It allows the researcher to discern convergent discoveries, theoretical conflicts and design implications across several studies (Snyder, 2019; Schirmer, 2018). The insights derived from this synthesis were subsequently utilised to develop a pre-implementation conceptual framework specifically designed for Malaysian primary school contexts involving students with dyslexia.

Following guidelines synthesised from Snyder (2019), Oosterwyk et al. (2019) and Schirmer (2018), the literature synthesis process was organised into five stages to ensure transparency and theoretical consistency, as follows:

- **Stage 1: Define the scope and protocol**

The review focused on gamified literacy or educational interfaces tailored to students with dyslexia or learning disabilities in primary education. The guiding question of the study was: In what ways do gamify literacy interfaces facilitate inclusive digital learning for students with dyslexia, specifically within the Malaysian context?

A preliminary scoping analysis established that research linking gamification and inclusive literacy in Malaysia is scarce, underscoring the need for a conceptual synthesis of global and local findings.

- **Stage 2: Search the Literature.**

The literature search was performed across various academic databases, including Scopus, Web of Science, IEEE Xplore and Google Scholar. These databases were selected to encompass a wide array of periodicals and conference proceedings in education, computer science and human–computer interaction. Search strings were iteratively optimised using Boolean operators to identify critical intersections, as outlined below.

('game-based' OR 'gamified' OR 'gamification') AND
('interface' OR 'design' OR 'UI/UX') AND
('dyslexia' OR 'dyslexic' OR 'learning disability' OR 'learning disabilities)

- **Stage 3: Select-and-screen sources**

Titles, abstracts and full texts were meticulously evaluated to ascertain relevance and scholarly integrity. Both conceptual and empirical publications were deemed suitable as research on gamified interfaces sometimes involves prototype designs, case studies and theoretical frameworks rather than standardised quantitative experiments.

3.1 *Inclusion*

The search was confined to English-language research published from 2020 to 2025. This period was chosen to encompass the latest design methodologies and advances. Studies were included if they met the following criteria:

- Focused on primary school students in literacy or cognitive learning environments.
- Analysed or assessed digital technologies—such as applications, games or interfaces—that utilised gamified components.
- Specifically targeted students with dyslexia or similar learning difficulties.
- Provided either empirical evidence (experiments, user studies and trials) or theoretical insights (frameworks and models).

- Were disseminated via journal articles, conference papers or book chapters.

From the initial pool of collected results, 17 studies were chosen for final synthesis. Each study was systematically coded to discern recurring design aspects. The aspects were categorised and aligned with the six dimensions of the DeLone and McLean IS Success Model: information quality, system quality, service quality, use, user satisfaction and net benefits.

3.2 Exclusion

Studies were excluded from the full-text review if they did not align with the goals of this synthesis. Studies were specifically excluded if they:

- Did not address dyslexia or similar learning difficulties.
- Examined general user interfaces without an instructional context.
- Prioritised screening and diagnostic technologies over literacy and learning enhancement.
- Described digital applications without gamification or gaming aspects.

These inclusion and exclusion decisions followed the select-and-screen principle emphasised by Oosterwyk et al. (2019), ensuring methodological consistency and transparency.

- **Stage 4: Analyse, synthesise and interpret.**

Schirmer's (2018) synthetic framework was employed to evaluate each selected study, entailing the coding of each article according to its research purpose, methodological approach, participants, main findings and implications. Subsequently, content categorisation was implemented to identify patterns and recurring categories. The central issues of gamified interface research, such as motivation mechanics, feedback design, accessibility elements and user experience outcomes, were reflected in thematic clusters formed by grouping these patterns.

The six constructs of the DeLone and McLean IS Success Model were then conceptually aligned with the resulting themes. This congruence facilitated the creation of a theoretically grounded framework for designing inclusive gamified literacy interfaces.

- **Stage 5: Write and validate the synthesis**.

The synthesis was articulated as a cohesive narrative illustrating the logical advancement from empirical data to conceptual integration. The authoring process was iterative, with each section validated for internal consistency, source traceability and conformity with the theoretical model.

4. Results

4.1 *Content Categorisation Aligned with the DeLone and McLean IS Success Model*

Content categorisation of the 17 reviewed studies revealed that the design of gamified literacy interfaces for students with dyslexia can be meaningfully aligned with the six dimensions of the DeLone and McLean IS Success Model. This provides a structured understanding of how gamification features influence cognitive accessibility and inclusive literacy outcomes. Table 2 shows the categorisation and frequency of recurring design features aligned with each dimension of the DeLone and McLean IS Success Model.

Table 2
Alignment of Gamified Design Features with the Six Dimensions of the DeLone and McLean IS Success Model

DeLone and McLean IS Success Model Dimension	Key Gamified Design Features Identified	Frequency (Out of 17)	Cognitive Accessibility Contribution
Information Quality	Structured literacy tasks, letter-mapping games, multisensory learning content (audio-visual cues and text-to-speech) and repetition-based exercises	12	Improves decoding and comprehension by reducing cognitive load and strengthening memory through multimodal feedback
System Quality	Intuitive navigation, clear layout, readable fonts, high-contrast interfaces, adaptive progression and lightweight/offline functionality	15	Improves usability and minimises visual stress for students with dyslexia and facilitates inclusion of students from low-connectivity (B40) environments
Service Quality	Teacher dashboards, technical assistance, curriculum alignment and progress monitoring features	8	Enhances educational integration, allowing educators to monitor performance and deliver specific feedback
Use	Rewards mechanisms (badges, points and leaderboards), progress tracking, level unlocking and time-based challenges	14	Enhances student engagement and motivation using intrinsic and extrinsic reinforcement
User Satisfaction	Cultural and linguistic localisation, storytelling elements, familiar avatars and positive feedback loops	11	Establishes an emotional bond, enhances relatability and maintains learning persistence by employing culturally relevant narratives
Net Benefits	Improvement in literacy skills, increased motivation and inclusion, long-term retention and digital equity outcomes	10	Improves reading fluency and addresses digital inequalities among diverse learners, thereby demonstrating a broader educational impact

The findings demonstrate that system quality and use were the most frequently emphasised dimensions in the reviewed studies, with 15 and 14 studies, respectively, addressing these dimensions. These results highlight the importance of usability, simplicity and structured interactivity as determinants of successful gamified literacy interventions. Reducing visual fatigue and cognitive overload depended on implementing dyslexia-friendly design elements, including high-contrast colour palettes, distinct navigation menus and Comic Sans fonts. Similarly, reward mechanisms and progress-tracking approaches have consistently been identified as effective strategies for promoting reading fluency and maintaining student engagement.

Information quality was mentioned prominently in 12 studies, emphasising the importance of structured and multimodal content for cognitive accessibility. Studies employing multimodal techniques, such as text-to-speech, animation and audio repetition, showed enhanced word recognition and decoding performance. These design decisions align with cognitive load theory, allowing dual-channel processing and memory retention.

Furthermore, cultural relevance and emotional engagement were closely associated with the user satisfaction dimension, as evidenced by 11 studies. Using culturally familiar narratives, narration and localised avatars (for example, Super Mario and 'Oyen' the cat) enhanced the confidence of students with dyslexia and alleviated anxiety, thereby fostering a sense of ownership in the learning process. This dimension highlights the importance of cultural and affective personalisation in developing educational games.

Meanwhile, service quality was less commonly highlighted, appearing in eight studies. However, it represents a developing area of importance as teacher dashboards and progress-monitoring tools improve instructional alignment and technical assistance in inclusive classrooms. Integrating educator feedback mechanisms ensures that gamified tools are pedagogically relevant and flexible across educational environments.

Finally, net benefits, documented in 10 studies, summarise the overall effect of gamified literacy systems on student outcomes. Evidence indicated considerable improvements in reading fluency, motivation and inclusive participation, especially when applications were optimised for low-cost or offline devices. These results underscore the capacity of gamified interfaces to promote digital equity for Malaysia's B40 community and analogous socioeconomically disadvantaged populations worldwide.

5. Discussion

The findings of this review, interpreted through the six dimensions of the DeLone and McLean IS Success Model, provide a comprehensive view of how the design of gamified literacy interfaces contributes to cognitive accessibility for Malaysian students with dyslexia. This discussion elaborates on the three research objectives and demonstrates how the results address previously identified gaps in design inclusivity, contextual accessibility and theoretical framing.

5.1 *Addressing the Design Gap: From Neurotypical Bias to Dyslexia-Centred Design*

The examination of 17 studies indicated that despite the widespread implementation of gamification in instructional technology, most current designs predominantly serve neurotypical learners. This review addresses the gap by synthesising research pertinent to students with dyslexia and identifying design features that cater to their unique cognitive processing requirements. Content categorisation indicated that effective interventions include dyslexia-friendly fonts, high-contrast interfaces, clear and simple navigation and organised reading activities. These findings validate that accessibility-focused design can alleviate the visual and cognitive strain frequently encountered by students with dyslexia in rapid digital contexts.

5.2 *Addressing the Contextual Gap: Promoting Accessibility for Low-Resource Environments*

The inequitable accessibility of gamified literacy tools, particularly among students from Malaysia's B40 community, represents another critical divide. The results suggest that inclusive implementation in low-connectivity contexts depends on system simplicity and adaptive usability, exemplified by lightweight and offline-capable designs. This review emphasises the importance of technical and infrastructural considerations, often disregarded in high-income contexts, to

ensure equitable participation in digital literacy programmes. These observations broaden the discourse on gamified learning beyond pedagogical innovation and underscore its relevance for social equity and digital inclusion.

5.3 *Addressing the Theoretical Gap: Aligning Gamified Literacy Interface Design with the DeLone and McLean IS Success Model*

The final gap discovered in this study was the lack of a cohesive theoretical framework connecting gamified design to educational success outcomes. This study aligns the observed design aspects with the six dimensions of the DeLone and McLean IS Success Model, offering a structured pre-implementation conceptual framework, as shown in Figure 2. The proposed framework depicts a comprehensive evaluation of system usability, content quality and student experience. The most frequently emphasised dimensions (system quality and use) indicate that the efficacy of gamified literacy interfaces relies on operational usability and continuous engagement. Meanwhile, information quality and user satisfaction elucidate how clear, culturally relevant content and affirmative feedback systems enhance confidence and perseverance among students with dyslexia. The underrepresentation of service quality indicates a potential for increased teacher engagement and the incorporation of technical help in future tools.

5.4 *Theoretical and Practical Implications*

The results collectively highlight that cognitive accessibility in gamified literacy interfaces is multifaceted, arising from the interaction of incentive, usability and context. The proposed pre-implementation conceptual framework (Figure 2) connects these characteristics and illustrates that inclusive gamified design can concurrently improve literacy outcomes and foster digital equity. Policymakers and developers should promote low-bandwidth optimisation, localised narratives and participatory design that involves educators and students. This study theoretically extends the IS Success Model to educational technology for students with special needs, providing a framework for empirical testing in further research.

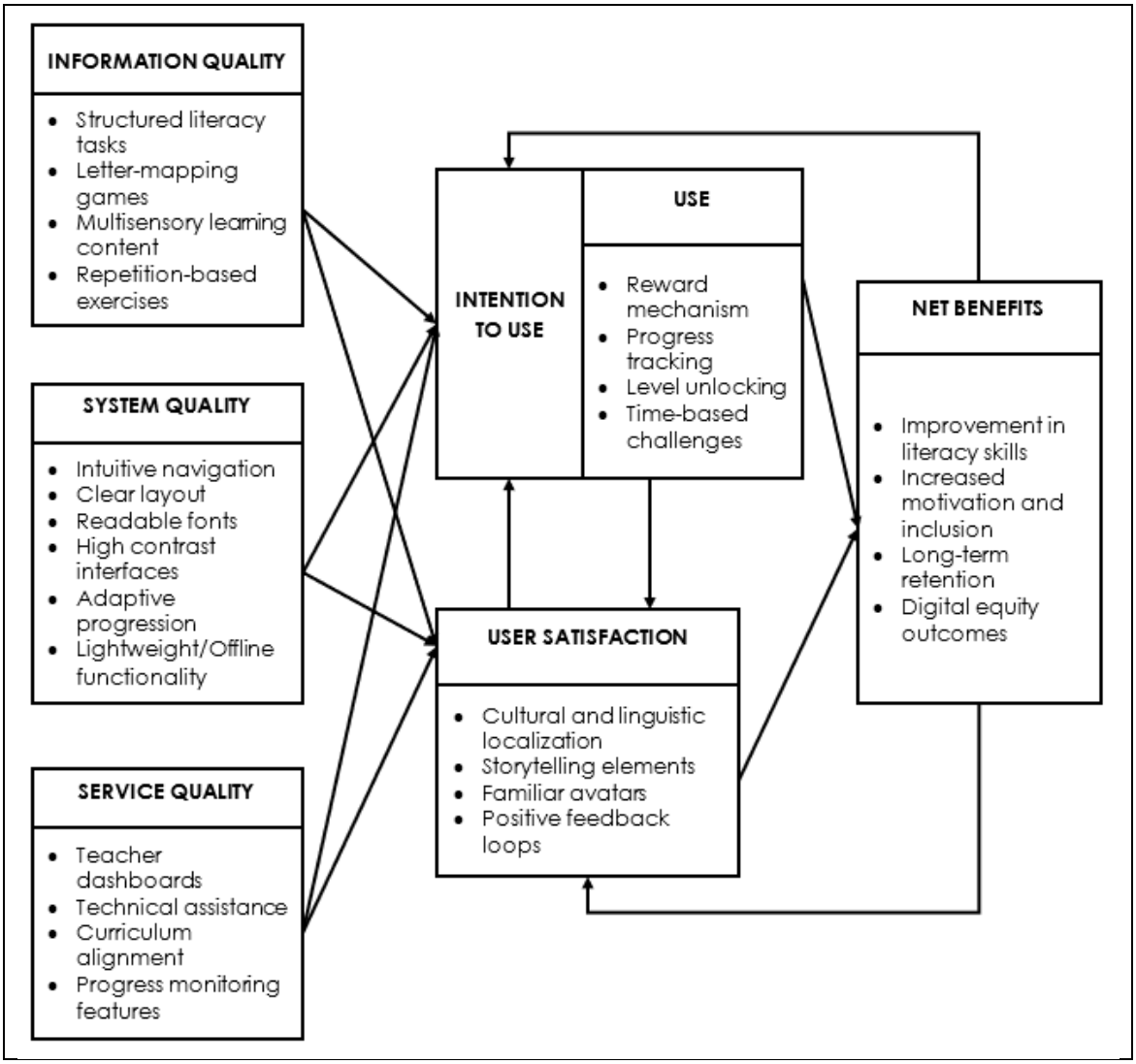

Figure 2. Proposed Pre-implementation Conceptual Framework

This discussion illustrates that the review effectively addressed three significant shortcomings in previous research by transitioning from a neurotypical-centric to a dyslexia-oriented framework, from high-resource to inclusive low-resource environments and from disjointed practice to theoretical unity. Collectively, these contributions underscore the importance of incorporating cognitive, technological and contextual elements into the design of gamified literacy interfaces. The findings establish a conclusion that underscores both the scholarly importance and practical ramifications of developing inclusive, accessible and theoretically informed gamified literacy tools.

6. Conclusion

This study thoroughly examined recent literature on gamified literacy interfaces for students with dyslexia and synthesised the findings using the DeLone and McLean IS Success Model. Six key dimensions were identified: information quality, system quality, service quality, use, user satisfaction and net benefits. Together, these dimensions explain how design, usability and motivation interact to determine the effectiveness of gamified literacy interfaces. The study found that reward mechanisms, storytelling, multisensory features, progressive task levels and culturally relevant designs are among the most employed strategies across various contexts. When combined with the IS Success Model's dimensions, these findings support the development of a pre-implementation conceptual framework for designing and evaluating inclusive gamified literacy interfaces.

This review also addressed the critical challenges of digital accessibility for B40 households in Malaysia, where equitable adoption is impeded by poor connectivity and limited device ownership. Implementing policy initiatives that expand public access and designing lightweight and offline-ready solutions are essential to addressing these disparities. By emphasising these equity concerns, this study positions gamified literacy interventions as pedagogical tools and enablers of broader societal objectives, particularly SDG 4 (quality education).

Moreover, this review identified persistent research limitations, such as small sample sizes, short-term evaluations and limited participatory design engagement. Most current research was conducted in controlled settings and lacked longitudinal evaluation, making it challenging to determine scalability and long-term learning outcomes. Future studies should explore codesign methods that actively involve students with dyslexia in developing features, content and game dynamics. Additional emphasis is also needed on deploying gamified literacy tools for socioeconomically disadvantaged learners, such as Malaysia's B40 group, to ensure that technology inclusion translates into educational inclusion.

In summary, this study introduces a pre-implementation conceptual framework that integrates the design of gamified literacy interfaces with the DeLone and McLean IS Success Model, thereby advancing theory and practice. The study also situates these interventions within the broader global sustainability agenda and Malaysia's socioeconomic landscape. The results collectively illustrate the potential of gamified literacy applications to improve digital equity, inclusivity and reading motivation among students with dyslexia. Ultimately, the study emphasises the importance of participatory, accessible and scalable future designs to ensure that gamified literacy tools genuinely function as inclusive pathways to equitable education.

Acknowledgments
I thank the anonymous reviewers for their useful suggestions.

Funding Details
This work was not supported by any grants.

Authors Contributions
The author was responsible for the conceptualization of the study, development of the methodology, literature search and synthesis, data analysis and interpretation. The author also prepared the manuscript, conducted revisions and approved the final version for submission.

Conflict of Interest
The author agrees that this work was conducted in the absence of any self-benefits, commercial or financial conflicts and declares the absence of conflicting interests with the funders.

References

Ali, M., Zainodin, W., & Mahamad, T. E. T. (2024). The challenges of digital inequalities in online and remote learning on b40 students during the covid-19 pandemic and beyond. *Journal of Media and Information Warfare*, *17*(1), 1-17.

Allafi, R., Alzahrani, I., & Newbury, P. (2022). Measuring the impact of developing a game-based mobile application to increase reading skills level for dyslexic students at primary schools in Saudi Arabia. *INTED Proceedings*, *1*, 10552-10559. https://doi.org/10.21125/inted.2022.2790

Ansari, S., Banerjee, H., Guha, R., & Mukhopadhyay, J. (2020). Improving the readability of dyslexic learners with mobile game-based sight-word training. In *2020 IEEE 20th International Conference on Advanced Learning Technologies (ICALT)*, 287-289. https://doi.org/10.1109/icalt49669.2020.00093

Bhatti, Z., & Shabbir, N. (2022). Serious game model for dyslexic children. *Sukkur IBA Journal of Computing and Mathematical Sciences*, 6(1), 72-78. https://doi.org/10.30537/sjcms.v6i1.864

Brennan, A., McDonagh, T., Dempsey, M., & McAvoy, J. (2022). Cosmic sounds: A game to support phonological awareness skills for children with dyslexia. *IEEE Transactions on Learning Technologies*, *15*(3), 301-310. https://doi.org/10.1109/tlt.2022.3170231

Cahyani, D. E., Wahyuningsih, S., Rahmadani, D., Khotimah, K., & Atan, N. A. (2024). User interface design for dyslexia children learning application using design thinking approach. *International Journal of Interactive Mobile Technologies (iJIM)*, *18*(06), 84-96. https://doi.org/10.3991/ijim.v18i06.47973

Cahyono, D. (2022). Gamification for education: Using lexipal to foster intrinsic and extrinsic learning motivation of students with dyslexia. In *Proceedings of the 14th International Conference on Education Technology and Computers*, 32-38. https://doi.org/10.1145/3572549.3572555

ChePa, N., Bakar, N. A., & Sie-Yi, L. L. (2022). Criteria and guideline for dyslexic intervention games. *International Journal of Advanced Computer Science and Applications*, *13*(9), 162–172. https://doi.org/10.14569/ijacsa.2022.0130919

Dela Cruz, C. (2024). Enhancing engagement: Key factors for exceptional learners in gamified education. In *2024 9th International Conference on Information Technology and Digital Applications (ICITDA)*, 1-7. https://doi.org/10.1109/icitda64560.2024.10809840

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60-95. https://doi.org/10.1287/isre.3.1.60

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9-30. https://doi.org/10.1080/07421222.2003.11045748

Devisakti, A., Muftahu, M., & Xiaoling, H. (2023). Digital divide among B40 students in Malaysian Higher Education Institutions. *Education and Information Technologies*, *29*(2), 1857-1883. https://doi.org/10.1007/s10639-023-11847-w

Ghazzai Alsulami, S. (2019). The role of memory in Dyslexia. *International Journal of Education and Literacy Studies*, *7*(4), 1. https://doi.org/10.7575/aiac.ijels.v.7n.4p.1

Jamshidifarsani, H., Garbaya, S., Lim, T., & Blazevic, P. (2021). Intelligent games for learning and the remediation of dyslexia: Using automaticity principles. *IEEE Systems, Man, and Cybernetics Magazine*, *7*(1), 15-24. https://doi.org/10.1109/msmc.2020.3007131

Jaramillo-Alcázar, A., Venegas, E., Criollo-C, S., & Luján-Mora, S. (2021). An approach to accessible serious games for people with dyslexia. *Sustainability*, *13*(5), 2507. https://doi.org/10.3390/su13052507

Khaleghi, A., Aghaei, Z., & Behnamghader, M. (2022). Developing two game-based interventions for dyslexia therapeutic interventions using gamification and serious games approaches entertainment computing journal. *Entertainment Computing*, *42*, 100482. https://doi.org/10.1016/j.entcom.2022.100482

Larco, A., Carrillo, J., Chicaiza, N., Yanez, C., & Luján-Mora, S. (2021). Moving beyond limitations: Designing the Helpdys app for children with dyslexia in rural areas. *Sustainability*, *13*(13), 7081. https://doi.org/10.3390/su13137081

Leseyane, M., Mandende, P., Makgato, M., & Cekiso, M. (2018). Dyslexic learners' experiences with their peers and teachers in special and mainstream primary schools in north-west province. *African Journal of Disability*, *7*, 1–7. https://doi.org/10.4102/ajod.v7i0.363

Mastropavlou, M., Zakopoulou, V., Christou, T., Nerantzini, M., & Lekakou, M. (2020). The design of New Digital Resources of personalized support of reading skills for novice readers and children with dyslexia: A presentation of the IREAD Software Linguistic Domain Models. In *Proceedings of the 9th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-Exclusion*, 241-245. https://doi.org/10.1145/3439231.3439279

Oosterwyk, G., Brown, I., & Geeling, S. (2019). A Synthesis of Literature Review Guidelines from Information Systems Journals. *Kalpa Publications in Computing*, *12*, 250-238. https://doi.org/10.29007/42v2

Piki, A., & Markou, M. (2023). Digital Games and mobile learning for inclusion: Perspectives from special education teachers. In *2023 10th International Conference on Behavioural and Social Computing (BESC)*, 1-8. https://doi.org/10.1109/besc59560.2023.10386117

Ramli, R., & Purba, K. R. (2023). The development of a game for cognitive remediation therapy (CRT) to improve attention span and memory among children with learning disabilities. In *2023 19th IEEE International Colloquium on Signal Processing & Its Applications (CSPA)*, 1-6. https://doi.org/10.1109/cspa57446.2023.10087548

Sarah Abu Bakar, S. N., Hafizah Mahamarowi, N., & Mustapha, S. (2022). Game-based learning as a teaching and learning tool for dyslexic children. In *2022 IEEE 10th Conference on Systems, Process & Control (ICSPC)*, 50-55. https://doi.org/10.1109/icspc55597.2022.10001824

Schirmer, B. R. (2018). Framework for Conducting and writing a synthetic literature review. *International Journal of Education*, *10*(1), 94. https://doi.org/10.5296/ije.v10i1.12799

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

Weerasinghe, Y., Perera, K. G., Gallage, S. C., Ramesh, S., Karunanayaka, K., & Nanayakkara, S. (2025). Lexilearn: Gamifying learning for dyslexia in a novel linguistic context. In *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*, 1-8. https://doi.org/10.1145/3706599.3720169

Yeratziotis, A., Fotiadis, T., Achilleos, A., Savvides, S., Mettouris, C., Christoforou, C., Arailoudi, A., Mytides, A., Papadopoulos, G. A., & Papadopoulos, T. C. (2024). A game-based cognitive intervention for young learners with reading difficulties. *SN Computer Science*, *5*(6), 701. https://doi.org/10.1007/s42979-024-03042-6

UNIVERSITI TEKNOLOGI MARA

eISSN: : 2682-7840