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Integrating sim city in learning urban geography among the second-year students of bachelor of secondary education major in social studies

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A B S T R A C T

With the ever-evolving landscape of education, integration of mobile games into classroom instruction has been remarkable. However, with the advancement of technology, newly developed mobile apps are needed to be evaluated before they can be fully utilized in the teaching-learning process. This study delved into the integration of Sim City, a simulation game focused on constructing cities, into Urban Geography classes with primary focus on evaluating the mobile app's appropriateness, efficiency, and relevance, as well as its perceived impacts on motivation and metacognition of the respondents. The research involved the utilization of mixed-method approach using the explanatory sequential design where the survey method was utilized to determine the evaluation of the respondents on the given criteria and the interview to identify the difficulties and challenges encountered by the respondents which are the second-year BSE-Social Studies students. The quantitative data were analyzed using the mean by employing the Likert Scale and appropriate adjectival interpretations where it was revealed that the mobile app's integration was highly favored. The visual clarity and compatibility of Sim City with the course content had a good impact on its appropriateness. The efficiency results emphasized the game's capacity to improve understanding through a structured learning process and challenging tasks. The relevance was confirmed, particularly in advancing the ideas about smart cities. Furthermore, respondents exhibited enhanced motivation and improved metacognitive abilities. Moreover, the qualitative data were coded and analyzed by employing the content-thematic analysis. It was found that challenges encountered by the respondents included game complexity, financial aspects and resource management, and technical issues.

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RESUMO

Com a paisagem sempre em evolução da educação, a integração de jogos móveis na instrução em sala de aula tem sido notável. No entanto, com o avanço da tecnologia, os aplicativos móveis recém-desenvolvidos precisam ser avaliados antes de poderem ser plenamente utilizados no processo de ensino-aprendizagem. Este estudo aprofundou a integração do Sim City, um jogo de simulação focado na construção de cidades, em aulas de Geografia Urbana com foco primário na avaliação da adequação, eficiência e relevância do aplicativo móvel, bem como seus impactos percebidos na motivação e metacognição dos usuários. A pesquisa envolveu a utilização da abordagem de método misto usando o design explicativo sequencial onde o método de pesquisa foi utilizado para determinar a avaliação dos respondentes sobre os critérios dados e a entrevista para identificar as dificuldades e desafios encontrados pelos usuários que são os alunos do segundo ano de Estudos Sociais da ESB. Os dados quantitativos foram analisados usando a média, empregando a Escala Likert e interpretações adjetivas apropriadas, onde se revelou que a integração do aplicativo móvel era altamente favorecida. A clareza visual e compatibilidade do Sim City com o conteúdo do curso teve um bom impacto na sua adequação. Os resultados de eficiência enfatizaram a capacidade do jogo de melhorar a compreensão através de um processo de aprendizagem estruturado e tarefas desafiadoras. A relevância foi confirmada, particularmente no avanço das ideias sobre cidades inteligentes. Além disso, os participantes mostraram maior motivação e habilidades metacognitivas melhoradas. Além disso, os dados qualitativos foram codificados e analisados utilizando a análise temática de conteúdo. Foi constatado que os desafios enfrentados pelos entrevistados incluíam a complexidade do jogo, os aspectos financeiros e a gestão de recursos, e questões técnicas.

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Introduction

The use of mobile games into regular classroom instruction has become a transformational approach in modern education, reshaping how students interact with and absorb educational content (Pendy, 2023). With the ongoing progress of technology, the integration of mobile games presents a distinct chance to foster a worldwide perspective in educational settings. Through the seamless integration of interactive gaming experiences with academic courses, educators can utilize the potential of mobile games to augment student motivation, foster critical thinking abilities, and cultivate cultural awareness (Lampropoulos et. al, 2022). This new methodology not only addresses the changing requirements of contemporary learners who are accustomed to digital technology, but also cultivates a vibrant educational setting that equips students to traverse a globally interconnected society with a wider and more comprehensive outlook. In this context, the incorporation of mobile games goes beyond being merely a teaching instrument as it serves as a means to access a comprehensive and immersive educational experience that surpasses geographical and cultural boundaries (Farman, 2020; DaCosta & Kinsell, 2022).

Integrating mobile games into classroom instruction has a significant effect on the motivation and metacognition of learners (Zhao et. al, 2021). Mobile games have an intrinsically captivating and interactive quality that can stimulate a heightened level of motivation among students, hence rendering the learning process fundamentally pleasurable (Cheung & Ng, 2021). As learners engage with these games, they are encouraged to utilize critical thinking abilities, problem-solving approaches, and metacognitive introspection (Rivas et. al, 2022). Gaming environments possess dynamic feedback loops that allow students to evaluate their own progress in learning and adjust their techniques accordingly (Abrams & Gerber, 2021). Moreover, the use of mobile games in classroom instruction is compatible with the varied learning styles and preferences of students, promoting a more comprehensive and flexible educational setting (Wang & Jou, 2023). Incorporating mobile game components not only improves the overall learning experience but also nurtures autonomy, curiosity, and intrinsic drive, hence promoting a more profound comprehension and retention of academic knowledge (Christopoulos & Mystakidis, 2023).

Concerning the details presented above, this study aimed to investigate the appropriateness, efficiency, and relevance of a mobile game called Sim City as well as the perceived impact on the motivation and metacognition of the respondents as they study Urban Geography. To define, Sim City is a city-building simulation mobile game series that allows players to design, build, and manage virtual cities (Bereitschaft, 2023). The franchise was first introduced by Will Wright and developed by Maxis, later acquired by Electronic Arts. The initial release, Sim City was launched in 1989, and it has since evolved into several iterations, each introducing new features and improvements. Moreover, within the discipline of human geography, urban geography is a multidisciplinary science that studies the spatial structure,

dynamics, and development of cities and urban regions. It covers a broad range of subjects, including land use, urbanization, cultural diversity, social and economic inequality, and the physical layout of cities (Fyfe & Kenny, 2020).

This study is anchored in the Technology Acceptance Model (TAM) which is a widely used theoretical framework in the field of information systems and technology adoption. It was originally proposed by Fred Davis and later extended by him and Richard Bagozzi in 1989. The model seeks to explain the factors influencing individuals' acceptance and use of technology, in this case, the appropriateness, efficiency, and relevance of Sim City in the study of Urban Geography. Furthermore, another theory was considered which is the Mobile Learning Theory which is said to be essential when thinking of the role of mobility and communication in learning environments (Kearney & Burden, 2020). In mobile learning, students learn across both space and time and move from topic to topic. Like a blended environment, learners move in and out of engagement with technology. A key point in mobile learning theory is that it is the learner that is mobile, not the technology (Richardson, 2013). Considering that learners are the ones who decide whether they are going to partake in a learning process, this idea of learning places a significant emphasis on the learners' motivation and metacognition as the primary areas of concentration when it comes to learning (Drigas & Mitsea, 2021).

The outcome of this study shall be the basis for the crafting of a module that shall be utilized as supplementary learning material for the Social Studies 2nd Year Class who are taking up the Urban Geography course.

The study looked into the integration of Sim City in learning Urban Geography class which specifically answered the following questions, viz.: How do the respondents evaluate the integration of Sim City in learning Urban Geography in terms of: a. Appropriateness;b. Efficiency; and c. Relevance. How do the respondents perceive Sim City integration in learning Urban Geography in terms of: a. Motivation; and b. Metacognition. What are the problems encountered by the respondents in integrating Sim City in learning Urban Geography?

Methodology

To find the answers to the questions under study, the researcher adopted a quantitative approach by conducting a survey. A concentration on objective measurement, statistical approaches, and methodical and structured processes characterizes this method (Nardi, 2018). In addition, the survey method is a common research tool that involves gathering data from a group of people using interviews or standardized questionnaires. Researchers can learn about a population's character, beliefs, habits, and outlook by administering surveys (Cui et. al, 2023). In addition, the calculation of the arithmetic mean was employed in order to ascertain the general evaluation and perspective of the respondents with regard to the criteria that were provided.

Furthermore, a qualitative approach was also utilized in gathering data relative to the difficulties and challenges the respondents encountered through an interview. An interview is a type of qualitative research that takes the form of a conversation in which questions are asked to collect information (Turner III & Hagstrom-Schmidt, 2022). There are typically two or more people involved in an interview, with one of them being the interviewer who acts as the questioner. In this case, an unstructured interview is the form of interview that was employed which offers the greatest versatility. It is not predetermined which questions will be asked or in what order they will be asked. An alternative would be to proceed with the interview in a more impromptu manner, considering the participant's past responses (Szulc & King, 2022).

Unstructured interview question is a method that may be utilized to gain an understanding of the intricate conduct of individuals without imposing any *a priori* categorization that could potentially restrict the scope of the investigation (Applications of Social Research Methods to Questions in Information and Library Science, n.d.). In this case, the challenges and difficulties encountered in the integration of Sim City in learning urban geography class. Following that, the content analysis was utilized to conduct an examination of the data by means of coding and the identification of emergent themes.

Specifically, the instrument that was utilized in this particular research effort is a modified version of the instrument that was utilized in the research conducted by Abenes et al. (2020) in their work titled "Assessment of Students in Digital Game-Based Learning in Teaching Physics 7," which was published in the CiiT International Journal of Automation and Autonomous System. Such study employed the utilization of a mobile application designed for Digital Game-Based Learning in Physics 7 from which a specific section from the entire instrument was utilized. More specifically, the sections that focused on the appropriateness, relevance, and efficiency of the instrument, as well as the perceived impact on the respondents' motivation and metacognition, were used.

Respondents

There are 115 respondents, as population, who took part in this specific study who are second-year BSE-Social Studies students of the College of Education of Rizal Technological University during the first semester of school year 2023-2024 with a specific focus on the Urban Geography course in pursuit of their degree. To ensure compliance with the Commission on Higher Education's CMO No. 75, Series of 2017, and because these students constitute the only groups enrolled in the Social Studies Curriculum course, respondents were selected using a purposive sampling technique which is a non-random technique (Khalefa & Selian, 2021).

By implementing this sampling approach, it can be ensured that respondents fulfill specific criteria wherein, in this instance, they must be enrolled in the BSE- Social Studies program and have engaged in the study of Urban Geography and completed such course at least 80% of the whole semester which is equivalent to four months. Additionally, they should

have played Sim City for at least three months with two or more hours of gametime per week within or prior to the semester as such period may have already given the respondents progress in building their virtual cities covering most of the relevant activities connected to the course content. The focus of this particular study is to gather data regarding the unique perspectives, experiences, and understandings that have been acquired through their engagement with the field of Urban Geography (Obilor, 2023).

The selection of purposive sampling was based on its alignment with the research objective and its ability to gather comprehensive data from individuals who have completed the Urban Geography course. Considering that the respondents are in their second year of the BSE-Social Studies degree, it is likely that they have a fundamental understanding of geography. This makes their viewpoints extremely essential to accomplish the objectives of the study. Furthermore, adherence to CMO No. 75, S. of 2017 ensures that the research conforms to the regulations and standards for academic work set by the Commission on Higher Education. The Urban Geography course is a valuable component of the Social Studies Curriculum, particularly for those aspiring to become social studies teachers, as it provides a specialized area of study.

Data Analysis

The respondents were given the whole 1st semester of the School Year 2023-2024 to play Sim City and to get themselves familiarized with the game context and its other features. Alongside the given playing period was the same period Urban Geography was offered in their class. A semester is composed of five (5) months in Philippine Tertiary Education. In connection with that, at the end of the semester, the survey instrument was disseminated through a Google form link and the respondents were given two (2) weeks to answer. Then, the researcher consolidated the responses and processed them through the Statistical Package for the Social Sciences which calculated the means among the given criteria that implies the utilization of arithmetic mean. The arithmetic mean is a measure of central tendency that enables us to describe the center of the distribution of frequencies of a quantitative variable by taking into consideration all of the observations with the same weight granted to each in contrast with the weighted arithmetic mean, which is a measure of the significance of each individual observation (Salcedo & McCormick, 2020).

In accordance with the research of Abenes (2020), adjectival interpretations of the calculated means were also ascertained using a 5-point Likert scale. On the part of the difficulties and challenges encountered by the respondents, an interview question was incorporated in the Google form link. The gathered data were subjected to coding and identification of emerging themes thus employing the content analysis. The objective of content analysis is to discern recurring patterns within recorded communication. The process entails the methodical gathering of data from a collection of texts, including those that are

written, spoken, or visual in nature. Books, periodicals, newspapers, films, interviews, web content, social media posts, and photographs may be included among the texts (Luo, 2023).

Results and Discussion

Table 1.

Evaluation on the Appropriateness of Integrating Sim City in Learning Urban Geography

Benchmark Statements	Mean	SD	Verbal Interpretation
The presentations and concepts in Sim City are clear and fitted to the user's needs.	4.28	0.83	Strongly Agree
The Sim City Mobile Game used words and terms well-matched to the reading comprehension of the users.	4.41	0.77	Strongly Agree
The mechanisms of Sim City Mobile Game suit the level of capability of the users.	4.26	0.86	Strongly Agree
The illustrations are appropriate and helpful in understanding the concepts covered by the mobile game.	4.43	0.78	Strongly Agree
The mobile game provides applications/ principles in daily life.	4.18	0.92	Agree
The mobile game contributes to less production cost for instructional materials.	3.93	0.99	Agree
The mobile game suits daily use for users.	3.97	1.00	Agree
The mobile game meets the necessity for technology-based urban geography instructional material.	4.39	0.82	Strongly Agree
Over-all	*4.23*	*0.87*	*Strongly Agree*

The table above presents the data relative to the responses of the respondents in terms of the appropriateness of Sim City as it was utilized in learning Urban Geography course. It is evident that benchmark statement 4 which says that, "The illustrations are appropriate and helpful in understanding the concepts covered by the mobile game," received the highest mean of 4.43 with an adjectival interpretation as strongly agree which may mean that that the mobile game's graphics successfully enhance and supplement the knowledge of the topics covered. A study from Dokuz Eylul University in Turkey investigated the impact of mobile learning apps on the academic performance, attitudes towards mobile learning, and animation skills of undergraduate students. The results indicate that mobile learning might enhance students' academic performance and greatly boost their motivation. The study emphasized the beneficial effects of graphics and animations in mobile learning applications (Bağcı & Pekşen, 2018). It is unyielding that the game's graphics are appropriate and helpful in helping respondents understand the intended concepts or information (Bell, 2018). The benchmark statement has a standard deviation of 0.78, suggesting that the values in the dataset are closely clustered around the mean, indicating a high level of agreement among the respondents further supporting that such features, the graphics, enhances the understanding of the respondents.

On the other hand, benchmark statement 6 which says, "The mobile game contributes to less production cost for instructional materials," obtained a mean of 3.93 with an adjectival interpretation of agree. Games played on mobile devices can serve as an efficient and inexpensive educational resource. Not only do they lower the cost of the materials, but they also improve the learning experience by making it more interesting and efficient (Haleem et al., 2022). Such implies that making educational resources with the mobile game is an affordable option (Yadav and Oyelere, 2021). Axelsson (2017) further stated that conventional instruction often utilizes physical learning resources, which might incur high expenses. Electronic learning platforms enable respondents to efficiently and promptly revise plans for instruction and text materials, reducing expenses associated with printing. However, due to some features incorporated in the game, it may become expensive as the respondents may tend to purchase digital currencies just to complete certain tasks. Such benchmark statement obtained a standard deviation of 0.99 which indicates a moderate level of variability or dispersion in the set of values indicating strong agreement among the respondents.

The overall mean is 4. 23 with the adjectival interpretation of strongly agree in the adjectival form. This demonstrates that, even though several benchmark statements received mean values with agree as their adjectival interpretations, the respondents' strong agreement indicates how appropriate Sim City was for learning urban geography. Mobile apps are becoming essential in education, providing a more convenient and adaptable way of learning. The rapid advancement of digital technology has created a conducive environment for the expansion of mobile learning, enabling students to study via mobile devices without limitations of location or time (Yang, 2024).

Table 2.

Evaluation on the Efficiency of Integrating Sim City in Learning Urban Geography

Benchmark Statements	Mean	SD	Verbal Interpretation
The mobile game helps the users to understand the topics in Urban Geography.	4.50	0.77	Strongly Agree
The game progression initiates sequential learning among users.	4.32	0.81	Strongly Agree
The phases in the mobile game present challenging tasks that efficiently help students to learn.	4.37	0.83	Strongly Agree
Concepts in the mobile game were presented from simple to complex.	4.36	0.83	Strongly Agree
Users are more interested in learning Urban Geography while playing Sim City.	4.30	0.89	Strongly Agree
The mobile game helps the users remember certain concepts about urban Geography.	4.38	0.81	Strongly Agree
The mobile game allows students to learn continuously.	4.34	0.83	Strongly Agree
The mobile game procedures are defined and presented clearly.	4.31	0.84	Strongly Agree
Over-all	*4.36*	*0.83*	*Strongly Agree*

Studies indicate that the features of mobile learning apps are directly correlated with the flow experience, a state of total engagement in an activity. Concentration throughout the

flow experience significantly influences learners' inclinations to continue. Hence, the quality of the material is essential for the appropriateness of the mobile learning (Brew, 2024). The value of the standard deviation of 0.87 which manifests a moderately dispersed response from the respondents further exhibiting collective agreement among the respondents.

The table above shows the data relative to the responses of the respondents in terms of the efficiency of Sim City as it was used in learning Urban Geography course. It is seen that the first benchmark statement which expresses, “The mobile game helps the respondents to understand the topics in Urban Geography,” obtained a mean of 4.51 which is the highest, with an adjectival interpretation of strongly agree. Such a benchmark statement emphasizes that the mobile game is to help respondents understand concepts associated with urban geography. The same holds true in the study of Gao et al. (2020) employing a systematic review of mobile game-based learning in STEM (Science, Technology, Engineering, and Mathematics) education which indicates that digital game-based learning may result in increased student engagement, understanding of course material, problem-solving skills, and academic achievement. This further implies that sim city as a mobile game imparts knowledge to respondents regarding diverse facets of urban environments, including but not limited to transportation systems, land use patterns, city layouts, socio-economic dynamics, and other pertinent elements. Evident among the responses the value of standard deviation of 0.77 which indicates a relatively low to moderate level of variability or dispersion in the set of values which reflects strong agreement among the respondents.

However, benchmark statement 5 which says, “Respondents are more interested in learning Urban Geography while playing Sim City,” garnered the lowest mean value of 4.30 with an adjectival interpretation of strongly agree. Such benchmark statement though obtaining the lowest mean, reveals that Sim City was able to make the learners more interested in learning the said subject. In light of this, digital gaming technologies, particularly mobile games, are becoming increasingly recognized as the most effective means of fostering interest for the learning of new languages. Following the implementation of the mobile learning intervention, the students in the experimental group demonstrated a significant increase in their level of motivation (Elaish et al., 2019). A standard deviation of 0.89 which manifests a moderate dispersion of data responses around the mean was computed for the said benchmark statement.

Moreover, the mean score of 4.36 with an adjectival interpretation of "strongly agree" suggests that the majority of respondents express a strong positive sentiment toward the game's efficiency in facilitating the understanding of Urban Geography concepts. The positive mean, when combined with the "strongly agree" adjectival interpretation, implies that Sim City is perceived as a highly efficient and valuable tool for enhancing understanding in Urban Geography coupled with a standard deviation of 0.83 which indicates a generally high level of agreement among respondents regarding the efficiency of Sim City as a tool for learning Urban

Geography. The moderate standard deviation indicates that while the majority of respondents are aligned in their positive evaluation, there are still some variations in opinions, emphasizing the need for further exploration of individual experiences and preferences.

Table 3.

Evaluation on the Relevance of Integrating Sim City in Learning Urban Geography

Benchmark Statements	Mean	SD	Verbal Interpretation
The concepts in the mobile game are consistent to the course content.	4.11	0.93	Agree
The mobile game exhibits economic management in the city.	4.33	0.81	Strongly Agree
The mobile game shows city physical morphology.	4.16	0.86	Agree
The mobile game displays transportation system development.	4.36	0.85	Strongly Agree
The mobile game simulates the provision of health services, education, security and order, etc.	4.39	0.87	Strongly Agree
The mobile game adheres to sustainable development.	4.45	0.82	Strongly Agree
The mobile game promotes the creation or establishment of smart cities.	4.58	0.75	Strongly Agree
The mobile game establishes the importance of sound spatial arrangements.	4.34	0.86	Strongly Agree
Over-all	*4.34*	*0.84*	*Strongly Agree*

The table above presents data on the relevance of Sim City in Learning Urban Geography wherein, benchmark statement 7, which says “The mobile game promotes the creation or establishment of smart cities,” garnered the highest mean value of 4.58 with an adjectival interpretation of strongly agree. This means that respondents strongly agreed with the given statement which suggests that the mobile game has features, elements, or objectives that contribute to or encourage the development of smart cities. The game Sim City has undeniably had a significant influence on the field of urban development and the notion of smart cities. The game provides players with the opportunity to engage in the design and administration of a city, encompassing various elements such as zones, infrastructures and services for the public. This resource facilitates players' comprehension of the intricacies inherent in urban planning and underscores the significance of sustainable development (Mora et al., 2019). A standard deviation of 0.75 was obtained for it which supports the consistency of responses as the given value reveals that there is only a little variation of responses around the mean.

On the other hand, benchmark statement 1 which expresses, “The concepts in the mobile game are consistent to the course content,” gained the lowest mean value of 4.11 with an adjectival interpretation of agree. Though still considerable, it may be gleaned that there are some encounters by the respondents where they found some inconsistent features of the mobile game against the course content. However, with such a score value, it may still be declared that the general concepts in the mobile game are consistent with the course content

which may increase cognitive loads. Liu et al. (2023) conducted a study which revealed that the perceived and actual learning relevance of mobile game-based learning applications are highly influenced by the quality of these programs and the cognitive load experienced by respondents. When learners allocate an excessive number of cognitive resources to knowledge that lacks relevance to their current learning objectives, they are prone to experiencing cognitive overload. Consequently, this cognitive overload undermines their overall efficacy in the learning process. Additionally, the same benchmark statement obtained a standard deviation of 0.86 which indicates that the values in the data set are relatively close to the mean, indicating moderate consistency and less variability thereby exhibiting collective agreement among the respondents on such feature.

With this criterion, the overall mean is 4.34 with an adjectival interpretation of strongly agree. This means that the overall impression among the respondents relative to the relevance of Sim City in Learning Urban Geography is strongly agreed establishing that the said mobile game is relevant in learning the said course or subject. A standard deviation of 0.84 which manifests a moderate amount of variability or dispersion in their responses.

Table 4.

Respondents' Perception on the impact of Sim City in their Motivation

Domains	Mean	SD	Verbal Interpretation
Learning Goal	4.48	0.78	Strongly Agree
Task Value	4.37	0.83	Strongly Agree
Self-Efficacy	4.14	0.86	Agree
Self-Regulation	3.95	0.98	Agree
Overall	*4.24*	*0.86*	*Strongly Agree*

The above table shows the data relative to the perception of the respondents on their motivation after they have integrated Sim City into learning Urban Geography course wherein, among the given domains, domain 1, which is the Learning Goal, obtained the highest mean value of 4.48 with an adjectival interpretation of strongly agree. This demonstrates the fact that the respondents' motivation in relation to the learning goal had a beneficial impact upon the integration of Sim City into the study of Urban Geography. The utilization of Sim City as a teaching tool for the said subject has resulted in a number of favorable outcomes, one of the most noticeable of which is an increase in the level of interest and involvement displayed by students (Arnold et al., 2019). When students use Sim City to study urban geography, their motivation substantially increases, and the educational experience becomes more dynamic and immersive. Sim City also makes the learning process more engaging (Robinson et al., 2021). A

standard deviation of 0.78 which reflects little variability among the responses around the mean further supports that the mobile game is strongly agreeable in terms of its ability to increase learners' motivation.

However, among the given domains, domain 4, which is the Self-Regulation, gained the lowest mean value of 3.95 with an adjectival interpretation of agree. This suggests that respondents' responses were predominantly favorable, indicating that after using Sim City, they were able to take control of themselves and persist in learning the content of the course under study rather than giving up. This proposes that the mobile game has motivated them to pursue more lessons. Self-regulated learning is a process in which individuals take charge of their own learning process and employ strategies to manage their mental and emotional resources in order to accomplish academic or skill-related objectives (Magsino, 2021). When applied to the utilization of a mobile application, the concept of self-regulated learning denotes those individuals actively and independently interact with the application in order to improve their overall learning experience. Respondents have the ability to establish objectives, track their progress, and modify their learning strategies in accordance with their level of comprehension of the subject matter (Hattie & Donoghue, 2016). A standard deviation of 0.98 was obtained which manifests a moderate variation among the responses around the mean solidifying the idea that the respondents collectively agreed that when the respondents used the mobile game, they were able to regulate themselves and continue to learn.

Table 5.

Respondents' Perception on the impact of Sim City in their Metacognition

Domains	Mean	SD	Verbal Interpretation
Declarative Knowledge	4.14	0.89	Agree
Procedural Knowledge	4.20	0.82	Agree
Conditional Knowledge	4.22	0.86	Strongly Agree
Planning	4.24	0.83	Strongly Agree
Monitoring	4.14	0.89	Agree
Evaluating	4.12	0.89	Agree
Information Management Strategies	4.14	0.88	Agree
Debugging Strategies	4.20	0.87	Agree
Over-all	4.17	0.87	Agree

With strongly agree as the adjectival interpretation, the overall mean score is 4.24 overall. This reveals that students' motivation towards learning Urban Geography significantly increased after integrating Sim City into their course. The application significantly enhanced their interest and engagement, making the learning process more dynamic and immersive.

However, the self-regulation domain showed the least positive response, suggesting however, that students were able to take control of their learning process and persist in their studies. A slight distribution of responses around this mean is indicated by the overall standard deviation, which measures response variability and is 0.86 which indicates that respondents' opinions are compactly and consistently distributed around the mean.

The table above presents the data relative to the domains under the Metacognition, wherein, domain 4, which is the Planning, obtained the highest mean of 4.24 with an adjectival interpretation of strongly agree. This means that the respondents were able to improve their planning as the game has exhibited features that require planning skills among the respondents in a way that they establish structured learning path. Mobile applications, particularly those specifically developed for educational purposes, frequently integrate a well-organized learning progression. The app's information is structured in a coherent and sequential fashion, resembling the chapters found in a book or each module within a course. By commencing with less intricate subjects and progressively progressing towards more intricate ones, students have the opportunity to expand upon their existing knowledge (Romiszowski, 2024).

The utilization of a scaffolding method serves to strengthen pre-existing knowledge and facilitate a more profound comprehension of novel concepts. A well-organized path offers a reliable and foreseeable educational encounter. Students possess a clear understanding of forthcoming events, thereby mitigating anxiety and enhancing concentration. Progress metrics, such as accomplishment percentages or badges, are frequently incorporated into structured learning paths. These strategies have the potential to enhance student motivation and facilitate the establishment and attainment of educational objectives. Certain applications modify the educational trajectory according to the student's academic achievements, offering a more tailored and efficient learning encounter (Allan, 2023). A standard deviation of 0.83 which indicates that there is a slight variation on the responses of the respondents was obtained for the said domain.

On the other hand, domains 1 and 5 which are Declarative Knowledge and Evaluating, respectively, gained the lowest mean of 4.14 with an adjectival interpretation of agree. Though still considerable, the respondents agreed that Sim City has improved their Declarative Knowledge and Evaluating Skills. Mobile applications have demonstrated substantial enhancements in learners' declarative knowledge and evaluative abilities in the context of learning. The dynamic and engaging aspect of mobile apps can boost declarative knowledge, which refers to the ability for recalling facts and concepts. These applications frequently include multimedia components and gamification strategies to enhance the enjoyment and memorability of the learning process, thereby enhancing the retention of knowledge (Johannsen et al., 2023). Both also obtained the same standard deviation of 0.89 which reflects a minimal variability among the responses further supporting that the respondents solidly

agreed on the improvement of declarative and evaluating skills after using the mobile application.

As a whole, the overall mean is 4.17 with an adjectival interpretation of agree and a standard deviation of 0.87 which explicitly manifests that the respondents generally agreed that the standard deviation exhibits a moderate variability of responses and that they are compressed around the mean value. As a result of this, it is clear that the respondents are in agreement that they have improved their metacognition, notably in the areas of planning, declarative knowledge, and evaluating skills.

Difficulties and challenges encountered by the respondents in integrating Sim City in learning Urban Geography

When utilizing emerging technologies in the actual classroom setup, it is imperative that respondents may encounter some difficulties or challenges in the technology itself or in utilizing it. In Sim City, the respondents in the foregoing study faced a numerable challenge that added complexity to the gameplay experience. The first one is that, as they advance to higher levels, obtaining items for expansion becomes increasingly difficult, requiring strategic planning and resource management. However, mobile game designers must often employ a progressive difficulty curve to captivate players as the game progresses. As the players advanced through the stages, the challenges became increasingly hard; overcoming these challenges gave them a sense of accomplishment (Aslan, 2016).

The respondents have also encountered a notable problem in the form of the game's financial stability, which presents a continual difficulty throughout the game and makes it difficult to obtain support for ambitious projects. Simoleons are the primary type of currency in the video game Sim City. They are also an essential component in the process of constructing and managing the user's virtual city. It is essential to have a thorough understanding of the worth of Simoleons to play the game efficiently. Simoleons can be used for a wide variety of purposes (Stephens, 2016).)

The slow gathering of resources and the potential lack thereof further heighten the game's difficulty, emphasizing the importance of effective resource management. Building structures without proper planning proves challenging, underscoring the need for thoughtful urban development. The process of effectively managing resources in Sim City is both dynamic and strategic. It requires players to make decisions based on accurate information to meet the ever- changing requirements of their virtual city. One of the most important aspects of developing a successful and sustainable urban environment is striking a balance between the needs of a growing population and the limited resources that are available (Lin and Lin, 2017).

The game also prompts the respondents to navigate the delicate balance between dedicating time to studying urban geography and engaging in Sim City gameplay. Though the

respondents may have encountered difficulty in this, they have to play the said mobile game and study Urban Geography at the same time because Sim City challenged the students to design and build economically viable virtual cities; a task expected to promote systems and critical thinking, as well as the acquisition and use of knowledge regarding urban geography, politics, and planning (Bradley, 2023).

There are also technical and storage concerns that might affect the entire game experience. One example of this is lag which occurs when there is not enough storage space. Because the aforementioned game has quite a high level of system requirements, it is recommended that it be played on mobile devices that are capable of meeting such criteria. There are a lot of software and hardware constraints that must be considered throughout the lengthy and intricate process of making video games. Compared to game consoles and personal computers, the resources available to mobile devices are severely limited, making this procedure significantly more challenging for mobile games. Because of this limitation, performance is now one of the most important needs, necessitating extra care in the design and development of video games. There are optimization strategies that can be performed at various phases of development to reduce a game's resource usage (Koulaxidis and Stelios, 2022).

Conclusion

The study reveals that Sim City's visuals significantly enhance understanding of Urban Geography, making it an appropriate tool for studying urban geography course. The game's efficiency and relevance to the course were emphasized, and its integration enhances respondents' motivation and metacognition. Respondents encountered a number of problems. When playing Sim City, getting expansion things gets harder as the game levels up. This makes strategic planning and resource management very important. Because Simoleons, as in-game currency, are so important, keeping the game's finances stable is incessantly a problem. This makes it harder to support big projects. Slowly gathering resources makes the game even more difficult, which shows how important it is to handle resources well and build cities carefully. Respondents have to find the right balance between learning about urban geography and playing the game. This is because they have to foster systems thinking and enhance their acquisition of information in developing their cities. Because of technical and storage issues, like lag from not having enough storage spaces, the respondents can only play on devices that meet the system requirements. Notwithstanding those challenges, addressing technical and gameplay difficulties enhances the integration of instructional technology.

Recommendations

The education sector, particularly teachers and educational institutions, may consider the integration of various mobile applications in their daily classroom instructions. In this case,

a mobile game can be utilized to optimize the student engagement. As what is needed, students should be given the opportunity to grasp the ideas of the mobile game hence, requiring an adequate time for orientation especially with the structure of the game so as to inform them of what to expect during the gameplay. Also, when integrating various mobile games in the actual classroom instruction, the respondents should be well informed of the progression and the relevant details to be utilized for such progression like the use of virtual money in accomplishing certain tasks, resource management and planning. Furthermore, the utilization of mobile games may be well regulated so as not to compromise the time for actual study of a certain course by playing the game all the way. It is likewise considerable that the teachers may opt mobile games that are at par with the capability level of the learners in terms of handsets or relevant devices and even internet connectivity. Moreover, teachers may use pedagogically appropriate mobile games to aid the delivery of their lessons without compromising the quality of learning.

Following the establishment of the app's appropriateness, efficiency, and relevance, as well as its impact on the learners' motivation and metacognition in the process of learning urban geography, a study may be conducted in the field of research with the purpose of determining whether or not Sim City is effective in improving the academic performance of learners. This study may be conducted using a quasi-experimental design or any other research design that is pertinent to the topic at hand. It is also possible to carry out the same study in a different location, or it might be expanded to encompass a wider range of research using the same mobile game and course of study to further determine the extent of the pedagogical potentials of Sim City.

Limitations

At the time that this study was being conducted, the respondents were second-year students of the Bachelor of Secondary Education major in Social Studies who were taking urban geography as a course in the College of Education at Rizal Technological University – Mandaluyong. The purpose of this study was to evaluate the integration of Sim City into the process of learning about urban geography, as well as the perceived impact of such a mobile game on the students' motivation and metacognition. They were selected to be the respondents because they were registered in the previously mentioned course, which demonstrates that they have first-hand knowledge of the material that will be covered in the course. They were provided with two days to play the game each week during the entirety of the semester, and at the conclusion of the term, the survey questionnaire was distributed over an online platform.

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Disclosure of Conflict of Interest

No conflict of interest.

Ethics Statement

The researcher used an internet-based platform to gather information from the respondents. In order to express consent, respondents in this study had to consciously do actions (such as clicking a link in an online survey). Respondents had the option to decline participating in the study if they did not give their consent. This guaranteed that it was a voluntary involvement. The researcher's pledge to protect respondents' identities was made clear in the consent form, which also stated that no specific comments that would allow for identification would be mentioned. Furthermore, neither a person nor an organization was harmed by the study, nor did the respondents get any financial compensation. In order to maintain confidentiality, all responses were carefully handled, safeguarded, and disposed of as soon as the study was over.

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