Exploring motivations for social games in virtual reality for smart cities

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Abstract. The Metaverse is experiencing widespread adoption by organizations aiming to elevate brand engagement, particularly in computer engineering's burgeoning field focused on virtual world gamification. This trend spans various sectors, including network science, smart cities, and online games. This study aims to reveal the motivations driving the use of virtual media, providing valuable insights into diverse user preferences. Integrating this information into smart city development holds promise for enhancing responsiveness to user needs, making our dataset relevant for both governmental and private entities seeking to create virtual media platforms or smart cities tailored to user demands. This research contributes to the ongoing evolution of smart city design, aligning with user motivations and adapting to evolving trends in user behavior. The findings offer a foundation for informed decision-making, promoting a user-centric and responsive approach in developing virtual experiences within the smart city context. Our research paper focuses on investigating the motivation and necessity of virtual reality (VR) games for potential integration into smart cities. Targeting a specific demographic of 40 individuals aged 18 to 24 in the capital of Thailand, we utilized correlational research methods to explore motivations and needs for VR games. Through the development of a socially virtual game-free asset using Unity, our experiments shed light on the significant motivations for Generation Z in Thailand, emphasizing convenience, product appearance, and game effects. The findings highlight the pivotal roles of social engagement and the motivation for self-disclosure in building relationships. Additionally, our study suggests that social connections and shared experiences strongly motivate individuals to participate in gaming activities. Notably, female players are significantly influenced by social connections, while branding has a minimal impact on their motivation and desire.

Keywords: Virtual reality, metaverse, smart cities, games, motivation, correlational research

1. Introduction

Various businesses are increasingly adopting virtual environment simulation tools to enhance brand engagement, spanning sectors such as automobiles, consumer products, smart cities, and online games. The utilization of this technology in marketing strategies has gained significant popularity. According to statistics presented in the StepsAcademy article, the number of people using virtual reality (VR) was 171 million in 2018. Furthermore, 62% of consumers reported feeling more engaged with brands when experiencing them through VR, with 71% expressing a belief that VR adopters are forward-thinking brands. Moreover, Kuznetcova et al. in 2023 [10] provided a

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comprehensive overview of the advancements in VR games and training, with a specific emphasis on enhancing visuospatial self-efficacy. Furthermore, López-Fernández et al. in 2023 [12] introduced a serious game designed for learning Scrum, a utilized methodology in the software industry. Furthermore, the integration of VR areas in the context of smart cities gives a promising avenue for solving the expanding complexity and usability challenges associated with modeling Zero Emission Neighborhoods (ZEN) and Zero Emission Buildings (ZEB), as discussed by Kohli et al. in 2022 [9]. The study conducted by Wiberg et al. in 2021 [23] underscores the significance of immersive technologies like VR in effectively handling vast datasets, catering to both top-down municipal planning and bottom-up project planning. In the intricate landscape of smart cities, where diverse stakeholders ranging from planners and architects to researchers and citizens play pivotal roles, the ability to dynamically and interactively visualize complex data becomes paramount. VR emerges as a powerful tool for facilitating engagement and decision-making processes, allowing stakeholders to comprehend and contribute to the design of future ZENs even without scientific backgrounds. The results of this research highlight VR's potential to communicate key performance indicators (KPIs) effectively, promoting citizen engagement, supporting interdisciplinary collaboration, and aiding professionals, particularly architects, in early design stages to reduce greenhouse gas emissions at both building and neighborhood scales. While the VR application is experimental, additionally exploration is warranted to expand its capabilities, compatibility with other VR applications, and its adaptability, as presented by Siriborvornratanakul [18,19]. It serves as a compelling testament to how VR can enhance stakeholder participation and seamlessly integrate knowledge in science into the early stages of smart city design, ultimately contributing to the advancement of sustainable urban environments. In other words, the growing adoption of virtual environment simulation tools spans various industries, from automobiles to consumer products, with businesses leveraging this technology to enhance brand engagement. The popularity of VR in marketing is evident, with 62% of users expressing increased brand engagement through VR experiences. Additionally, research has underscored the potential of VR in the gaming realm, focusing on advancements in VR games and training, as well as the development of serious video games for learning methodologies like Scrum in the software industry. While VR's integration in smart cities shows promise for addressing complex challenges, a primary emphasis here is on exploring the motivations behind VR gaming, acknowledging its significance as a standalone aspect of technology and entertainment.

From an e-commerce standpoint, despite the prevalence of online shopping, individuals still crave the ability to see products and engage with customer service representatives. The capacity to physically inspect a product continues to be a distinguishing advantage for brands. Augmented Reality (AR) and VR technologies have started to enhance the online shopping experience, rendering it more comfortable, convenient, and expediting purchasing decisions. In a recent study, Shoshani in 2023 [17] explored the impact of prosocial games for VR on the prosocial behavior of preschool children in real-life settings. The study delved into the potential mediating role of positive affect and a sense of competence in connecting VR prosocial play to prosocial behavior in the real world. Additionally, Muravevskaia and Gardner-McCune [15] conducted a study in 2023 to examine the efficacy of VR in fostering empathy among children aged 6–9. They introduced an empathy game using VR based on findings from a participatory design study involving 11 children and insights from the Early Childhood Development study. Similarly, Tsuei and Chiu [20], in 2020, explored the effects of two mudslide applications using VR by comparing different usability designs on young people's learning motivation and presence experience. Their findings suggest that the low-polygon mudslide application using VR, specifically designed as a game for usability, enhanced young people's learning about mudslide disaster precautions, particularly among boys. Furthermore, Cuthbert et al. [3] conducted an experimental study to investigate the impact of a motivational design principle, specifically functional and aesthetic customization, on players' experiences in a VR game. The study's findings revealed that customization positively influenced players' sense of autonomy and the need for satisfaction and enjoyment within the VR game environment. These results carry significant implications for individuals interested in designing motivational VR applications for physical rehabilitation purposes.

Considering the aforementioned factors, the researchers focused on studying the requirements and driving factors influencing individuals from Generation Z in Bangkok who engage with VR games. Generation Z was chosen as the primary target audience due to their high level of activity and involvement in gaming. The research question was derived from Newzoo, an analysis and survey platform that delves into consumer behavior within the market for video games. The survey found diverse motivations for playing games, such as achieving goals, challenging oneself, practicing planning, witnessing character growth and development, immersing in the survey and story within

the game, and selecting easy games for quicker completion. These motivations demonstrate the varied perspectives consumers hold towards gaming, which can be influenced by factors such as state, context, or demographic characteristics. When games are played using virtual environment simulation technology, physical factors also come into play. Some individuals may experience no abnormalities, while others may experience motion sickness, characterized by dizziness caused by a mismatch between visual perception and the inner ear's sense of balance – a common occurrence among gamers in virtual environments.

Based on the factors mentioned above, our main contribution is centered around conducting a comprehensive study on the motivations of Generation Z individuals in Bangkok who engage with VR games. By focusing on this specific demographic, our research aims to shed light on the preferences and desires of this target audience. This understanding will not only benefit the students involved in the study but also readers who have access to this research. They can utilize the findings to foster innovation, further develop the gaming market, and create games that cater to the evolving needs of consumers in the future. The results of our study hold the potential to build a better comprehension of gaming motivations among Generation Z individuals in Bangkok. This knowledge can be leveraged by various stakeholders, including government bodies and private companies, to drive advancements in the gaming industry. By aligning game development and marketing strategies with the identified needs and motivations, the industry can better serve its target audience, resulting in enhanced user experiences and increased market demand.

Moreover, the insights gained from our research can inform decision-making processes within the government and private sectors, guiding resource allocation and planning linked to the VR development of games. Understanding the motivations of Generation Z gamers in Bangkok can provide valuable guidance for future research endeavors and help shape policies that support the growth and sustainability of the gaming industry. Ultimately, we aspire that the outcomes of our study in this paper will not only contribute to academic knowledge but also have practical implications for practitioners in industry, game developers, and smart city implementors. By catering to the needs and motivations of Generation Z gamers, we can foster a more engaging and fulfilling gaming experience while driving the progress of the gaming industry as a whole.

The integration of virtual environment simulation tools, such as VR, into the development of smart cities holds profound implications for society. As highlighted in the research, VR technology serves as a powerful tool in addressing the increasing complexity and usability challenges associated with modeling ZEB and ZEN. In the context of smart cities, where diverse stakeholders play pivotal roles, the ability to dynamically and interactively visualize complex data becomes paramount. VR emerges as a key enabler for facilitating engagement and decision-making processes among stakeholders, including planners, architects, researchers, and citizens. This immersive technology not only helps in visualizing and comprehending data but also promotes citizen engagement, supports interdisciplinary collaboration, and aids professionals, particularly architects, in early design stages to reduce greenhouse gas emissions. By aligning VR applications with the identified requirements and driving factors influencing individuals of Generation Z individuals in Bangkok, smart cities can further enhance their responsiveness to user demands. This holistic approach, integrating insights from consumer behavior, motivations, and immersive technologies, contributes to the creation of smart cities that are not only technologically advanced but also user-centric and sustainable. The outcomes of the study in this paper not only have academic value but also give practical implications for urban planners, government bodies, private companies, and game developers, fostering a symbiotic relationship between technology, society, and the advancement of smart city design.

In this paper, we seek to illuminate the motivations behind the usage of virtual media, offering valuable insights into the preferences of various user groups. The integration of this knowledge into the development of smart cities has the potential to significantly improve responsiveness to user needs. As a result, our dataset becomes pertinent to both governmental and private entities aiming to create virtual media platforms or smart cities that effectively meet user demands. This research contributes to the ongoing progression towards smart city design that not only aligns with user motivations and needs but also adapts to the evolving trends in user behavior. The findings provide a foundation for informed decision-making, fostering a more user-centric and responsive approach in the development of virtual experiences within the context of smart city initiatives.

2. Literature review and research hypotheses

To study the factors related to the motivation for playing VR games among Generation Z individuals in Bangkok and to understand the underlying reasons behind these factors, we conducted experiments involving the target audience and collected relevant data.

2.1. Uses and gratifications

The Uses and Gratifications Theory, initially presented by Katz and Blumler [8], defines the audience's selection of media based on their specific needs. According to this theory, individuals choose different forms of media to fulfill their unique requirements. As Grissa [6] discusses, the theory focuses on explaining audience behavior and the underlying causes behind media selection. Therefore, media production should be designed in accordance with the audience's needs and interests. Furthermore, Ball et al. in 2021 [1] provided valuable insights into the potential changes in the utilization and gratifications of VR and device ownership/variability as a result of the perceived impacts of COVID-19. Their study highlighted the significance of different VR applications during the virus outbreak, demonstrating that the desire for social interactivity plays a mediating role in the relationship between the impacts of COVID-19 and individuals' intentions to adopt VR in the future.

Considering the context of gaming, Goh et al. [5] explain that motivation often arises when individuals engage in activities such as interacting with others or seeking enjoyment. Additionally, Wang and Goh's in 2020 [21] research complements this explanation by highlighting the influence of social factors on gaming, including the number of players, the fun derived from playing games, the interaction with others, the pursuit of gaming experiences, and the sharing of those experiences. These factors significantly impact gaming intent, as explained by Wei and Lu [22] in the context of mobile gaming, where individuals intend to play games on their own devices to seek fun, enjoyment, and interaction with other players on the same gaming platform. In the case of VR gaming, which relies on a sense of social presence, the aforementioned factors become crucial in generating a strong desire to engage in such games, as described by Chen et al. [2]. Additionally, Faralla et al. in 2021 [4] conducted research on the impact of experiencing further self-continuity within a CAVE automatic virtual environment on the ability to delay immediate gratification. Their study involved participants making choices between monetary options available either sooner or later, and the findings revealed that individuals were more likely to opt for delayed gratification after exposure to VR.

2.2. Smart cities

In our previous work, the study conducted by Meksumphun and Kerdvibulvech in 2022 [14] represents an initial contribution to VR. While our previous work delved into understanding the needs, motivations, and product factors related to VR games through correlational research, the present study takes a step further by examining the needs and motivations of Generation Z individuals engaging with VR games in the context of Bangkok, Thailand. This extension of research not only provides valuable insights into the preferences and behaviors of a specific demographic but also hints at the broader implications for smart cities and societies. Understanding the motivations and needs of individuals engaging with VR content can inform the development of immersive and interactive experiences within smart city environments, potentially enhancing citizen engagement, education, and entertainment. By employing tools and methodologies grounded in the Uses and Gratifications theory, this work not only contributes to our comprehension of VR adoption but also opens doors to leveraging VR as a means to enrich the urban experience in the evolving landscape of smart cities.

2.3. The concept of game types affects game motivation

Hussain et al. [7] provide an explanation that different types of games have a significant impact on players' motivation to engage with them. These game types can be categorized into novelty-oriented, social and discovery-oriented, aggressive, highly social and competitive, low-intensity enjoyment (fun) games, and games that cater to specific social groups. The preferences and behaviors of players towards each type of game are influenced by demographic factors such as gender and age, as explored in the study conducted by Malik et al. in 2020 [13].

When a game strongly motivates and captivates players, it can lead to addictive behaviors, commonly known as game addiction. Gunuc's research (2015) concludes that game addiction behaviors manifest in various forms, and regardless of the type, they tend to elicit similar responses. Gunuc's study was conducted on a sample of 200 students in the eastern region of Turkey and found a negative correlation between internet addiction behavior and internet usage, which aligns with the current state of research as presented by Wongwarawipat in 2013 [24]. Wongwarawipat's research highlights the critical factors associated with game products that influence players' motivation to engage with online games. The three key factors identified include game content, game system, and game graphics. The content of the game plays a critical role in shaping the direction of gameplay, influencing the emotions and experiences that players encounter. Wutthiprahman's analysis [25] of the research findings reveals that players' motivation in terms of game content is driven by the need for stress relief, followed by the desire for competition, recognition, and praise for their playing skills. The content and system surrounding the game play a crucial role in determining the emotional direction of players.

In general, mobile games refer to games that can be played on mobile phones and are classified as Value Added Services (VAS). This paper provides a categorization of games based on their characteristics. The game types are described as follows:

1. Action game (Action): This type of game involves controlling a character to engage in fights or missions.
2. Simulation game: These games allow players to assume a role and interact in a fictional world, carrying out activities according to the story.
3. Sports game (Strategy Game): This category includes strategy games that require the management of available resources to achieve maximum efficiency. Many of these games revolve around war or military themes.
4. Casual Game: Casual games are designed to be easily understood and played. They serve as a way to pass time and relax, focusing on providing a simple and stress-free experience for the player.

Additionally, the paper explores Role-Playing Games (RPGs), where character development is a key aspect, and players gain experience throughout the game. Furthermore, we investigate different game types on the VR platform based on data obtained from the Oculus Store. The Oculus Store serves as a central platform for downloading games for VR. By surveying the Oculus Store's VR platform, smaller categories of VR games can be identified. VR games are characterized by their ability to simulate player actions and provide detailed and flexible game content compared to regular games. Each game type has distinct content, systems, and graphics. These variations in game types can influence consumer motivation differently, as mentioned earlier.

2.4. Concepts of demographic characteristics are affecting game motivation

Lee [11] conducted research on the relationship between individuals with similar personalities and social expressions. The study revealed that groups of people who share similar personalities and social expressions are more likely to form friendships compared to individuals with different personalities. This finding aligns with the influence of peers in gaming, as described by Wei and Lu [22], where the external impact of the network plays a crucial role. When individuals join a game and provide benefits to other users in the network, it leads to network growth, attracting more users to use the game service. This phenomenon is influenced by the presence of people in their social circle using the same game commercially.

Demographic characteristics play a significant role in consumer product selection, influencing consumer experiences, perceptions, values, and social relationships. Therefore, analyzing the impact of demographic factors is essential. The researchers conducted further analysis on different age groups and found that age variables align with the concept of categorizing people by generation. The study identified four age groups, with Generation Z (18 to 24 years old) having the highest usage and adoption rate, particularly in social networking. However, acceptance of social media does not tend to increase with age. The Generation Y group (25 to 35 years old) demonstrated the second-highest acceptance of social networks, followed by Generation X (36 to 50 years old), and lastly, the Baby Boomers or Gen B group (51 years and older).

The study specifically targets the Generation Z demographic in Bangkok. The rationale for this choice lies in Generation Z's notable inclination towards social networks compared to other age groups. Building on these observations, the research hypothesis posits that Generation Z individuals in Bangkok, characterized by their unique population attributes, display distinct gaming motives.

3. Methodology

This research adopts a correlational research model and seeks to examine the usage of VR technology glasses among the target group to understand their desires and motivations for engaging with VR applications and games. The experimental process includes offering users the chance to experience two games designed explicitly for testing purposes, followed by a one-on-one interview conducted after the gaming session.

The first game consists of two modes. The first mode is a low graphics mode that offers easy gameplay, while the second mode is a high graphics mode that is more challenging. Both modes have the objective of finding a way out of a room. By introducing varied game elements aimed at achieving the same objective, researchers can gather data and assess assumptions regarding the influence of the game product on the motivation to play among Generation Z individuals in Bangkok.

The second game allows users to create characters and interact with other players. After testing the program, a questionnaire will be conducted to study the results and determine whether they align with the set assumptions. The research design for this study is a One-Shot Case Study, which involves examining the test results after the experimental process.

The research incorporates independent and dependent variables, with a focus on the concepts of demographic characteristics influencing game motivation. The independent variables are factors that precede and influence various outcomes, such as the behavior of Generation Z users in different age groups. The dependent variable is the test result of the program's function, which, in this paper, is categorized into three parts.

The first part is the low graphic prototype, a role-playing game where a magician is trapped in a laboratory, and the player must find a way out of the room. This mode features low graphics, making it easier to locate objects. The second part features the high-graphic prototype, posing greater challenges due to the sharpness of graphics and textures, making it more difficult to locate objects. The goal remains consistent: finding a way out of the room. By introducing diverse application elements for the same objective, researchers can collect data to assess assumptions regarding the product's influence on game motivation among Generation Z individuals in Bangkok.

The third part involves testing with Oculus Home, where users can create identities and experience social influence within the game. This mode allows testing of acceptance, knowledge, and experiences gained from immersing oneself in the game environment and interacting with others. The presence of mirrors in the game enables players to adjust their appearance and shape their character's identity. This second game was included because research suggests that social engagement and the motivation for self-disclosure contribute to building and maintaining relationships. By allowing players to express their identities and interact with others, this game component aligns with the research findings on motivation for self-disclosure.

The research and one-on-one interviews targeted individuals within the Generation Z age group (18–24 years old), amounting to a total of 40 participants. This age cohort was selected due to its notable percentage of innovation adoption and constitutes a demographic with the highest prevalence of game players. The research employed the Oculus Quest 2 as the chosen instrument, recognized for its user-friendly interface and being the latest VR device available during the testing period. Table 1, detailing the features of the Oculus Quest 2, is available but not included in the provided text.

Experimental Medium: To gather data for testing and validate the researchers' hypothesis, two games in the form of applications were developed as the experimental tools. Game 1 consists of two modes, namely the high graphics mode and the low graphics mode. These games were developed using Unity, with the assistance of Free Asset provided by Unity Technologies. Figure 1 displays an image captured during the game development process using

Table 1

Oculus Quest 2 specs briefly

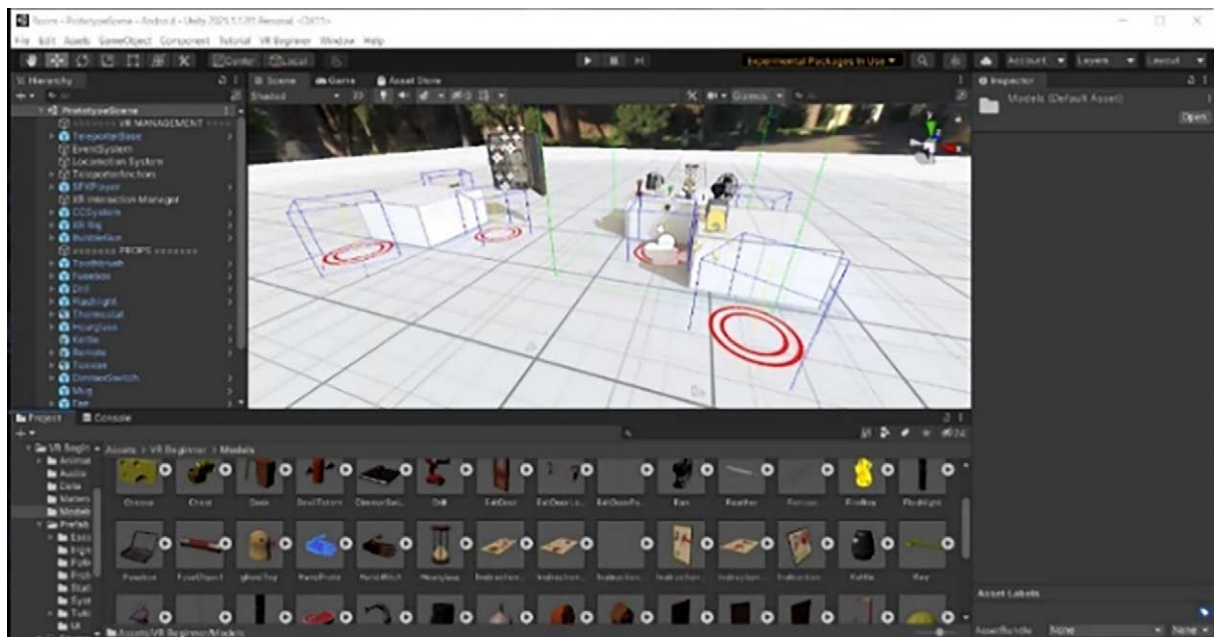| Specs	Detail
Product dimensions	191.5 mm × 102 mm × 142.5 mm (strap folded in), 191.5 mm × 102 mm × 295.5 mm
Product weight	503 g
Tracking	E.g., discussion boards, blogs, and e-mail
Storage	256 GB

Fig. 1. Image during game development with Unity.

Unity. The second game utilizes functions available in Oculus Home to facilitate detailed testing. The specifics of the games are described below:

a. Game Development – Escape Room: This game offers two modes, the low graphics mode and the high graphics mode, and falls under the category of a role-playing game. Participants take on the roles of magicians confined in a laboratory room and must devise a strategy to break free. In the first mode, low graphics are employed to facilitate easy gameplay by making objects easier to locate. Conversely, the second mode features high-quality graphics with detailed textures, posing a greater challenge in finding objects. The objective of both modes remains the same – finding an escape route from the room. By introducing different game elements for the same objective, data can be collected to evaluate assumptions 1 and 3.

b. Testing with Oculus Home: This portion of the experiment aims to evaluate participants' perception and experiences when immersing themselves in the game and engaging with other players. The game will provide a simulated environment, incorporating mirrors that allow players to customize their character's appearance using various pre-existing functions available on Oculus Home. This testing phase will provide insights into the participants' interaction and immersion levels within the virtual environment.

Questionnaire: After experimenting with the sample, the researchers used questionnaires to collect data for questionnaires and sample groups. By the nature of the questionnaire, they are closed-end questions consisting of 2 parts, consisting of 15 questions:

a. Part 1 Questionnaire on general information of respondents
b. Part 2 Questionnaire on motivations impacting Generation Z in VR Games, Bangkok

Table 2 delineates the criteria utilized for measuring and categorizing age data. In contrast, Table 3 displays the questions related to motivation reasons. In this work, characteristics of inquiries and scoring criteria in the questionnaire are utilized as a tool. The questionnaire comprises closed-ended ones. The first part was a questionnaire on general information of the respondents which consisted of 4 closed-ended questions with a dichotomous question and a multiple-answer to choose from. (Multichotomous Question) including

a. Gender or sex (Nominal Scale)
b. Age (Ordinal scale)

Table 2

Measurement and categorization criteria for the age data

Variables	Measurement	Classification criteria
Gender or sex	Nominal scale	1 = male
		2 = female
Age	Ordinal scale	1 = 18 years old
		2 = 19 years old
		3 = 20 years old
		4 = 21 years old
		5 = 22 years old
		6 = 23 years old
		7 = 24 years old
Levels of education	Ordinal scale	1 = elementary education
		2 = junior high school
		3 = high school or equivalent
		4 = bachelor's degree or equivalent
		5 = master's degree or equivalent
		6 = Ph.D. or equivalent
Career	Nominal scale	1 = student
		2 = government service/state enterprise
		3 = employee/private company employee
		4 = private business
		5 = other (specify)

Table 3

Questions for reason motivation

Variables	Measurement	Classification criteria
1. Hints and playing guides can provide you with detailed information about the game's content.	Interval	1 = lowest motivation degree
2. Various illustrations can tell how to play the game as well		2 = low motivation degree
3. Does having someone you know play the same game as you make you more interested?		3 = moderate motivation degree
4. How can immersing yourself or projecting your imaginary self into creating a character in the game enhance your motivation to play?		4 = high motivation degree
5. Does the product's attractive appearance capture your interest?		5 = highest degree of motivation
6. Does the ease of using the product make it more appealing to you?		
7. Does the association with a well-known brand increase your interest?		

    c. Levels of education (Ordinal Scale)

    d. Occupation (Nominal Scale)

The second part of the study involved administering a questionnaire to assess the factors influencing the motivation of Generation Z individuals when it comes to VR games. Figure 2 illustrates the rendering on VR within the game we developed, whereas Fig. 3 presents the VR rendering from various perspectives. The questionnaire consisted of two main areas:

First is Reasoning Motivation (Ordinal scale). This section aimed to determine the reasons and logical motivations behind participants' engagement with VR games. The questionnaire utilized a scale with five levels to evaluate the level of reasoning motivation. The interpretation of the results relied on average criteria for computing the width of the class rate.
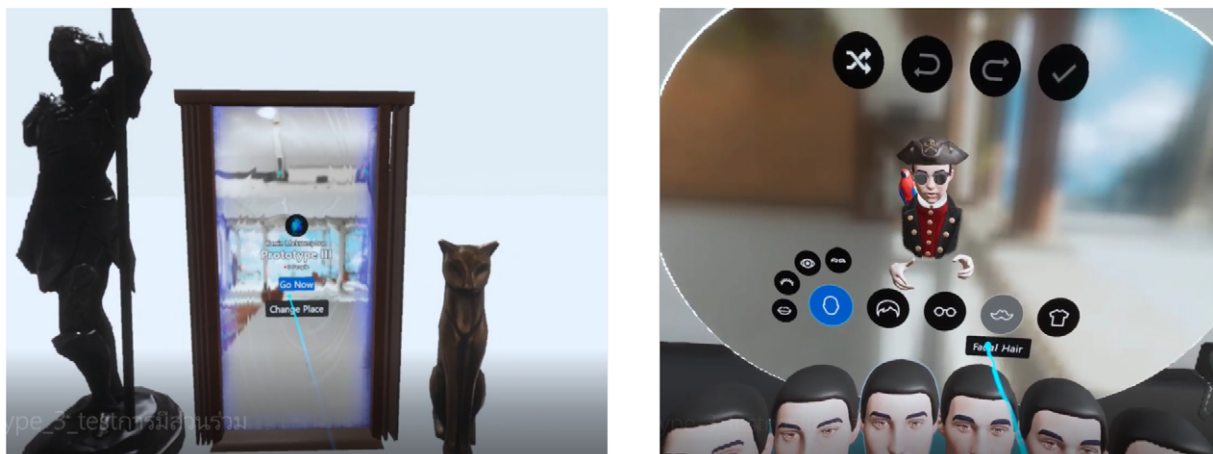
Fig. 2. Render on VR in the game we create.

Fig. 3. Render on VR from different perspectives.

The interpretation of the five levels of motivation is as follows:

a. Level 5 indicates that participants exhibit the highest degree of motivation.
b. Level 4 suggests that participants exhibit a high degree of motivation.
c. Level 3 implies that participants exhibit a moderate degree of motivation.
d. Level 2 indicates that participants exhibit a low degree of motivation.
e. Level 1 suggests that participants exhibit the lowest degree of motivation.

Second is Emotional Motivation. This section of the questionnaire aimed to assess the emotional factors influencing participants' motivation to engage with VR games. It focused on understanding the emotional experiences and drives that contribute to their motivation. The evaluation of emotional motivation did not utilize the same ordinal scale as the reasoning motivation section but rather relied on qualitative analysis and interpretation based on the participants' responses. By collecting data through this questionnaire, the researchers aimed to gain insights into the different levels of motivation among Generation Z individuals regarding VR games. Table 4 presents the questions pertaining to emotional motivation. The following are the average scores representing the degrees of motivation for Generation Z in Bangkok's VR games.

Table 4

Questions for emotional motivation

Variables	Measurement	Classification Criteria
1. The images and graphics in the game evoke a stronger desire to play.	Interval	1 = lowest motivation degree
2. The lighting and effects in the game create a playful atmosphere.		2 = low motivation degree
3. Sound effects enhance the overall enjoyment of playing in the game.		3 = moderate motivation degree
4. The challenges presented in the game contribute to its overall enjoyment.		4 = high motivation degree
		5 = highest degree of motivation

Table 5

Gender of the sample group

Gender	Number (person)	Percentage
Male	26	65.00%
Female	14	35.00%
Total	40	100.00%

   a. Average score 4.21–5.00 refers to the highest level of motivation.
   b. Average score 3.41–4.20 refers to a high degree of motivation.
   c. Average score 2.61–3.40 refers to a moderate motivation degree.
   d. Average score 1.81–2.60 refers to a low motivation degree.
   e. Average score 1.00–1.80 refers to the lowest degree of motivation.

Data Processing and Analysis: After Data processing and analysis were conducted after the data collection phase in order to validate and analyze the gathered information. The researchers employed various statistical calculations to present and summarize the results of the research. The following are the statistical calculations that were utilized:

First is Descriptive statistics. We analyzed the collected data using descriptive statistics. These included percentages, means, and standard deviations. These statistical measures were employed to describe and summarize the personal information received from the participants.

Second is Comparative analysis. A comparative analysis was performed to examine the differences between the results of the post-test questionnaires administered to the experimental groups for each prototype. The researchers employed t-test statistics to assess the variations between variables and compare their values. The analysis was conducted in accordance with the hypotheses established, and the statistical significance level was set at 0.5 to determine the significance of the observed differences.

By conducting these statistical analyses, the researchers aimed to gain a deeper understanding of the data and provide meaningful interpretations of the research findings. These analyses allowed for the identification of patterns, comparisons, and statistical significance in relation to the research objectives and hypotheses.

4. Results

This research aimed to investigate the motivation of Generation Z in Bangkok to play virtual world games. The target group was asked to participate in an experiment using a developed VR system, and data was collected following the test. The analysis presented in this study includes general information about the respondents and consumers, categorized by quantity and percentage.

Part 1: Descriptive statistical data

Part 2: Hypothesis Testing

1. **Descriptive statistical:** According to Table 5, the gender information of the sample indicates that the majority of respondents were males, accounting for 65.00 percent, which corresponds to 26 individuals. On the other hand, females accounted for 35.00 percent, with a total of 14 individuals.

Table 6

Age of the sample group

Gender	Number (person)	Percentage
18	12	50.00%
19	3	7.50%
20	1	2.50%
21	1	2.50%
22	3	7.50%
23	2	5.50%
24	18	45.50%
Total	40	100.00%

Table 7

Showing the study data of the sample group

Education level	Number (person)	Percentage
Currently studying in junior high school	0	0.00%
Currently studying high school	12	30.00%
Currently studying first year student	3	7.50%
Currently studying 2nd year student	4	10.00%
Currently studying 3rd year student	1	2.50%
Currently studying in year 4–6	3	7.50%
Graduated at the graduate level or equivalent	15	37.50%
Graduated at the master's level	2	5.00%
Graduated at the doctoral level	0	0.00%
Total	40	100.00%

Table 6 illustrates that the largest proportion of respondents were 24 years old, with 18 individuals representing 45.00 percent. The second-highest age group was 18 years old, with 12 individuals comprising 30.0 percent. Following that, ages 19 and 22 had an equal number of 3 respondents each, accounting for 7.50 percent. The age of 23 had 2 respondents, representing 5.00 percent. In contrast, the age groups with the fewest respondents were 20 and 21, with only 1 respondent each, making up 2.50 percent of the total number.

Table 7 presents the educational information about the respondents. It indicates that the largest portion of respondents, accounting for 37.50 percent, had attained a graduate level of education or its equivalent. Following that, 12 individuals were in high school, representing the second-highest educational category in the sample.

Table 8, titled "Occupational Data," provides insights into the occupations of the respondents. The majority of the participants, comprising 60.50 percent, were identified as students or individuals currently pursuing their education. Following this, 12 respondents (30.50 percent) were employed in private companies, while a smaller proportion, 12.50 percent, were self-employed in their own businesses. The table also reveals that two individuals, equivalent to 5.00 percent of the sample, were engaged in programming work. Additionally, one person (2.50 percent) each reported working in government or state enterprises and having graduated from an engineering field.

Overall, the data from Table 8 underscores the prominence of students or individuals pursuing education among the respondents, representing the largest occupational category. This is followed by employees in private companies, self-employed individuals, and those involved in programming work. The representation of individuals working in government or state enterprises and graduates from engineering fields is relatively smaller in comparison.

Table 8

Showing the career data of the sample group

Career	Number (person)	Percentage
Still a student or student	24	60.50%
Government service/state enterprise	1	2.50%
Employees	12	30.50%
Entrepreneur	5	12.50%
Working in programming	2	5.50%
Graduated from engineering and studying in programing	1	2.50%
Total	40	100.00%

Table 9

Rational motivations in effect in Generation Z VR games in Bangkok

Reason motivation	Average	S.D.	Priority
The hints and playing guides can provide you with extensive information about the game's content.	4.03	0.86	Highest level of motivation
Various illustrations can tell how to play the game as well.	3.98	0.83	Moderate motivation level
Does having someone you know play the same game as you make you more interested?	4.40	0.74	Highest level of motivation
Creating a character in the game, either reflecting yourself or an imaginary persona, enhances your motivation to play.	4.30	0.94	Highest level of motivation
Does the attractive design and overall appearance of the product capture your interest?	4.20	0.91	Highest level of motivation
Does the convenience of using the product make you more interested?	4.25	0.81	Highest level of motivation
Does a well-known brand make you more interested?	3.60	1.01	Moderate motivation level

Table 9 presents the findings of the data analysis, which highlight the factors influencing motivation to play virtual world games among the respondents. According to the data, the factor with the greatest impact on motivation was having acquaintances who also played the same game, accounting for 4.40 percent. This suggests that social connections and shared experiences play a significant role in motivating individuals to engage in gaming activities. Following closely behind was the aspect of incorporating oneself into the game, which accounted for 4.30 percent of the respondents' motivation. This implies that personal immersion and identification with the game world contribute to higher levels of motivation to play. Another factor that significantly influenced motivation was the appearance or visual presentation of the game product, accounting for 4.20 percent. This implies that aesthetics and graphical quality significantly influence the motivation of Generation Z gamers in Bangkok. Additionally, hints and manuals provided within the game had an impact on motivation, accounting for 4.03 percent. These resources likely assist players in overcoming challenges and enhancing their overall gameplay experience.

Furthermore, the data revealed that illustrated descriptions of gameplay and the presence of a recognizable brand both had a moderate effect on motivation, with each accounting for 3.98 percent. This suggests that clear and visually appealing explanations of how to play the game, as well as the reputation and familiarity associated with a brand, contribute to motivating players. Overall, the findings from Table 9 shed light on the various factors that influence the motivation of Thai Generation Z gamers, emphasizing the significance of social connections, personal immersion, visual appeal, helpful resources, and recognizable brands.

Table 10 presents the results of the data analysis regarding emotional motivation among the respondents. The findings indicate that lighting and visual effects in games had the most significant impact on motivation, accounting for 4.18 percent. This suggests that the visual elements and atmospheric effects within the game, such as lighting techniques and visual enhancements, strongly influence the emotional engagement and motivation of players. Similarly, the impact of images and graphics on motivation was also significant, accounting for

Table 10

Emotional motivations affecting Generation Z for VR games in Bangkok

Emotional motivation	Average	S.D.	Priority
The images and graphics in the game evoke a stronger desire to play.	4.05	0.93	Highest level of motivation
The lighting and effects in the game enhance the playability of the game.	4.18	0.81	Highest level of motivation
The sound effects in the game enhance the playability of the game.	3.93	0.92	Moderate motivation level
The game's challenges contribute to a more enjoyable playing experience.	3.93	0.76	Moderate motivation level

Table 11

Male rational motivation is affected in playing VR games

Reason motivation	Average	S.D.	Priority
The hints and playing guides provide detailed information about the game's content.	4.15	0.67	Highest level of motivation
Various illustrations can tell how to play the game as well.	4.04	0.72	Highest level of motivation
Does having someone you know play the same game as you make you more interested?	4.54	0.65	Highest level of motivation
Being able to create a character in the game, either based on yourself or your imagination, motivates you to play the game.	4.50	0.71	Highest level of motivation
Is the appealing appearance of the product a factor that increases your interest?	4.42	0.70	Highest level of motivation
Does the convenience of using the product make you more interested?	4.35	0.75	Highest level of motivation
Does a well-known brand make you more interested?	3.65	1.02	Moderate motivation level

4.18 percent. This aligns with the earlier discussion, indicating that the visual aspects of the game, including the quality of images and graphics, play a crucial role in motivating Thai Generation Z gamers in Bangkok. Furthermore, the sound effects associated with the game challenge were found to have an equal mean impact on motivation, accounting for 3.93 percent. This suggests that the audio components, such as background music, sound effects, and the overall auditory experience, contribute to creating an immersive and engaging gameplay atmosphere, thus influencing the emotional motivation of players.

Overall, Table 10 provides insights into the factors that influence emotional motivation among the respondents, highlighting the importance of lighting and visual effects, images and graphics, as well as sound effects in driving motivation among Thai Generation Z gamers.

2. **Hypothesis testing:** After experimenting with the sample, the researchers used questionnaires to collect data for questionnaires. Sample group by the nature of the questionnaire closed-end questions consist of 2 parts, consisting of 15 questions. In terms of hypothesis testing, the researchers compiled and analyzed the collected data on PowerBi, creating a dashboard to support the hypothesis analysis. The hypothesis posits that Generation Z in Bangkok, characterized by diverse demographic traits, exhibits distinct gaming motives.

Table 11 presents the results of the data analysis, indicating that all incentives, except for branding, demonstrated the highest degree of motivation. This suggests that the various incentives provided in the games significantly influence the rational motivation of the target audience, particularly male players.

Interestingly, the presence of a famous brand in the game was only associated with a motivation level of 3.65 percent, indicating a moderate impact. This finding implies that male gamers from Generation Z primarily focus on interacting with friends through games or game elements, rather than being influenced by the reputation of the company behind the game.

Overall, Table 11 highlights the significance of incentives in driving rational motivation among the respondents, with the exception of branding, which demonstrates that the presence of a renowned brand

Table 12

Female rational motivation is an effect of playing VR games

Reason motivation	Average	S.D.	Priority
The hints and playing guides provide detailed information about the game's content.	3.79	1.12	Highest level of motivation
Various illustrations can tell how to play the game as well.	3.86	1.03	Highest level of motivation
Does having someone you know play the same game as you make you more interested?	4.14	0.86	Highest level of motivation
Being able to create a character in the game, either based on yourself or your imagination, motivates you to play the game.	3.93	1.21	Highest level of motivation
Is the appealing appearance of the product a factor that increases your interest?	3.79	1.12	Highest level of motivation
Does the convenience of using the product make you more interested?	4.07	0.92	Highest level of motivation
Does a well-known brand make you more interested?	3.50	1.02	Moderate motivation level

Table 13

Emotional motivation is affected by playing VR games

Emotional motivation	Average	S.D.	Priority
The images and graphics in the game evoke a stronger desire to play.	4.35	0.69	Highest level of motivation
The lighting and effects in the game enhance the playability of the game.	4.46	0.65	Highest level of motivation
The sound effects in the game enhance the playability of the game.	3.15	0.73	Highest level of motivation
The game's challenges contribute to a more enjoyable playing experience.	3.00	0.69	Highest level of motivation

in the game does not hold substantial influence on the motivation of male players in Generation Z.

According to Table 12 and the data analysis, it was observed that female players from Generation Z are primarily motivated to play games by the presence of acquaintances or friends who are also playing the same game, with a motivation level of 4.14 percent. Additionally, incentives such as games that are easy to play or devices that offer convenience and ease of use play a significant role, with a motivation level of over 4.07 percent. These factors are more influential in motivating female players than the presence of a brand, which accounts for a lower percentage or element within the game. In summary, Table 12 highlights that female Generation Z players are driven by social factors, such as playing games with friends or acquaintances, and by the ease and convenience of gameplay and devices. The brand itself holds less significance in motivating female players compared to these other factors or elements present in the game.

Based on the findings presented in Table 13, the data analysis indicates that among the Generation Z group in Bangkok, males were significantly influenced by emotional motivation factors such as in-game images and graphics, lighting and effects, as well as sound effects and challenges. These elements had the greatest impact on their motivation levels. These results suggest that the male Generation Z players in Bangkok are more influenced by the multidimensional aspects of the game, indicating that they are likely to consider the specific elements of the game they choose to play more than the female group.

In summary, the data from Table 13 highlights that emotional motivations related to game elements have a stronger impact on male players from the Generation Z group in Bangkok. Factors such as in-game visuals, lighting and effects, and sound effects and challenges play a significant role in shaping their motivation to engage with the game. This suggests that male players are more attuned to these aspects and consider them important when selecting and enjoying games, as compared to the female group. The findings presented in Table 13 shed light on the intriguing connection between emotional motivations and male

players from the Generation Z group in Bangkok. The data analysis underscores that elements such as in-game visuals, lighting and effects, sound effects, and challenges wield a substantial influence on the motivation levels of male players. This intriguing result has implications for the integration of VR and immersive technologies within the context of smart cities. Understanding that male players are particularly attuned to these sensory and experiential aspects of gaming highlights the potential for similar emotional motivators to enhance the engagement and interaction of citizens in smart city environments. As smart cities increasingly adopt VR and immersive experiences for various applications, including education, entertainment, and urban planning, these emotional motivators can serve as a valuable tool in creating more appealing and captivating urban experiences. This insight suggests that VR applications within smart cities should focus on delivering visually and emotionally engaging content to resonate with their target audience effectively.

5. Discussion

In delving into the qualitative analysis and deep discussion, particularly in the realm of Emotional Motivation, the questionnaire aimed to assess the emotional factors influencing participants' motivation to engage with VR games. Unlike the ordinal scale used for reasoning motivation, the evaluation of emotional motivation relied on qualitative analysis based on participants' responses. This paper sought to gain nuanced insights into the diverse levels of motivation among Generation Z individuals in Bangkok regarding VR games. The average scores categorized the motivation degrees as follows: the highest degree (4.21–5.00), high degree (3.41–4.20), moderate degree (2.61–3.40), low degree (1.81–2.60), and the lowest degree (1.00–1.80). This approach not only enriches the understanding of participants' motivations but also provides a comprehensive basis for discussions, drawing on existing literature and contributing to the broader discourse on Generation Z engagement with VR gaming.

This section provides a summary of the study and test results, comparing them with the concepts, theories, and related research presented in the previous literature review section. Based on this study, the researchers identified several significant findings and proposed relevant discussions:

1. The findings indicated that the motivations for playing games among the Generation Z group in Bangkok varied depending on their demographic characteristics. When analyzing the data by gender, it was observed that certain factors significantly influenced male gaming motivation, such as the clarity of in-game content, gameplay mechanics, interaction with others, and self-expression. These factors align with previous research indicating that ease of understanding and a well-designed application can impact motivation and user satisfaction. In contrast, for female players, rational motivation was primarily influenced by ease of use and having acquaintances playing the same game. This finding supports the idea that social connections play a significant role in motivating female players.

2. Emotional motivation exhibited notable differences when analyzed across gender groups. Male players showed the highest motivation levels across all emotional factors, indicating their attention to game elements such as graphics, lighting effects, sound effects, and game difficulty. In contrast, female players demonstrated a lower level of emotional motivation, with all factors falling within the moderate range. This suggests that male players prioritize the emotional aspects of the game to a greater extent than female players.

3. Analyzing the average motivation for each answer based on different age ranges revealed varying motivational patterns that align with the hypothesis. It became evident that Generation Z groups in Bangkok, characterized by different demographic traits, harbor distinct gaming motives, as evidenced by variations related to age.

4. The influence of social factors, particularly the involvement of friends or acquaintances, in motivating the Thai Generation Z group to play virtual world games was explored. The analysis indicated that having acquaintances playing the same game had a significant impact on motivation across various age groups. Social influence was particularly evident among female players, affecting their rational motivation levels. In contrast, social influence was less clear among male players, where motivation levels were highest for most factors. However, considering the overall survey results, social influence and the participation of friends or acquaintances were found to greatly affect motivation to play the game. This aligns with a study by Wei and Lu [22]

emphasizing the external impact of networks and the perception that people around or within society are using the product or service.

5. Product factors were found to influence the motivation to play games among Thai Generation Z in Bangkok. The analysis revealed that the brand itself had relatively little impact on motivation. Instead, factors such as the game's imagery and convenience of use had a more significant influence, in line with previous research by Wongwarawipat [24]. The study concluded that game content, system, and graphics were critical factors affecting motivation to play online games, supporting hypothesis 3 on product influences on gaming motivation among the sample group.

6. Within the framework of smart cities, when crafting media or services targeted at the male gender segment, it is advisable to accentuate emotional motivations. Studies indicate that men showcase elevated levels of emotional engagement, particularly in factors like graphical effects and sound effects simultaneously. Conversely, in developing services for the female gender segment, a less intricate approach is recommended, with a greater emphasis on social factors, such as community or group marketing, rather than prioritizing emotional motivations.

Overall, the findings from this study shed light on the diverse motives for playing games among the Generation Z group in Bangkok, considering various demographic characteristics and highlighting the significance of social influences and product factors in motivating players. In exploring the distinct behavior of female players, our research delved into nuanced aspects that contribute to their engagement with VR gaming. The findings underscore a notable trend wherein female players exhibit a preference for a less intricate approach in the design of media or services within the smart city context. This preference leans towards a greater emphasis on social factors, such as community or group marketing, rather than placing primary importance on emotional motivations. The study reveals a unique pattern in the interaction of female players with VR experiences, suggesting that the social context and communal aspects play a pivotal role in shaping their engagement preferences. These insights not only contribute to the refinement of targeted services for female gamers but also hold relevance for the broader landscape of smart city development, emphasizing the need for a diversified and nuanced approach to cater to the preferences of different gender segments.

6. Conclusions and future works

Regarding government agencies, it is evident that VR area is poised to play a significant role in the future, particularly in gaming and communication. The research highlights the motivations behind its adoption. Analyzing the mean motivation for each factor, it becomes apparent that Generation Z individuals exhibit relatively high levels of motivation across the board. This indicates substantial growth potential for the virtual gaming market in the future. It also presents a favorable opportunity for government support and involvement in this market. In addition to its evident role in gaming and communication, VR technology holds promising implications for the advancement of smart cities and government initiatives. The research underscores the motivations driving the adoption of VR among Generation Z individuals, revealing consistently high levels of motivation across various factors. This not only signals a burgeoning market for virtual gaming but also extends its applicability to the realm of smart cities. The findings suggest that the immersive and engaging nature of VR can be harnessed to enhance the urban experience within smart cities significantly. By incorporating VR technologies into urban planning, education, and public services, governments can foster more interactive and innovative solutions for their citizens. This not only aligns with the growing expectations of Generation Z but also underscores the potential for government agencies to play an active role in shaping the future of smart cities through strategic support and engagement with immersive technologies like VR, such as the work of Zhang [26] and the work of Rausch et al. [16].

Similarly, private companies can leverage virtual world technology for various purposes. The second section of this study explores data collection to uncover the potential of the virtual gaming market. The private sector can utilize virtual world technology for business marketing, including applications in advertising, public relations, and gamification for promotional campaigns. Additionally, investing in the virtual world game market is a recommended course of action for private companies, especially considering the high average incentives observed among Generation Z, a group that will possess significant purchasing power in the future. More research on motivation within

the virtual world, particularly within the target demographic that will shape future purchasing behavior, is highly beneficial. As children using virtual world technology evolve over time, understanding their motivations becomes crucial. Therefore, further research on virtual game motivations is encouraged to enhance knowledge and provide valuable insights for future developments.

To enhance future studies, achieving a more balanced representation in the target audience is crucial for further applications in smart cities. In our research, obtaining precise demographic information has been challenging due to the impact of COVID-19. The process of gathering data and identifying the target audience has been complicated, resulting in an inability to achieve 100 percent demographic representation in terms of sex or gender and an equal number of test subjects in each age group. As a workaround, we have employed the method of estimating averages from each age group to address this issue. Looking ahead, it is hoped that future research on this topic will concentrate on refining demographic characteristics to provide more comprehensive insights. In future research aimed at enhancing the development and implementation of smart cities, addressing challenges related to demographic representation remains crucial. While this study has utilized the method of estimating averages from various age groups to mitigate this issue, future studies should strive to refine demographic characteristics further. By focusing on improving data collection methods and enhancing representation in terms of gender and age groups, future research can offer more comprehensive and accurate insights into the utilization of smart city technologies. This will finally contribute to the implementation of more inclusive and effective smart city solutions catering to the diverse needs of the population.

Availability of data and materials

The authors confirm that the data supporting the findings of this study are available within the article.

Authors' contributions

The authors contributed equally to this work.

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