New Digital Gamification Perception in STEAM Approach: Secondary ESL Teachers' Perspectives in STEAM-oriented ESL Classrooms

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Abstract

Language learning has been ominously obstructed by a greater emphasis on the living technology curriculum and the concept of interdisciplinary integration, STEM (Science, Technology, Engineering, and Mathematics) in the school system. Although increasingly adaptive and a more comprehensive learning approach integrating STEAM (Science, Technology, Engineering, Art and Mathematics) which emphasized on the role of ART are further highlighted in language learning, there have been concerns regarding insufficient information on appropriate teaching tools utilisation and sustainability of the approach. Therefore, this mixed-method study is intended to delineate English as a Second Language(ESL) teachers' perspectives towards digital gamification adoption in STEAM-oriented ESL classrooms. A survey was distributed to 160 ESL teachers with 53 items in which their perception was analysed descriptively with the mean score. Besides, thematic analysis was also employed to analyse 8 respondents' semi-structured interview data. Overall, the findings of this study showed that language learners showed positive feedback toward the digital gamification incorporation in STEAM ESL lessons due to its effectiveness, practicality, ease of use and user satisfaction. This paper implied that researchers should look into ESL teachers' perceptions that they are well-prepared in utilising digital gamification for effective STEAM approach-based English as a Second Language teaching and learning experience.

Keywords: Digital Gamification, Educational Technology, Language Learning, Language Teachers' Perceptions, Science, Technology, Engineering, Art and Mathematics(STEAM)

Introduction

Over the past few years, there has been a noticeable shift towards the integration of technology curriculum in educational environments, gradually displacing traditional learning approaches. The interconnection between rapid social changes, ongoing technological advancements, and their globalised impacts contributes to the dynamic progress towards a

more sustainable way of life. The widespread adoption of technology has become prevalent across many households globally, exerting a substantial influence on various aspects of life, including educational settings. Moreover, the implementation of a living technology curriculum serves as a significant strategy in guaranteeing the provision of high-quality and equitable education. This approach particularly emphasises the facilitation of access to educational opportunities across an individual's lifespan. In reference to Rafiq et al (2021), the United Nations has emphasised the significance of education in ensuring the long-term viability of industries, with a specific emphasis on the year 2030.

The rise of the Fourth Industrial Revolution (4IR) has sparked debates about the positive connection between incorporating technology into education to address the evolving demands of our innovative society (Jerry and Yunus, 2021). As a result, the technological and scientific advancements and innovations will place new demands on students of the 21st century generation, forcing them to develop new skills and abilities. The rapid advancement of technology has facilitated the emergence of living technology curricula and the integration of interdisciplinary education. The author, Henriksen (2017) claimed that the interdisciplinary character of STEM (science, technology, engineering, and mathematics) is rooted in the amalgamation of the four disciplinary domains, enabling students to employ their knowledge from diverse perspectives to devise a resolution to a complex problem. The definition of STEM education proposed by Sanders embodies an open model, as it encompasses the potential for integrating STEM with other curriculum subjects such as arts, language, history, and more.

The integration of Art into the traditional STEM fields, resulting in the STEAM approach, has emerged as a more inclusive and adaptable educational framework. According to Georgette and Hyonyong (2012), the categorization of STEAM subjects is outlined as follows: Science encompasses the study of phenomena that occur naturally and the examination of their corresponding effects. On the other hand, technology pertains to the domain of human-made creations and innovations. Engineering involves the application of both creativity and logical reasoning, drawing upon mathematical and scientific principles, and utilising technology as a means to connect various elements in order to generate meaningful contributions to society. The field of Arts encompasses the study of how societies evolve, the influence they exert, the modes through which they are communicated and the comprehension of their attitudes and customs across different time periods - past, present, and future. In the field of mathematics, various fundamental areas are studied, including numbers and operations, algebra, geometry, measurement, data analysis and probability. Additionally, the discipline encompasses problem solving, reasoning and proof, communication, trigonometry, and calculus.

There is a growing trend towards the adoption of STEAM education according to (Tracey et al., 2018). This necessitates that educators in the STEM fields incorporate the Arts into their instructional materials in a manner that is culturally appropriate for students. This approach recognises the significance of Art in addressing the demands of the contemporary era, as it encompasses Science, Technology, Engineering, Art, and Mathematics. By incorporating Art into the curriculum, STEAM acknowledges the importance of both technical and creative proficiencies, thus equipping learners with a well-rounded skill set necessary for navigating the complexities of the 21st century. The development of the STEAM approach is considered to be a prominent trend in the field of global education (Wahyuningsih et.al., 2020). This educational approach facilitates the integration of art practises, design principles, and assessment with established elements of STEM disciplines (James, 2016). As stated by the source cited as Oner et. al (2016), the core principle of STEAM education, which integrates

the genuine nature of art curriculum, promotes the cultivation of inquiry skills, collaboration, and a pedagogical approach centred around project-based learning.

The field of education is characterised by continuous growth, as teachers consistently acquire innovative methods and strategies to effectively engage their students in their learning process. Additionally, education field is renowned for its propensity to introduce a multitude of teaching approaches, strategies, tools and methods. While the incorporation of STEAM technology in contemporary language teaching and learning signify a notable progress, it also presents considerable challenges and complexities. The feasibility or implementation of the STEAM may be hindered by various factors. One significant obstacle hindering the successful implementation of STEM education is the lack of collaboration across a wide range of multidisciplinary fields teachers. This challenge is compounded by teachers' unwillingness to engage in cooperative efforts and the insufficient support provided by the educational system (Kastriti et. al., 2020). According to Karangeorgiou, Mavrommati & Fotaris, lack of adequate school facilities and infrastructures, time constraints, and insufficient time for teachers to attend interdisciplinary workshops also contribute to the difficulties to adopt such an educational method. Time is the another most important factor impeding the successful introduction of STEAM education.

Teachers are accustomed to teaching by subject in today's schools thus making it challenging for learners to quickly acquire knowledge across disciplines. Various studies Maarouf (2019); Olsen (2019); Getmanskaya (2021); Padani & Amelia (2021); Kastriti et.al (2022) Another concern that hinder STEAM education from achieving meaningful interdisciplinary integration is language teachers' readiness in term of inadequate training, insufficient qualified teachers and teachers' technological competence. This pedagogical approach, nevertheless, places considerable demands on language educators. On top of that, the success of a lesson can be further determined by teachers' digital competence in incorporating digital teaching tools that could promote STEAM strategies. Hence, it is imperative to note that language teachers' lack of exposure to e-learning platforms is hindering their learners from making significant strides in their acquisition of the English language. Apart from that, teaching English in Malaysian national schools can be quite challenging due to the fact that it is taught as a second language as mentioned in Yunus, Tuan and Salehi study. Furthermore, teachers reluctancy to engage in collaboration, maintain consistent communication, and actively contribute to the advancement of the curriculum possess major threat to the successful STEAM education implementation. Yunus and Arshad (2014) study also highlighted that due to the exam-focused education system that has been implemented in Malaysia for decades, soft skills such as autonomous learning characteristics also appear to be absent from the conventional learning process.

The ultimate purpose of this study was to gain an understanding and explore Malaysian secondary ESL teachers' perception in promoting digital gamification-oriented STEAM approach. Qing et al (2020) define digital games as online games that are created and designed using computer technology and executed through digital devices as a medium. They define digital games as ones played on a computer, interactive board games, video games, internet games, and mobile games. This study employs the term "digital games" to encompass all online games utilised for the purpose of teaching and learning the English language. Specifically, these games serve as an educational platform or, as highlighted by Endang et al (2019), a multimedia teaching technique that holds considerable potential for enhancing the education system. A key function of digital games is to accelerate learners'

motivation to complete learners' commitment, but also in boosting their motivation to progress through positive reinforcement like points and badges.

A number of technologies and educational tools have emerged to make language learning more effective and sustainable. Thus, it is understood that the education system is dynamic and any changes would be great as long as it helps to ensure the teaching and learning is happening and sustained. More specifically, this study looks at ESL teachers' perception specifically in terms of their "perceived usefulness", "perceived ease of use", "intention" as well as the" user satisfaction" domains in Technology Acceptance Model toward digital gamification utilisation in STEAM-based English as a second language classroom. Therefore, the research being conducted aims to accomplish the following objectives as to identify ESL teachers' perception toward digital gamification-oriented STEAM approach.

Literature Review
Digital gamification-oriented STEAM in English as a Second Language Learning
In virtual worlds, digital gamers or players build cities, houses, and take care of a population to recreate the day-to-day experiences of real life. Players would be exposed to many types of conditions and situations and therefore learn STEAM interdisciplinary subjects thematically. This means that different types of digital games offer language learning contexts of various kinds, hence it leads to English language learning and acquisition. Learning English as a second language is considered challenging and it is inevitable that ESL students will have a lower level of English proficiency as highlighted in Santhanasamy and Yunus (2021) study. Therefore, the interdisciplinary subjects making it even more difficult to alleviate STEAM interdisciplinary incorporation challenges especially from the teachers' perspectives.

According to Hunter-Doniger et al (2017), there is a need for STEM educators to employ strategies that incorporate culturally relevant arts into educational settings in order to effectively implement STEAM frameworks in education. Hence, diverse digital gamification approaches with a focus on STEAM disciplines have been implemented across multiple contexts and for various objectives. Lameras et al. (2017) emphasise the importance of incorporating pedagogically oriented and inclusive methodologies in the design of game-based learning. This viewpoint is supported by Gurbuz and Celik (2022), who conducted a comprehensive review of the literature on game-based learning design. Their analysis encompassed a total of 2,466 articles spanning a 20-year period.

Furthermore, empirical research has provided evidence that games have the ability to integrate the Arts and incorporate them within the domain of STEM disciplines. In their recent publication, Breien and Wasson (2021) conducted a comprehensive analysis of existing literature, uncovering a collection of attributes pertaining to digital game-based learning. These attributes have been found to be correlated with favourable outcomes in terms of language learners' levels of engagement, motivation, and overall learning progress. The research conducted by Breien and Wasson (2022) served as the foundation for the development of the eLuna Framework. This framework is a co-design and co-specification methodology that enables educators and game developers to create and implement digital game-based learning systems. These systems are designed to promote the desired characteristics that have been linked to positive outcomes in STEAM learning environments.

Several studies propose that integrating the STEAM idea with game-based learning features might enhance students' academic performance in comparison to lecture-centered instruction. In Abdullah Al-Malki (2020) research, the experimental group's cognitive burden

was lower than the control group's. For ongoing development, Henriksen (2017) asserted that these activities could be connected to academic courses and is advantageous for several reasons, including encouraging students to read books for enjoyment and pique their interest in English language instruction and literary studies. By using STEAM practises, language learners might expand and successfully use their understanding of literary analysis and evaluation, read broadly and independently, and interact critically and creatively with their reading materials. Carter et al., Hakuta & Turkan et al. cited in Maarouf (2019), combining Science, Technology, Engineering, Math (STEM) and reading comprehension with other English language activities will not only help learners build a strong foundation in interdisciplinary content areas but also promote English language literacy.

According to the Kastriti et.al (2022), the implementation of STEAM can foster the development of creative imagination and composition skills. Furthermore, the researchers incorporated the elements of entertainment and creative writing into their study. They achieved this by creating a gameplay escape room design that immersed learners as active participants in a stimulating learning environment. The aforementioned phenomenon will ultimately result in the improvement of writing proficiency among individuals who are acquiring a new language. In a study conducted by Su (2019), the focus was on investigating the impact of users' behavioural intentions on the integration of gamification and augmented reality in STEM (Gar-Stem) education.

The integration of advanced technology and instructional methods has the potential to augment the efficacy of STEM education, leading to increased engagement and positive dispositions among learners (Maurais & Morris, 2003). The findings of this study indicate that the integration of STEAM education with virtual reality (VR)-assisted experiential courses has the potential to enhance students' learning satisfaction, academic performance, and intrinsic motivation. Furthermore, the utilisation of a STEAM-based approach proved to be advantageous in the development of oral communication abilities. The study conducted by Raimjanovna & Senior proposed that the implementation of steam technologies in English classes has a positive impact on students' speech competence.

This intervention was found to enhance students' confidence, motivation, and reduce anxiety levels when communicating in English within group settings. Besides, the same study conducted by them revealed that language learners expressed a positive perception towards the versatility, user-friendliness, effectiveness, and utility of STEAM technology as an interactive medium for communication. In their study, the researchers utilised project-based learning strategies with a focus on STEAM (Science, Technology, Engineering, Arts, and Mathematics) to improve the communicative and listening abilities of the participants, as documented in (Lu et al., 2022). The innovation process involves learners engaging in communication with their teachers, actively listening to and accepting diverse opinions during practical activities within the project-based STEAM curriculum.

Teachers' perceptions and readiness towards the application of digital gamification in STEAM-based ESL classrooms

The global technology utilisation in education has gained significant ground as many have increasingly recognised the immense potential of digital tools in enhancing educational experiences for learners across various proficiency levels (Lim and Yunus, 2021). The substantial rise in the usage of technology for educational purposes has been shown to have positive effects, particularly in terms of the level of engagement of language learners in the process of language learning and acquisition. Hence, the integration of technology is

considered a highly effective educational strategy for supporting English language learners in their language learning and acquisition process. The rapid advancement of technology has had a profound impact on the English as a second language acquisition, learning, and teaching in contemporary digital-oriented societies.

Digital gamification has been identified as an extremely versatile digital tool for educators across all levels of the educational system in the context of 21st century learning. In their study, Hamari et al (2014) conducted a comprehensive review of empirical research on gamification. They found that gamification in educational context was the most frequently reported area of focus in the literature. The majority of the publications they looked at described learning outcomes as increased motivation, engagement, and satisfaction. Other researchers also claim that the gamification in learning could assist learners become more motivated, engaged, and adapt their behaviour, as was noted in the Swacha, 2021 study. Beside that, numerous studies indicate that digital educational games have the capacity to actively engage students in classroom activities, facilitate active learning, cultivate a sense of teamwork, and consequently enhance the learning process by making it more efficient, enjoyable, and rewarding (Hung et al., 2018).

The discourse concerning the utilisation of digital games for language learning has gained popularity due to technological advancements (Peterson et al., 2021). According to a literature review by Chen et al (2021), digital games are gaining credibility as an invaluable tool for contemporary language teachers. Moreover, the implementation of digital gamification has been found to promote extracurricular and interdisciplinary learning, as evidenced by the research conducted by Jagust et al. in 2018. Hence, it is plausible to integrate these objectives by conceptualising gamification as an educational approach intended for advancing and promoting STEAM Education (Das-Cleophas, 2020). STEAM education, as proposed by Papadakis & Kalogiannakis (2020), is an interdisciplinary approach among the fields of Science, Technology, Engineering, Art, and Mathematics which delivers interdisciplinary knowledge as well as cultivates autonomous learning and critical thinking in daily life.

Most language teachers concur that a STEAM-based digital gamification approach is an effective means of teaching and learning English. The effectiveness of integrating digital gamification in STEAM-based language learning has received significant amounts of positive feedback from teachers (Sidekerskiene & Damasevicius, 2023; Breien & Wasson, 2022; Breien et.al., 2022; Wannapiroon & Pimdee, 2022; Hsiao & Su, 2021; Lopez et.al., 2021; Houghton et.al.. 2021; Herrera et.al., 2021; Alsale et.al., 2021; Kummanee et.al., 2020). However, there are several key criteria in ensuring success in English as a second language teaching and learning. Studies from various countries affirmed that the STEAM approach has been effective in numerous ways, particularly when it comes to assisting learners in learning in fun, interactive and contextualised settings (Breien & Wasson, 2022; Aguilera & Ortiz-Revilla, 2021). On top of that, an extensive amount of studies also recommends gamification as a proactive approach for STEM instruction in various countries. A few countries like Brazil, Egypt, and Romania have even reported adopting gamification in teaching sign language to deaf learners as reviewed by Mendes et al.(2019).

By utilizing appropriate teaching and learning strategies, language learners with a contextualized environment has a higher potential to foster a desirable attitude and outcome towards language learning (Breien & Wasson, 2022). Reviewing the literature on gamified learning Gurjanow et al (2018); Su (2017); Lameras & Moumoutzis (2015), the learners leverage gadgets and mobile devices to progress through a variety of digital games

while fulfilling the task requirement in order to achieve the learning outcome. In their research, Hawari and Noor (2020) suggested that the STEAM approach is significantly outperformed the more conventional approaches in terms of helping language learners to learn English by emphasising the creative process and bringing together all the relevant artistic content via active collaboration, exploration of real-world challenges and problem solving in educational settings. The STEAM gamified method, according to Cleophas (2020), allowed for progressing challenges, providing room for feedback, engaging and motivating learners, along with promoting cooperation within them.

STEAM implemented in an integrated manner effectively promotes a greater balance between language acquisition and interpersonal skills according to a research conducted by (Pasani and Amelia, 2021). Integrative STEAM positively contributes to the development of 21st-century skills as mentioned in a number of studies Getmanskaya (2021); Hawari & Noor (2020); Tabi'in (2019) like critical thinking, collaboration, communication, and problem-solving. Digital STEAMification accommodates technological advancement therefore effectively and positively affect language learners' creativity (Kastriti, 2022; Lu, 2022; Aguilera & Ortiz-Revilla, 2021; Wahyuningsih et.al., 2020; Tabi'in, 2019). Integrating digital gamification into the STEAM based ESL classroom is an efficient means of developing language learners' critical thinking, collaboration, and technological competence. Jagut et al (2018), for instance, revealed the results of an empirical research on a gamified lesson using tablets featuring elements of competition, transformation, and collaboration.

The STEAM approach to learning a language is renowned because it is practical, versatile, and relevant to learners' daily life (Pasani & Amelia, 2021). Moreover, Yunus and Abdullah (2011) stressed that active learning is crucial for students to establish connections between their existing knowledge and what they are about to learn. The STEAM approach, a contextual one, is practical in which second language learners are encouraged to make connections between the target language and real-world phenomena (Kastriti et.al., 2022). Learning a language becomes more meaningful and productive when students are able to more easily apply what they are learning to real-world contexts (Hawari & Noor, 2020; Huang, 2020). Furthermore, researchers have looked at educators' perspectives on gamification and concluded that, on the whole, they are favourable (Mart et.al., 2021; Gómez et.al., 2019). In a gamified teacher training course, pre-service teachers are also taught how to improve their learning, teaching, and affective domain abilities (Gomez-Carrasco et al., 2019). Alabbasi (2017) observed that educators see gamification favourably and believe it has the potential to enhance digital learning experiences. Teachers may take into account that, for instance, students are more motivated to achieve the intended learning objectives, their level of engagement with the course escalates, and they feel more compelled to go above and beyond what is required.

There are several studies that show that STEAM has become a vital approach that boosts students' motivation in the process of language learning. Various studies carried out in several countries Lewis (2023); Breien & Wasson (2022); Kastriti (2022); Hsiao & Su (2021); Huang (2020); Soroko (2020) Tabi'in (2019) indicate that English language learners project a positive vibe towards the implementation of STEAM in English learning Li et.al (2022); Kastriti (2022); Hsiao et.al (2021); Huang (2020); Soroko (2020) claimed that the majority of the learners not only regard STEAM as helpful in enhancing their English language skills but also bring great motivational values in learning the language. Breien and Wasson (2022), also prodess that digital game-based learning make a good impact on language learners' interest, motivation, and knowledge retention in the process of learning English and their

readiness in acquiring, practising targeted language structures and even conversing in English language. Additionally, Breien et.al (2022) also revealed that digital gamification in STEAM ignite the learners learning motivation along with enhance their learning satisfaction.

However, the act of integrating educational technology curriculum for instance STEAM approach and other digital tools to language teaching is not always straightforward or successful according to (Lewis, 2023). There may be variations in how teachers perceive interdisciplinary approaches, such as the different points of view of secondary and primary teachers regarding the potential impact of STEAM instruction on student achievement (Park et.al., 2016). As Kastriti et al (2022); Maarouf (2019) point out, many teachers have a dim view of STEAM curriculum because they feel unprepared to implement them in their classrooms. According to Kim and Bolger (2017), it is noteworthy that although Korean teachers acknowledge the potential positive effects of STEAM on learning, there is nevertheless a significant reluctance among them to take an active role in STEAM education. One of the primary concerns raised by teachers is the escalation in their workload, which has resulted in challenges in effectively collaborating with teachers from various disciplines and an acute lack of support from both colleagues and school administration (Boice et al., 2021).

Methodology

This section of the study presented the methodology employed in the conducted study. Besides, it also elaborated on the study's methodology, including its design, sample, research instruments and data analysis procedures so that readers may grasp how the research will be carried out and why it is vital to answer the research questions.

Research Design

As a result, this undertaken research is a mixed-method study aimed at exploring secondary ESL teachers' perception toward digital gamified STEAM-based English lessons on their confidence, attitudes and self-efficacy. Specifically, the research question addressed the research problems are: How do secondary ESL teachers' perceive digital gamification oriented STEAM approach? The two main research instruments used in this study include a set of survey's questionnaires and semi-structured interviews aimed at answering the above research question. Besides, the means situation analysis is used alongside the thematic analysis. The findings will delineate ESL teachers' perception to adopt digital gamification in implementing STEAM-based ESL teaching and learning.

Research Population and Sample

This study comprised a population of 70 secondary ESL teachers currently teaching English as a Second Language in public secondary schools within a district in the northern state in Malaysia. According to Martinez-Mesa et al (2016), the inclusion of a representative sample is crucial to derive dependable conclusions regarding a given population. Hence, the researcher has referred to Krejcie & Morgan's table to determine the appropriate sample size for this study, which is estimated to be approximately 52 participants to partake in the survey. The response rate is 85.71% where 60 secondary ESL teachers have responded to the distributed questionnaire.

Research Instruments

A set of questionnaires entitled "New Digital Gamification Perception in STEAM Approach: Secondary ESL Teachers' Perspective and Readiness" was developed from this literature (Schmidt et al., 2009-2010; Ibrahim et al., 2017; Schmid et al., 2020; Marikyan & Papagiannidis, 2023). The survey method of data collection was employed. The first part of the questionnaire, section A is intended to investigate the English as second language learners' demographic information such as their workplace(school name), gender, race, teaching experience, academic qualification and prior knowledge of STEAM and digital gamification.

Section B of the questionnaire solicited secondary ESL teachers' perspectives toward digital gamification in STEAM English lessons. This section was comprised of 4 subtopics namely perceived usefulness, perceived ease of use, intention and user satisfaction constructed based on Technology Acceptance Model(TAM)(1989) 4 main components. There are 4 questions for each subtopic on ESL teachers' perspective adhering to the Likert Scale with four intervals: "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree.

Table 3.1

ESL Teachers' Perspective Toward Digital Gamification In STEAM Approach

No.	Components in TAM Model	Statement
1.	Perceived Usefulness	Digital gamification oriented STEAM approach is helpful in enhancing language learners' academic performance.
2.	Perceived Usefulness	Digital gamification oriented STEAM approach is effective in enhancing language learners' English proficiency level.
3.	Perceived Usefulness	Digital gamification in STEAM based English lessons provide effective learning environment for my language learners.
4.	Perceived Usefulness	Incorporating digital gamification in STEAM based English lessons enhances my effectiveness in teaching English.
5.	Perceived Ease of Use	I believe that learning to incorporate digital gamification oriented STEAM approach in English lessons does not require a lot of my mental effort.
6.	Perceived Ease of Use	I assume that the incorporation of digital gamification in STEAM to be easy to implement.
7.	Perceived Ease of Use	I think it is easy to become skilful at executing digital gamification oriented STEAM English lessons.
8.	Perceived Ease of Use	I feel that it would be easy for me to find teaching materials and teaching tools in implementing digital gamification based on STEAM approach.
9.	Intention	I prefer digital gamification incorporation based on STEAM approach to traditional English teaching method.
10.	Intention	I will recommend digital gamification oriented STEAM approach implementation to other teachers.
11.	Intention	I think digital gamification in STEAM approach should be implemented in English lessons.

12.	Intention	I intend to incorporate digital gamification during my STEAM English classes.
13.	User Satisfaction	Digital gamification oriented STEAM approach enhances language learners' interest in English lesson.
14.	User Satisfaction	Students compete with motivation using digital gamification in STEAM approach based English lessons.
15.	User Satisfaction	Digital STEAMification is an attractive way to teach and learn English as a second language.
16.	User Satisfaction	Utilising digital gamification in STEAM based English lesson is fun

Three experts checked the questionnaire in the related field to address the face and content validity. The instrument utilised has a Cronbach's alpha value of 0.953, which shows high reliability.

According to Sarah and Alexandra (2021), the distinction between online and face-to-face interviews is minimal when ethical protocols are adhered to. Therefore, the interview was conducted via Google Meet platform. The interviewee are ESL teachers from public secondary schools in Northern region of Malaysia. They were chosen because their school was involved with dual-language programme(DLP), giving more justifications and insights regarding the secondary ESL teachers' perspectives on teaching English for STEAM. The semi-structured interview was directed by a set of predetermined questions. The purpose of the questions is to collect comprehensive data from participants regarding their perceptions of digital gamification, as well as their level of readiness and perceived challenges associated with its implementation in STEAM-based ESL classrooms. Four open-ended questions were developed by researcher and validated by the same experts, as per shown by Table 3.2. The interview protocol utilised in this study was derived from the work of (Decena, 2014).

Table 3.2
Semi-structured Questions Used for Interview

No.	Interview question
Q1	What do you know about STEAM education and digital gamification?
Q2	Why do you think digital gamification approach is important for you as a secondary ESL teacher in STEAM based ESL classroom?
Q3	What are the difficulties or challenges that you might face in utilizing digital gamification in STEAM oriented ESL classroom?

Data Analysis

The quantitative data was collected through an online platform, google form. All data collected were analysed descriptively which was to identify the perception and readiness of ESL teachers. All data were analysed with the Statistical Package for Social Sciences (SPSS) version 29.

This study deployed statistical analysis on the quantitative data utilising SPSS software version 29. Data were described and summarised using descriptive analyses, which entail condensing a large number of sample data points to a smaller number of useful summary values and graphs. This may encompass various statistical measures such as frequency, percentage, central tendency (mean), and data dispersion (standard deviation). In this research, descriptive analyses were utilised to assess and characterise the features of a dataset in terms of the demographic profile of respondents as well as the responses obtained from questionnaire questions.

On the contrary, the qualitative data was collected via semi-structured interviews. Thematic analysis by Braun and Clarke (2006) was utilised for comparing and contrasting the viewpoints of study participants on the topic of digital gamification in STEAM-ESL classrooms, drawing forth unexpected discoveries, and revealing parallels and contrasts.

Table 3.3
Summarizes the type of statistical analyses that would be used to answer the research questions of this study

No.	Research Question	Statistical analysis
RQ1	How do ESL teachers' perceive digital gamification-oriented STEAM approach?	Frequency, percentage, mean, standard deviation & thematic analysis

Findings
Referring to the objectives of this study, secondary ESL teachers' perspectives on digital gamified STEAM-ESL lessons and its corresponding Technology Acceptance Model (TAM) domains were analysed descriptively. Descriptive anaylsis of the Secondary ESL teacher's perceptions toward digital gamification in STEAM-oriented English lessons involved measure of frequency, percentage, mean and standard deviation. Besides, thematic analysis was employed to enrich the quantitative data gathered. The findings provide an overview of secondary ESL teachers' perceptions towards the utilisation of digital gamification in STEAM-oriented ESL lessons.

RQ1: How Do Secondary ESL Teachers' Perceive Digital Gamification-Oriented STEAM Approach?
The researcher employed a survey and conducted interviews with semi-structured questions to ascertain individuals' perceptions regarding the application of digital gamification in STEAM education. Firstly, the questionnaire comprised 16 items that sought to gather the perspectives of secondary ESL teachers regarding the incorporation of digital gamification in ESL classrooms with a focus on STEAM education. These questions are evaluated through a four-point Likert scale with four intervals: "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree."

Table 4.1
Four-Point Likert Scale

Likert Scale	Mean Value	Description
1	1.00 - 1.75	Very Low
2	1.76 - 2.50	Low
3	2.51 – 3.25	High
4	3.26 – 4.00	Very high

For interpretation of means score, the interpretation by Noor and Yunus (2017) was employed. The interval scales encompass a range of values from 1.00 to 1.75, indicating a classification of "very low". This is followed by a range of values from 1.76 to 2.50, which is regarded as "low". The subsequent range, spanning from 2.51 to 3.25, is deemed as "high". Finally, the range of mean values from 3.26 to 4.00 is categorised as "very high". The scale was employed to analyse the mean scores of individual items pertaining to the perceptions of secondary ESL teachers regarding the implementation of digital gamification in ESL classrooms with a focus on STEAM approach.

ESL Teachers' Perception Toward The Utilisation Of Digital Gamification In STEAM-Oriented ESL Lessons

The findings on ESL Teachers' Perceptions towards the Utilisation of Digital Gamification In STEAM-Oriented ESL Lessons are analysed based on Technology Acceptance Model (TAM). The perspective of secondary ESL teachers on the utilisation of digital gamification in STEAM education is examined in this study with a specific focus on the four main constructs proposed in the Technology Acceptance Model (TAM): perceived usefulness, perceived ease of use, intention and user satisfaction.

Table 4.2
The Overview Of ESL Teachers' Perceptions Towards The Utilisation Of Digital Gamification In STEAM-Oriented ESL Lessons

Constructs	Mean	Standard Deviation	Interpretation
Perceived Usefulness	3.46	0.43	Very High
Perceived Ease of Use	2.61	0.60	High
Intention	3.22	0.57	High
User Satisfaction	3.57	0.43	Very High

The data collected from the four main four components in TAM: perceived usefulness, perceived ease of use, intention, and user satisfaction as entailed in the questionnaire items is presented in Table 4.2 Each domain of the TAM model encompasses four questions that aim to investigate the perspective of ESL teachers towards the utilisation of digital gamification in STEAM-oriented ESL lessons. The findings indicate that items designed based on "perceived ease of use" and "intention" constructs as "high" with mean value ranging from 2.51 – 3.25. On top of that, items constructed based on "perceived usefulness" and "user

satisfaction" demonstrate a significantly high average value, falling within the range of 3.26 to 4.00.

"Perceived Usefulness" of ESL Teachers' Perspectives on Digital Gamification in STEAM-ESL Classroom

This section presents the findings regarding the perceptions of ESL teachers concerning the usefulness and effectiveness of digital gamification in the context of STEAM ESL classrooms. The frequency, mean score and standard deviations for the 4 items assessing ESL teachers' perspective pertaining "perceived usefulness" towards the utilisation of digital gamification in STEAM-oriented ESL lessons are presented in Table 4.3. The findings suggest that the mean value of each item constructed based on "perceived usefulness" is exceptionally high with values ranging from 3.26 to 4.00. Within the TAM model's domain of "Perceived Usefulness," ESL teachers demonstrate a notable inclination toward embracing digital gamification as an effective digital educational tool in STEAM ESL classrooms.

Table 4.3
"Perceived Usefulness" Of ESL Teachers' Perspectives On Digital Gamification In STEAM ESL Classroom

Item No.	Statement Perceived Usefulness	Strongly Disagree n(%)	Disagree n(%)	Agree n(%)	Strongly Agree	Mean	SD	Interpretation
1	Digital gamification oriented STEAM approach is helpful in enhancing language learners' academic performance.	0 (0%)	1 (1.7%)	31 (51.7%)	28 (46.7%)	3.46	0.536	Very High
2	Digital gamification oriented STEAM approach is effective in enhancing language learners' English proficiency level.	0 (0%)	0 (0%)	30 (50.0%)	30 (50.0%)	3.51	0.504	Very High
3	Digital gamification in STEAM based English lesson provide effective learning environment for my language learners.	0 (0%)	1 (1.7%)	29 (48.3%)	30 (50.0%)	3.49	0.537	Very High

4	Incorporating digital gamification in STEAM based English lessons enhances my effectiveness in teaching English.	0 (0%)	0 (0%)	35 (58.3%)	25 (41.7%)	3.42	0.498	Very High

In the analysis, the findings revealed that item 2 emerged with the highest mean score (M=3.51) revealing that half of the sample size (50%) strongly agreed while the other half(50%)agreed that digital gamification-oriented STEAM approach is perceived as effective in enhancing language learners' English proficiency level. Besides, all of the respondents where 35 of them(58.3%) agreed and the remaining 25 respondents(41.7%) strongly agreed that by incorporating digital gamification in STEAM-based English lessons enhances the effectiveness in teaching English as a second language.

Respondents also demonstrated that digital gamification in STEAM-based English lessons is deemed helpful in enhancing language learners' academic performance(M=3.46) as well as providing an effective learning environment for their language learners(M=3.49). The observed low standard deviation values among all items ranging from (SD=0.498)to (SD=0.537) indicate that there is a consensus among ESL teachers regarding the positive influence of digital gamification in STEAM-ESL lessons. This consensus is characterised by minimal variability in their individual responses. As a result, the standard deviation values serve to strengthen the dependability and uniformity of the reported mean scores cultivating optimism about the recognition that ESL teachers widely perceive digital gamification as greatly beneficial in improving various aspects of language learning and teaching within the STEAM approach.

"Perceived Ease Of Use" Of ESL Teachers' Perspectives On Digital Gamification In STEAM ESL Classroom

Although the effectiveness and usefulness of utilising digital educational games for language learning have been acknowledged, there remains a concern among some educators regarding potential challenges that ESL teachers may encounter when incorporating these games into STEAM-based English as a second language teaching experiences. The data that was gathered in order to ascertain the perspective of ESL teachers regarding the perceived ease of incorporating digital gamification into STEAM-ESL educational settings is presented in this section. The analysis of secondary ESL teachers' points of view on the "perceived ease of use" of digital gamification in STEAM yielded interesting findings as indicated by the descriptive findings reported in Table 4.4.

Table 4.4

"Perceived Ease Of Use" Of ESL Teachers' Perspective Towards The Utilisation Of Digital Gamification In STEAM-Oriented ESL Lessons

Item No.	Statement Perceived Ease of Use	Strongly Disagree	Disagree n(%)	Agree	Strongly Agree	Mean	SD	Interpretation
5	I believe that learning to incorporate digital gamification oriented STEAM approach in English lessons does not require extra effort for teaching preparation.	12 (20.0%)	28 (46.7%)	17 (28.3%)	3 (5.0%)	2.17	0.81 3	Low
6	I assume that the incorporation of digital gamification in STEAM to be easy to implement.	4 (6.7%)	21 (35.0%)	26 (43.3%)	9 (15.0%)	2.66	0.82 2	High
7	I think it is easy to become skillful at executing digital gamification oriented STEAM English lessons.	3 (5.0%)	18 (30.0%)	29 (48.3%)	10 (16.7%)	2.76	0.79 5	High
8	I feel that it would be easy for me to find	2 (3.3%)	19 (31.7%)	26 (43.3%)	13 (21.7%)	2.81	0.79 8	High

teaching materials and tools in implementing digital gamification based on STEAM approach.	

Three out of four items pertaining to the ease of digital gamification utilisation yielded mean values that lie within the medium range specifically between 2.51 and 3.25. The mean values, which range from 2.51 to 3.25, suggest a moderate level of consensus among the ESL teachers regarding the ease of digital gamification incorporation and application for fostering STEAM approach. This implies that although the ESL teachers acknowledge the practicality of using digital gamification, there is not an overwhelming agreement among the surveyed ESL teachers regarding its efficacy. Items 6, 7, and 8 had higher means (2.66, 2.76, and 2.81, respectively), implying that ESL teachers generally perceived a higher level of ease when it comes to employing digital gamification in STEAM, becoming competent at conducting related lessons, and discovering teaching resources and tools. Conversely, Item 5 has the lowest mean (2.17), indicating that ESL teachers perceive a relatively low level of ease when it comes to the effort required for teaching preparation with digital gamification in STEAM. A considerable proportion of ESL teachers considered the implementation of digital gamification as a challenging task. Specifically, 20% of the respondents strongly disagreed while 46.7% disagreed with the notion that integrating a STEAM approach through digital gamification into English lessons does not necessitate additional teaching preparation. This implies that ESL teachers perceived that digital gamification STEAM lessons preparation process as the most challenging as compared to the other aspects.

"Intention" of ESL teachers' perspective towards the utilisation of digital gamification in STEAM-oriented ESL lessons
The users' decision to utilise a technology is influenced by their perception of its effectiveness as well as its user-friendliness. If ESL teachers perceive digital gamification as effective and user-friendly, they are more inclined to have a favourable inclination to utilise it in STEAM ESL classrooms resulting in the actual implementation and utilisation of the technology. Thus, the questionnaire items also ascertain the intention of ESL teachers in employing digital gamification in English lessons that are based on STEAM approach. The mean values depicted in Table 4.5 provide valuable insights into discernible patterns.

Table 4.5
"Intention" of ESL teachers' perspective towards the utilisation of digital gamification in STEAM-oriented ESL lessons

Item No.	Statement Intention	Strongly	Disagree (%)	Agree	Strongly Agree	Mean	SD	Interpretation
9	I prefer digital gamification based on STEAM approach to traditional Chalk- and-Talk teaching method.	2 (3.4%)	6 (10.2%)	33 (55.9%)	19 (31.7%)	3.14	0.730	High
10	I will recommend digital gamification oriented STEAM approach implementation to other teachers.	0 (0%)	7 (11.7%)	32 (53.3%)	21 (35.0%)	3.24	0.652	High
11	I think digital gamification in STEAM approach should be implemented in English lessons	0 (0%)	5 (8.3 %)	29 (48.3%)	26 (43.3%)	3.34	0.633	Very High
12	I intend to incorporate digital gamification during my STEAM English classes.	0 (0%)	11 (18.3%)	30 (50.0%)	19 (31.7%)	3.12	0.697	High

The overall mean values are quite similar, ranging from 3.12 to 3.34, suggesting a generally strong interest among ESL teachers for incorporating digital gamification in STEAM-oriented ESL lessons. The results indicate that the average score for items 9 and 10 which are related to the "intention" domain is relatively high ranging from 2.51 to 3.25. On the other hand, items 11 and 12 have a significantly higher average score ranging from 3.26 to 4.00. The

findings of the study indicated that English as a Second Language teachers exhibit a preference for utilising digital gamification, specifically based on the STEAM approach, over the traditional Chalk-and-Talk teaching method (M=3.14). They also expressed willingness to recommend the implementation of this approach to other educators (M=3.24). Most of the ESL teachers surveyed comprising 29 respondents (48.3%) who strongly agreed and 26 respondents (43.3%) who agreed expressed their belief in the relevance of incorporating digital gamification within the STEAM approach for English lessons. Furthermore, not only half of the participants(50%) in the sample indicated their agreement but also 31.7% expressed strong agreement regarding their intention to integrate digital gamification into STEAM English lessons. Although the average scores for all items suggest a strong level of intention, the standard deviations range from (SD=0.633 to 0.730) suggesting that individual ESL teachers may have different perceptions and ideas regarding incorporating digital gamification. It is worth noting that, although there is a generally positive attitude towards digital gamification, there are nuanced variations in the way people respond to different aspects. Interestingly, item 12 (SD=0.697), which pertains to the intention of incorporating gamification in STEAM classes, shows a slightly higher level of variability.

"User Satisfaction" Of ESL Teachers' Perspective Towards The Utilisation Of Digital Gamification In STEAM-Oriented ESL Lessons

The domain of user satisfaction in TAM is a crucial factor in determining the extent to which digital games fulfil ESL teachers' expectations and enhance their overall positive experience in implementing it in STEAM-oriented ESL lessons. This section of analysis focuses on the domain of user satisfaction specifically in examining the perspectives of ESL teachers regarding the utilisation of digital gamification in STEAM education.

Table 4.6

User satisfaction of ESL teachers' perspective towards the utilisation of digital gamification in STEAM-oriented ESL lessons

Item No.	Statement	Strongly	Disagree n(%)	Agree n(%)	Strongly Agree n(%)	Mean	SD	Interpretation
	User Satisfaction							
13	Digital gamification oriented STEAM approach enhances language learners' interest in English lesson.	0 (0%)	0 (0%)	29 (48.3%)	31 (51.7%)	3.51	0.504	Very High

14	Students is more motivated when using digital gamification in STEAM approach based English lessons.	0 (0%)	0 (0%)	28 (46.7%)	32 (53.3%)	3.54	0.502	Very High
15	STEAM oriented digital gamification is an attractive way to teach and learn English as a second language.	0 (0%)	0 (0%)	24 (40%)	36 (60%)	3.61	0.492	Very High
16	Utilising digital gamification in STEAM based English lesson is fun	0 (0%)	0 (0%)	23 (38.3%)	36 (61.7%)	3.61	0.492	Very High

The mean values obtained from the statements reflecting the ESL teachers' satisfaction of integrating digital gamification into STEAM English lessons consistently fall within the category of very high satisfaction. The mean scores, ranging from 3.25 – 4.00, indicates an extremely strong level of agreement among the ESL teachers concerning the satisfaction toward digital gamification integration and utilization in fostering ESL learners interests in STEAM English classrooms. The surveyed ESL teachers perceived digital gamification as an attractive way to teach and learn English as a second language and its utilisation in STEAM based English lesson is fun where both items 15 and 16 shared the same mean value, M= 3.61. Items 13 and 14 show slightly lower mean values, although they still indicate high satisfaction. Additionally, in item 13, up to all of the respondents(100%) where 29 of them(48.3%) agreed and the remaining 31 of them(51.7%) strongly agreed that digital gamification oriented STEAM approach enhances language learners' interest in English lesson. This implies that there is a prevalent and universally high level of satisfaction among the ESL teachers who also acknowledge the benefit associated with STEAM digital gamification utilisation in ESL teaching and learning process.

The application of thematic analysis as outlined by Braun and Clarke (2006) has uncovered a few emergent themes that complement the aforementioned data. The outcomes obtained from the semi-structured interviews exhibited similar patterns. This

section features overarching themes such as the importance of STEAM, the versatility of digital gamification in promoting STEAM-oriented ESL lessons and diversity of ESL teaching strategies.

The Importance of STEAM
The analysis of the quantitative data revealed that ESL teachers' perception of digital gamification in STEAM-oriented ESL classrooms was examined across four key aspects: perceived usefulness, perceived ease of use, intention and user satisfaction. In accordance with the findings of the questionnaire, the integration of digital gamification in promoting the significance of STEAM ESL lessons is generally regarded as beneficial in terms of its utility, user-friendliness, intention, and user satisfaction by a majority of ESL teachers. This perception is further supported by the following excerpts, which demonstrate the effectiveness of incorporating gamification in boosting comprehension and emphasising the significance of the STEAM approach.

> *"STEAM is an incorporation of the existing STEM component where Art is added to it to create creative students who can do critical thinking as well."*- Teacher 28F

> *"...... it stresses on applying knowledge to real-world situations."*- Teacher 8F

> *"STEAM is an education key to a good career in future industries this is because steam is brought disciplines that helps nurture versatile individuals who are able to equip with various skills."* - Teacher 35F

The findings explore the shift towards an interdisciplinary living technology curriculum and the adoption of the STEAM approach by contemporary Teaching English as a second language teachers which are considered to be a prominent trend in the field of global education (Wahyuningsih et al. 2020). By integrating Art into the educational curriculum, the STEAM approach acknowledges the significance of both technical and creative abilities thereby equipping language learners with a comprehensive range of skills essential for effectively navigating the intricacies of the 21st century. The adoption of these educational practices also holds the promise of augmenting ESL language learners' inclination towards pursuing careers in the domains of science, technology, engineering, arts, and mathematics (STEAM) thereby resulting in a general upsurge in the STEAM workforce as mandated by the Malaysia Ministry of Education.

The Versatility of Digital Gamification in Promoting STEAM-Oriented ESL Lessons
A significant number of ESL teachers envision digital gamification to be positively perceived in terms of its versatility, usefulness, ease of use, intention and ability to promote STEAM-oriented ESL lessons. This perception is supported by the following excerpts:

> *"…they are born with games surrounding them and they never get tired of that."*- Teacher 19F

> *"It added fun elements to my lesson and it encourages my students to participate better in any activity that I prepare for them."*- Teacher 28F

"As for my ESL classroom, it is very important to make the learning process to be fun & interactive."- Teacher 53F

The findings obtained from the interview demonstrated the multifaceted nature and versatility of digital gamification in STEAM education. Digital gamification functions as an educational platform or, as emphasised by Sulistianingsih et al (2019), a multimedia instructional method that exhibits significant promise for augmenting the education system. One crucial aspect of digital gamification utilisation is their ability to enhance ESL language learners' motivation to meet their learning goals as well as to boost their motivation to advance in learning English as a second language by employing fun and positive reinforcement mechanisms such as points and badges. Several digital gamification platforms and applications have emerged to enhance the enjoyment, effectiveness and sustainability of STEAM-based language learning.

The Diversity of ESL Teaching Strategies
ESL teachers also acknowledge the diversity of ESL teaching strategies specifically those that incorporate the use of digital gamification which have been proven to be effective, practical, user-friendly and motivating in fostering the adoption of STEAM education. This acknowledgment is further supported by the subsequent excerpts:

"In modern society, we cannot live without digitalisation. By using this, we can reach more learners in a wider scope at anytime using various interactive E-learning platforms."-Teacher 32F

"We are preparing the language learners for the 21st century learning and I think that we should also equip the students with digital competency."- Teacher 3F

"...... promote synchronous and asynchronous learning when we introduce digital gamification where they could learn English in both formal and informal settings."- Teacher 8F

The findings derived from the interview unveiled the broad spectrum of ESL teaching strategies employed in the utilisation of digital gamification in STEAM education showcasing its diversity in this area. Tracey et al (2017) argue that STEM educators should utilise instructional approaches that integrate culturally relevant arts within educational environments to successfully implement STEAM frameworks in the field of education. Therefore, a range of diverse digital gamification strategies specifically targeting STEAM disciplines have been successfully employed in numerous settings and for a variety of purposes. The significance of designing game-based learning with pedagogically focused and inclusive teaching techniques is highlighted by (Lameras et al., 2017).

Discussion
The utilisation of technology in education has become increasingly prevalent over time as individuals have come to realise the enormous potential of digital gamification tools in enhancing educational experiences for language learners across various proficiency levels (Lim and Yunus, 2021). Teachers who play a crucial role in the educational ecosystem have offered valuable insights into the integration of digital games in STEAM-ESL classrooms. Their

perspectives, especially regarding its perceived usefulness, perceived ease of use, intention and user satisfaction adhering to TAM seem to converge on the potential of digital games to heighten STEAM-oriented ESL lessons.

ESL teachers have a very high degree of favourable perception of the use of digital gamification in STEAM-oriented ESL classes in the "Perceived Usefulness" domain. The mean scores obtained from all the questionnaire items surpass the threshold of 3.4, signifying a persistently elevated degree of perceived utility in several facets of English as a second language teaching and learning. Additionally, the standard deviations are relatively low, indicating that the respondents' views about the usefulness of digital gamification are very consistent and in accord with one another. This analysis highlights the perceived impact of digital gamification on academic performance, English as a second language proficiency, effective learning environments and teaching effectiveness, as well as shows a strong positive inclination among ESL teachers towards its perceived usefulness in incorporating it into STEAM-oriented ESL lessons.

Perceived Usefulness
Teachers' feedback on the success of incorporating digital gamification into STEAM-based learning has been overwhelmingly positive (Sidekerskiene & Damasevicius, 2023; Breien & Wasson, 2022; Breien et.al., 2022; Wannapiroon & Pimdee, 2022; Hsiao & Su, 2021; Lopez et.al., 2021; Houghton et.al., 2021; Herrera et.al., 2021; Alsale et.al., 2021; Kummanee et.al., 2020). ESL teachers also perceived that digital gamification oriented STEAM approach is helpful in enhancing language learners' academic performance. Integrating STEM (science, technology, engineering, maths) with reading comprehension and other English language activities will help learners not only build a strong foundation for academic achievement, establish a solid foundation in content subjects but also enhance English language proficiency, according to Carter et al. and Turkan et al. as cited in (Maarouf, 2019). In addition, a digital gamification-oriented STEAM approach works well to enhance language learners' English proficiency. According to Fan et al (2020), the integration of electronic technology and traditional art education into the STEAM interdisciplinary course design improved the efficacy of language art learning and contributed to the sustainable growth of education.

Furthermore, the use of digital gamification in STEAM education has a good influence on a variety of linguistic skills. Reading skills are popularly mentioned in STEAM digital gamification integration due to its practicality and effectiveness as mentioned in (Getmanskaya, 2021). Furthermore, Raimjanovna's study revealed that STEAM technologies enhance students' communicative achievement in English lessons, leading to a rise in confidence, willingness, and reduced fear while speaking English. Digital gamification in STEAM based English lessons is perceived to provide effective learning environment for ESL language learners as well as enhances my effectiveness in teaching English. Adnan (2020) emphasised that digital gamification is viewed as a beneficial educational tool to facilitate better language learning experiences in the modern digital era when a thorough system shift has been carried out to match the significantly modified paradigm of language acquisition.

Perceived Ease of Use
Within the context of incorporating digital gamification in STEAM-oriented ESL lessons, secondary ESL teachers hold varying perceptions regarding its ease of use. Although many

ESL teachers find the use of digital educational games effective and practical for language learning, there are still concerns about the possible challenges teachers may encounter in utilising these games. ESL teachers primarily find it less difficult to incorporate digital gamification in STEAM, become skilled at teaching STEAM related ESL lessons, and discovering appropriate STEAM digital gamified teaching resources and tools. With the growing popularity of the use of digital games for language learning as a result of technology enhancements ,ESL teachers are more at ease (Peterson et al., 2021). A literature review undertaken by Chen et al (2021) has also highlighted the growing recognition of digital games as an indispensable tool for language teachers in today's educational setting. Furthermore, studies carried out by Jagust et al. in 2018 have shown that the adoption of digital gamification fosters extracurricular and multidisciplinary learning. Therefore, it is plausible to integrate these goals with the notion of digital gamification as a tool for learning aimed at promoting and upholding STEAM Education (Das-Cleophas, 2020). This approach aims at offering learners with a comprehensive education that fosters independent learning and the ability to think critically in everyday situations.

Although the majority of the items show a positive perception of ease of use, there is one item that indicates a lower perception, specifically in terms of the effort needed for digital gamified STEAM teaching preparation. It appears that ESL teachers find teaching preparation with digital gamification in STEAM to be quite challenging. Teachers have expressed concerns about their increasing workload, which has made it difficult for them to collaborate effectively with teachers from different disciplines (Boice et al., 2021). In addition, as noted by Kastriti et al (2022); Maarouf (2019), numerous educators express reservations about STEAM curriculum due to concerns about the additional workload required for implementation in their classrooms. It is interesting to note, according to Kim and Bolger (2017), that while Korean teachers are aware of the prospective benefits of STEAM for education, they are nevertheless quite reluctant to become involved in STEAM education. The standard deviations across all items show that teachers' responses varied, indicating a range of perspectives on the ease of integrating digital gamification in STEAM-oriented ESL lessons.T his analysis focuses on areas where ESL teachers may have varying perspectives on the perceived ease of use and identifies specific aspects of digital gamification in STEAM that may be interpreted differently by educators.

Intention
In the domain of "Intention" in TAM, ESL teachers generally demonstrate a strong inclination towards incorporating digital gamification in STEAM-oriented ESL lessons. The mean scores for all the items range from 3.12 to 3.34, indicating a consistently high level of intention across different aspects of digital gamification in STEAM-ESL classrooms. ESL teachers express a high level of preference for digital gamification based on a STEAM approach over the traditional Chalk-and-Talk teaching method. Various research suggests that integrating the STEAM approach with game-based learning elements could potentially improve learners' performance in comparison to traditional classroom instruction. Similarly, in a study conducted by Abdullah Al-Malki in 2020, it was found that the experimental group had a lower cognitive burden compared to the control group. Language learners have expressed their admiration for the versatility, user-friendliness, effectiveness, and practicality of STEAM technology as an interactive communication medium according to Raimjanovna's study.

In addition, ESL teachers express a high intention to recommend the implementation of digital gamification-oriented STEAM approaches to other teachers. Digital games are a creative and engaging approach for facilitating the learning and acquisition of English as a second language. Research conducted by Vasquez and Ovalle (2019) reveals that a significant number of gamers are drawn to digital games due to their exceptional graphics, immersive sound, captivating plotlines, engaging gameplay, and well-developed characters. Apart from that, the integration of digital gamification in STEAM education has been shown to have a significant impact on the creativity of language learners. Several studies have highlighted the positive effects of this approach (Kastriti, 2022; Lu, 2022; Aguilera & Ortiz-Revilla, 2021; Wahyuningsih et al., 2020; Tabi'in, 2019). Incorporating digital gamification into the STEAM-based ESL classroom can positively impact language learners' critical thinking, collaboration, and technological abilities.

ESL teachers are eager to integrate digital gamification into their STEAM English classes. In his work, Prensky (2001) identified a range of elements that contribute to the appeal of games. These include factors such as enjoyment, play, rules, objectives, interaction, adaptation, outcomes, feedback, win states, conflict, problem solving, representation, and narrative. These components collectively enhance the overall interest and engagement of a game. These elements have the ability to engage players in fun and unique ways. Prensky (2001) identified several key components that contribute to the appeal of games. These include elements such as enjoyment, play, rules, objectives, interaction, adaptation, outcomes, feedback, win states, conflict, problem solving, representation, and narrative. These elements have the ability to engage players in fun and unique ways.

Furthermore, ESL teachers are proponents of incorporating digital gamification into English lessons using a STEAM approach. According to Apriliani (2021), Quizlet is a recommended learning digital tool for language learners. Additionally, VocScape is another platform that can greatly benefit English as a second language learners. According to a study by Jerry & Yunus (2021), VocScape is an offline educational game-based application that has shown promise in improving students' engagement and performance in language learning lessons. It is believed to be the fusion of gamification and e-learning theories. One of the goals of this application is to assist learners in expanding their vocabulary and improving their proficiency in English through engaging and cooperative learning experiences. The findings emphasise the eagerness and positive intention among ESL teachers to incorporate digital gamification into STEAM-oriented ESL lessons, showcasing their openness to innovative teaching methods.

User Satisfaction

ESL teachers exhibit a very high level of satisfaction with the utilization of digital gamification in STEAM-oriented ESL lessons across all measured aspects. Along with this, the standard deviations for all items are relatively low, suggesting a strong consensus among the teachers regarding their perceptions of user satisfaction. The findings indicate that ESL teachers view the use of digital gamification as a valuable and enjoyable method, which enhances language learners' engagement and motivation in English classes.

There is a wealth of research indicating that the integration of digital gamified STEAM into language learning has proven to be highly effective in enhancing students' motivation. Several studies conducted in different countries have shown that English language learners

have a positive attitude towards the implementation of STEAM in English learning. These studies include research by (Lewis, 2023; Breien and Wasson, 2022; Kastriti, 2022; Hsiao and Su, 2021; Huang, 2020; Soroko, 2020; Tabi'in, 2019). A number of studies have shown that many learners find STEAM to be beneficial for improving their English language skills and also find it motivating for language learning (Li et.al., 2022; Kastriti, 2022; Hsiao et.al, 2021; Huang, 2020; Soroko, 2020).

On top of that, numerous researchers have found that online games can enhance motivation and foster positive attitudes towards digital games in English lessons (Abdul Halim et al., 2020). Based on the research conducted by De Souza Jr. et al (2018), incorporating play tools into the teaching process has been found to enhance student engagement and improve learning outcomes. A similar approach can be applied to STEAM education, where the use of digital educational games can motivate learners to engage in the learning process. Breien and Wasson (2022) assert that digital game-based learning has a positive effect on language learners. It increases their interest, motivation, and knowledge retention in the process of learning English. It also improves their readiness to acquire and practise targeted language structures, as well as converse in English. In a recent study by Breien et.al (2022), it was found that incorporating digital gamification in STEAM subjects can significantly boost learners' motivation and satisfaction with the learning process. In addition, integrating STEAM education with digital gamification such as VR-aided experience courses had a positive impact on students' learning satisfaction, outcomes, and motivation to learn (Su, 2019).

Conclusion

This study explores the multifaceted nature of secondary ESL teachers' perceptions towards the application of digital gamification in STEAM-ESL classrooms. The blend of quantitative and qualitative findings offers an all-encompassing viewpoint on ESL teachers' perceptions on digital gamification in STEAM-oriented ESL lessons. ESL teachers generally have a positive perception of digital gamification in STEAM-oriented ESL lessons, indicating high perceived usefulness, intention, and user satisfaction. Although there is consensus on the advantages of incorporating digital gamification into education, there are some challenges identified related to the perceived ease of use for its teaching preparation. The qualitative insights provide a fuller grasp of the factors driving quantitative trends thus enhancing the overall analysis with greater depth. The integrated method strengthens the reliability of the research and offers practical insights for ESL teachers. Furthermore, the findings are in line with the central concepts of recognizing the significance of STEAM, acknowledging the versatility of digital gamification as well as embracing diverse ESL teaching strategies.

Implications And Recommendations

The theoretical implications of this study are multi-layered, strengthening the underpinning of Technology Acceptance Model in exploring ESL teachers' perception towards digital gamification utilisation in teaching STEAM context. By exploring the secondary ESL teachers' perspectives, the study enriches the discourse on the TAM which advocates for their perceived usefulness and perceived ease of use in shaping their intention and user satisfaction in adopting digital gamification in STEAM. From a pedagogical standpoint, the challenge lies in ESL teachers limited experience and exposure to digital gamification in fostering STEAM approach. This entails a pedagogical shift where ESL teachers could consider adopting a digital gamification-oriented STEAM approach in their lessons, leveraging the positive impact on student motivation, engagement, and language learning outcomes. ESL

teachers may benefit from interdisciplinary collaborative efforts in sharing best practices, resources, and strategies for incorporating digital gamification in STEAM-oriented ESL classes.

Last but not least, from a practicality point of view, digital gamification utilisation in STEAM-based ESL classrooms enhance English as a second language learning experiences through its positive impact on learners' learning strategies and motivation (Chen et.al., 2021) and effectively caters to the diverse needs of language learners (Rafiq et al., 2021). It also bring positive impact not only on learners' academic performance but also their English as a second language proficiency level. Digital gamification in STEAM education positively enhanced language learners' both overall language competency and various language skills with a focus on enhancing vocabulary, reading skills as well as communicative achievement.

On top of that, digital gamification utilisation in STEAM-oriented ESL classroom is aligned with our national goal, Malaysia Education Blueprint (2013-2015) in transforming students in readiness for the 21st century emphasizes the concepts inspired by the 4C components namely communication, collaboration, creativity and critical thinking. Even though this study has provided insightful information, it is important to address its limitations. It would be prudent to expand the population size and diversify the sample to increase the study's robustness and aim for a higher response rate in subsequent research projects. While the current study achieved a 85.71% response rate, expanding the participant pool could provide a more representative and comprehensive understanding of ESL teachers' perspectives on digital gamification in STEAM-oriented ESL classrooms. Furthermore, future research should involve both primary and secondary ESL teachers considering the possible disparities in their instructional settings and demands to capture a wider range of ESL teaching and learning experiences.

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