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Pre-Design User-Centred Investigation of a Serious Game for Mental Health Literacy: A Study of Malaysian Youth

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ABSTRACT

Mental health (MH) conditions are projected to become the leading cause of global disease burden by 2030, which indicates a need to improve mental health literacy (MHL), especially among youth. Digital gaming is rapidly gaining popularity in Malaysia, with serious games (SGs) increasingly recognition as promising tools for education, engagement, and behavioural change. However, low engagement and poor retention in digital MH interventions persist, often due to insufficient user-centred design and a limited understanding of user preferences. Therefore, this study presents a preliminary, user-centred investigation of Malaysian youths' attitudes, needs, and motivations regarding SGs for MHL. A cross-sectional survey was conducted with 419 respondents aged 18–25. The data were analysed using SPSS, employing ANOVA, t-test, and correlation analyses. Research findings were interpreted through the Mechanics–Dynamics–Aesthetics framework to inform game design. Results show high baseline MHL (M = 4.19/5) and generally positive attitudes toward SG-based learning (M = 3.81–4.08). Significant correlations were found between openness to SGs and key MHL components namely self-help strategies (r = 0.421), help-seeking behaviour (r = 0.381), and MH knowledge (r = 0.395). These findings suggest that well-designed games hold promise for supporting proactive MH engagement. A weaker correlation regarding erroneous beliefs (r = 0.253) points to a need for more targeted anti-stigma content. Nearly 25% of respondents preferred puzzle-based games, primarily motivated by the need for emotional relief and creative expression.

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1. INTRODUCTION

Mental health literacy (MHL) is increasingly recognised as a foundational component of mental health (MH) promotion, equipping individuals with the knowledge and attitudes necessary to recognise, manage, and prevent MH problems. Initially defined by Jorm et al. (1997) as public knowledge related to identifying mental disorders and encouraging help-seeking behaviour, the concept has since been expanded by Dias et al. (2018) to include awareness of risk factors, knowledge of self-help strategies, and the ability to counter stigma and support MH care. As MH conditions are projected to become the leading cause of global disease burden by 2030, the urgency for scalable, youth-focused educational interventions continues to grow. Youth are particularly vulnerable, with most mental disorders manifesting before the age of 24, yet traditional outreach methods often fail to resonate with this digital-native generation. In Malaysia, nearly one in ten adolescents experience severe depressive symptoms, and over 30% of the population are expected to face mental disorders in their lifetime (Institute for Public Health, 2023). The effort to improve MH awareness among youth aligns with the World Health Organisation's Mental Health Action Plan (WHO, 2021), where enhancing MHL is one of its core global strategies.

Despite the increasing exploration of digital health tools for innovative MH awareness and management, many suffer from low user engagement and high attrition, particularly among young people. Serious games (SGs) as digital tools designed to educate through interactive gameplay have emerged as promising alternatives for delivering psychoeducational content in engaging formats. Malaysia's rapidly growing digital gaming industry, ranked as Southeast Asia's third-largest gaming market among youth (Malaysia Digital Economy Corporation, 2021), presents a uniquely fertile ground for such interventions. However, the success of SGs hinges not merely on technological novelty but on their capacity to sustain engagement through culturally relevant, user-centred experiences. Multiple studies underscore the potential of SGs in supporting MH education and behaviour change. Nicholas et al. (2022) emphasised the importance of relatable characters and contextual storytelling in drug use prevention games. Dietvorst et al. (2022) demonstrated the feasibility of the Grow It! app, which delivers CBT-based coping strategies to adolescents through gamified challenges. Sriwatanathamma et al. (2023) integrated the ABCDE (Activating event, Belief, Consequences, Disputation of Belief, and Effective New Approach) model into the narrative game *BlueLine* for urban millennials, while Ghosh et al. (2023) explored cognitive bias modification paradigms to enhance engagement in depression-related games. These studies highlight the value of narrative-driven, personalised content and advocate for co-designing with end-users and MH professionals. While much of this existing work has concentrated on Western or clinical settings, its insights offer a strong conceptual foundation for expanding educational strategies to broader youth populations in Southeast Asia.

Building on recent developments, research increasingly recognises the importance of integrating MHL, user-centred design, and cultural relevance in digital interventions. Liu (2023) and Almeqbaali et al. (2022) demonstrate that interventions incorporating real-life scenarios and expert-informed content can be effective across diverse cultural and religious settings such as Malaysia. However, these approaches have not yet been rigorously tested in Malaysian or similar Southeast Asian settings, limiting confidence in their local applicability. Schilt et al. (2022) further identify persistent engagement challenges in cognitive training apps, and their findings suggest that even scientifically sound interventions may fail when they do not resonate emotionally or culturally with users. This underscores a growing consensus that technical accuracy alone is insufficient. For meaningful impact, interventions must reflect the lived experiences and sociocultural values of the target population particularly in non-Western contexts where stigma, cultural norms, and local narratives shape MH perceptions and help-seeking behaviours.

In Malaysia, young people navigate MH within a complex landscape of social and academic pressure, family expectations, and stigma, which collectively influence how psychological distress is perceived and addressed. SGs that embed locally resonant narratives present a viable pathway to bridge this gap by grounding *MHL* in authentic, relatable experiences. This leads to a critical question: *How can SGs be*

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adapted to reflect the sociocultural realities of Malaysian youth while fostering MH literacy and sustained engagement? Answering this question is not only academically valuable but also essential for developing scalable, culturally responsive tools in regions where stigma, limited resources, and cultural misalignment continue to hinder access to MH support. In response to this question, the present study undertakes a formative, user-centred investigation to inform the design of a serious game for MHL targeting Malaysian youth. A cross-sectional survey was administered to youth in Malaysia, and respondent input was interpreted through the lens of the Mechanics–Dynamics–Aesthetics (MDA) framework to align findings with game design principles. The study explores user attitudes toward SGs, gaming motivations, genre preferences, and baseline levels of MHL. Specifically, it aims to: (1) assess MHL components, including MH knowledge, first aid and help-seeking behaviours, erroneous beliefs and self-help strategies; (2) evaluate attitudes toward SGs as educational tools; (3) identify common gaming habits and preferred genres; and (4) determine culturally relevant and engaging design content to inform future game design and development. Fig. 1 illustrates how data on MHL, gaming preferences, and user motivations are interpreted into actionable game design elements guided by the MDA framework.

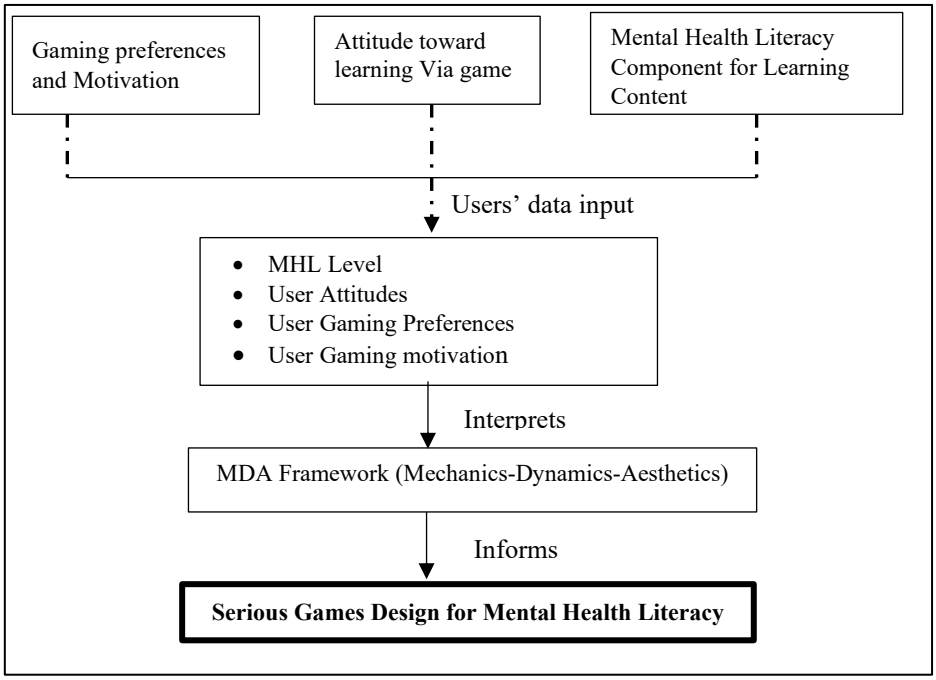

Fig. 1. Conceptual model of serious game design for MHL

2. METHODOLOGY

This study employed a cross-sectional online survey targeting youth in Malaysia, with a specific focus on university students aged 18 to 25 who were familiarity with digital games and platforms. Participants were selected from public universities using convenience sampling to ensure broad accessibility while acknowledging potential limitations in generalisability. Surveys were distributed via WhatsApp, Telegram, and email platforms, facilitating broad geographic participation. Respondents accessed the survey through a Google Forms link and completed it voluntarily after reading an informed consent statement. The survey took approximately 5 to 10 minutes to complete. It included closed-ended and Likert-scale questions to collect quantitative data on MHL, attitudes toward learning using games, and gaming preferences. Data collection occurred over one month in January 2024. Based on sampling guidelines for populations

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exceeding 100,000, a minimum sample size of 384 was recommended by Krejie and Morgan (1970). A total of 419 valid responses were obtained, meeting the 95% confidence level with a 5% margin of error.

2.1 Development, Validation, and Reliability of the Research Questionnaire

The structured questionnaire consisted of three sections. Section A collected demographic information. Section B assessed MHL across four dimensions, and Section C evaluated attitudes toward game-based learning, gaming behaviours, and design preferences. All items were developed in bilingual format (English and Malay) and refined with input from experts in psychiatry and game design to ensure content validity and cultural relevance. A total of 42 items were included in the final instrument.

Section B included four subscales adapted from validated instruments cited in Dias et al. (2018) and Campos et al. (2022). Internal consistency was assessed using Cronbach's alpha, with values above 0.70 indicating acceptable reliability: knowledge of MH problems ($\alpha = 0.827$), erroneous beliefs ($\alpha = 0.714$), first aid skills and help-seeking behaviour ($\alpha = 0.797$), and self-help strategies ($\alpha = 0.835$). Item-total correlations were examined to assess scale homogeneity, with acceptable values across all subscales indicating good internal consistency.

Section C measured attitudes toward learning via SGs ($\alpha = 0.865$), gaming motivations, and gameplay preferences. Items were adapted from established sources, including Ibrahim (2013), Riemer and Schrader (2015), and Mz and Sy (2008).

As shown in Table 1, all scales demonstrated acceptable reliability, supporting the use of the questionnaire to explore youth engagement with game-based MH education tools.

Table 1. Reliability and item-total correlation ranges for questionnaire scales

Dimension	Cronbach's Alpha	Item-Total Correlation Range
Knowledge of MH Problems	0.827	0.30–0.65
Erroneous Beliefs/Stereotypes	0.714	0.018–0.659
First Aid Skills & Help-Seeking Behaviour	0.797	0.20–0.78
Self-Help Strategies	0.835	0.475–0.689
Attitudes Toward Learning via Games	0.865	0.552–0.719

2.2 Statistical Analysis

The data were analysed using IBM SPSS statistical software. Descriptive statistics were used to summarise and interpret respondents' survey outcomes. Pearson's correlation coefficient was used to explore relationships between MHL dimensions and attitudes toward games as learning tools. One-way ANOVA was used to test differences across age groups, while independent samples t-tests assessed differences based on gender and academic program enrolment. All statistical tests were conducted at a 95% confidence level. Prior to conducting parametric analyses, the assumption of normality was evaluated using the Shapiro–Wilk test.

3. RESULTS

The demographic profile of the 419 respondents reflects key trends in Malaysian higher education. As shown in Table 2, the sample is predominantly female (74.0%), consistent with national data from the Ministry of Higher Education Malaysia (2023), which reports higher female enrolment in both diploma and degree programs across public and private institutions. The sample also skews toward diploma students (74.9%), reflecting the younger average age of those at the beginning of their academic pathways. Geographically, most respondents are from northern (51.3%) and central (36.0%) states, contributing to regional diversity in the sample. This variation in gender, academic level, and location enhances the range of perspectives on MHL and attitudes toward game-based learning, supporting the contextual depth and relevance of the findings. Detailed results are outlined in Table 2 below:

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Table 2. Detailed demographic profile of respondents

Demographic	Category	Frequency (N)	Percent %
Gender	Male	109	26.0
	Female	310	74.0
Age	18-19 years	192	45.8
	20-21 years	159	37.9
	22-25 years	68	16.3
Program Enrolment	Diploma	314	74.9
	Degree	105	25.1
Geographic Distribution	Northern States (Perlis, Kedah, Penang, Kelantan, Terengganu)	215	51.3
	Central States (Terengganu, Pahang, Selangor, Wilayah Persekutuan & Putrajaya)	151	36.0
	Southern States (Melaka, Negeri Sembilan, Johor)	29	6.9
	East Malaysia (Sabah, Sarawak, Labuan)	24	5.7

3.1 MH Literacy Evaluation

MHL was assessed using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Responses were analysed using descriptive statistics and reported as means (*M*) and standard deviations (*SD*) to summarise levels of agreement across knowledge, attitudes, and behaviours. The scale was designed to capture nuanced perspectives, with midpoints indicating neutrality or uncertainty. Although Shapiro–Wilk tests indicated significant deviations from normality ($p < .001$ for all variables), the large sample size ($N = 419$) justifies the use of parametric inferential tests, which are robust to non-normality under such conditions (Field, 2018). Accordingly, Pearson correlations, independent samples t-tests, and one-way ANOVA were conducted and are reported in the following sections.

3.1.1 Knowledge of MH Problems

Respondents demonstrated strong awareness of common MH concepts. High agreement was observed for items related to stress as a cause of mental disorders (KMH.5: $M = 4.43$, SD = 0.64), depression symptoms (KMH.9: $M = 4.28$, SD = 0.74), and panic in anxiety disorders (KMH.10: $M = 4.46$, SD = 0.58). There was also strong recognition of the biological basis of mental illness (KMH.4: $M = 4.06$), though 18.9% of respondents selected Neutral, suggesting uncertainty. However, knowledge gaps emerged in more complex or stigmatized areas. The understanding of schizophrenia symptoms was moderate (KMH.2: $M = 4.07$, SD = 0.69; KMH.6: $M = 4.14$, SD = 0.68), and awareness of alcohol's harmful effects on MH was relatively low (KMH.7: $M = 3.91$, SD = 0.84), with higher variability indicating inconsistent knowledge. Similarly, recognition of symptom duration as a diagnostic criterion (KMH.8: $M = 4.07$, SD = 0.68) and the link between drug addiction and mental disorders (KMH.3: $M = 4.42$, SD = 0.71) showed mixed responses. Overall, while foundational knowledge is strong, misconceptions persist around substance use and psychotic disorders

3.1.2 Erroneous Beliefs and Stereotypes

Several misconceptions remain prevalent. A notable proportion of respondents either agreed or were uncertain about the false claim that "depression is not a mental disorder" (EB1: $M = 3.59$, SD = 1.13), indicating significant misunderstanding. Beliefs linking mental illness to low-income families (EB2: $M = 4.15$, SD = 0.97) and the idea that only adults experience mental disorders (EB3: $M = 4.21$, SD = 1.00) were moderately rejected, but variability suggests lingering stereotypes. While most agreed that early intervention is important (EB5: $M = 4.26$, SD = 0.77), misconceptions about emotional impact for example "Mental disorders do not affect feelings"; EB6: $M = 4.17$, SD = 0.87) and non-judgmental attitudes (EB7: $M = 4.23$, SD = 0.85) showed uncertainty. These findings highlight the need for targeted anti-stigma content.

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3.1.3 First Aid Skills and Help-Seeking Behaviour

Respondents were more willing to encourage help-seeking in others than to seek help themselves. While most indicated they would encourage someone to see a psychiatrist (FAHSB2: $M = 4.36$, SD = 0.77) or a psychologist (FAHSB5: $M = 4.27$, SD = 0.73), personal willingness was lower (FAHSB1: $M = 4.07$, SD = 0.80; FAHSB3: $M = 4.11$, SD = 0.83). Notably, reliance on informal support was limited and show mean= 3.74 ($SD = 1.04$) those who agreed that they would seek help from relatives, and just 3.52 ($SD = 1.00$) for friends, which show the lowest scores in this domain. This pattern suggests a cultural preference for professional help over personal networks, but also hesitation in self-referral, pointing to barriers in personal help-seeking

3.1.4 Self-Help Strategies for MH

Respondents strongly endorsed enjoyable activities (SH1: $M = 4.47$, SD = 0.60) and sleep (SH4: $M = 4.51$, SD = 0.63) as effective self-help strategies. Physical exercise (SH3: $M = 4.37$, SD = 0.63) was also widely recognized, though slightly less so than sleep. Balanced diet (SH2: $M = 4.22$, SD = 0.76) showed moderate agreement, with greater variability indicating less consistent awareness. These results suggest that while youth recognize behavioural and rest-based strategies, nutritional aspects of MH may be underemphasized in current education efforts. Fig. 2 shows self-help strategies (SH) recorded the highest mean score (M = 4.39, SE = 0.03), followed by knowledge of MH problems (KMH; M = 4.25, SE = 0.02). Erroneous beliefs and stereotypes (EB; M = 4.11, SE = 0.03) and first aid and help-seeking behaviours (FAHSB; M = 4.01, SE = 0.03) were endorsed at moderately high levels.

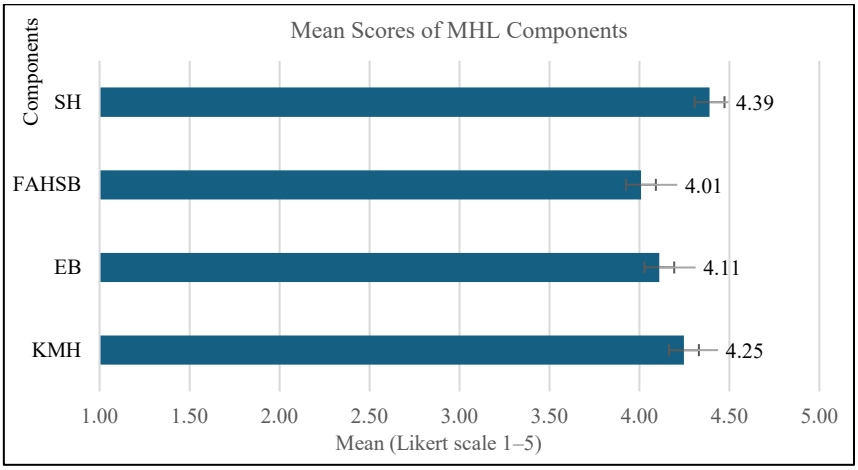

Fig. 2. Mean scores of MHL components (N = 419) with error bars represent ±1 standard error of the mean (SE)

3.2 Attitudes Toward Game-Based MH Learning

Respondents expressed generally positive but mixed attitudes toward using games for MH education. As shown in Table 3 and illustrated in Figure 3, the item *"Using games to learn about MH would be a good idea"* (ATT1) received a mean score of 3.81 ($SD = 0.81$), with 67.3% agreeing or strongly agreeing, though 28.9% selected Neutral, indicating hesitation about the concept's legitimacy. Similarly, *"I would like learning with games"* (ATT4) scored 3.89 ($SD = 0.87$), with high variability suggesting uncertainty about practical implementation. In contrast, effective and engagement-related items received stronger support. Most respondents agreed that learning with games would be fun (ATT2: $M = 4.08$, $SD = 0.73$) and that games make MH learning more interesting (ATT3: $M = 3.97$, $SD = 0.77$). The lower standard deviation for ATT2 indicates greater consensus on the enjoyment value of games.

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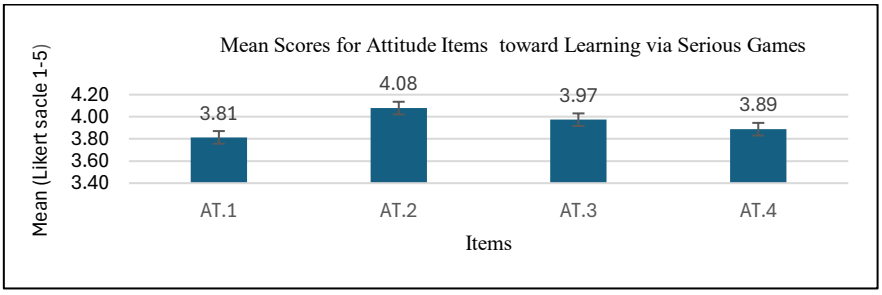

Fig. 3. Mean scores of items measuring attitudes toward learning via SGs (N = 419) with error bars represent ±1 standard error of the mean (SE)

Overall, while participants view games as engaging and enjoyable, there is noticeable skepticism about their educational usefulness, particularly among those unfamiliar with SGs. This suggests a need for design strategies that clearly demonstrate learning outcomes and build trust in games as credible educational tools. Table 3 shows the descriptive statistics for the four attitude items.

Table 3. Attitudes toward game-based MH learning ($N = 419$)

		N						
Item	Total	1	2	3	4	5	Mean	Std. Deviation
ATT1	419	3	15	121	198	82	3.81	0.812
ATT2	419	1	10	60	232	116	4.08	0.729
ATT3	419	3	10	82	224	100	3.97	0.771
ATT4	419	3	21	102	187	106	3.89	0.866

Note: 1 = Strongly Disagree, 5 = Strongly Agree

3.3 Gaming Habits, Genre Preferences, and Motivations

Most respondents (45.1%) reported playing games for one hour or less per week, and only 21.7% played for four or more hours weekly, indicating that the sample consists primarily of casual gamers. Puzzle games were the most preferred genre (24.8%), followed closely by action and shooter games (24.3%), suggesting a balanced appeal of cognitive challenge and high-intensity engagement. Sports, adventure, and other genres accounted for the remainder, reflecting moderate diversity in preferences. The primary motivations for playing games were fun (39.1%) and filling free time (38.4%). When asked about reasons for *liking* games, calming thoughts (26.5%) and filling free time (27.4%) emerged as the top responses, followed by increased creativity (16.9%). Only a small proportion played to demonstrate ability (9.1%) or engage with fantasy worlds (3.1%).

These findings highlight that Malaysian youth use games not only for entertainment but also for emotional regulation, relaxation, and creative expression hence motivations that can be leveraged in the design of SGs for MH. The preference for low-time-commitment, cognitively engaging formats further supports the development of short, modular game experiences with calming and reflective elements

Table 4. Gaming Frequency, Genre Preferences, and Motivations ($N = 419$)

Category	Item	N	Percentage (%)
Gaming Frequency	1 or less hour/week	189	45.1
	2 hours/week	84	20.0
	3 hours/week	55	13.1
	4 or more hours/week	91	21.7
Genre Preference	Puzzle	104	24.8
	Action & Shooter	102	24.3
	Sports & Adventure	66	15.8
	Others/Unspecified	81	19.3
Motivation for Playing	Fun	164	39.1
	Fill free time	161	38.4

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	Enthusiastic with adventure	16	3.8
	Show ability	38	9.1
	Adventure interest	16	3.8
	Fantasy world	13	3.1
	Others	27	6.4
Motivation for Liking Games	Fill free time	115	27.4
	Calming thoughts	111	26.5
	Increase creativity	71	16.9
	Fun	58	13.8
	Improve gaming skills	42	10.0
	Others	22	5.3

3.4 Relationship between MHL and Attitudes toward Learning MH Via SGs

The analysis examines the relationship between attitudes toward learning about MH via SGs and various components of MHL. Generally, a moderately strong positive correlation is found between attitudes toward learning about MH through games and the overall MHL ($r = 0.495$, $p < .001$), indicating that individuals with favourable attitudes toward game-based learning have higher MHL levels. These finding underscores SGs' potential as effective tools for enhancing MHL, making them valuable for broad MH education initiatives. Among individual MHL components, the strongest correlation is with self-help strategies ($r = 0.413$, $p < .001$), suggesting that those open to learning through games are more likely to adopt proactive MH practices. A similar positive relationship is seen with first aid skills and help-seeking behaviour ($r = 0.397$, $p < .001$), indicating that SGs can promote essential skills like seeking help and providing initial support for MH issues. The correlation with knowledge of MH problems is also moderately strong ($r = 0.400$, $p < .001$), reinforcing the idea that SGs can enhance understanding of specific MH topics. However, the weakest correlation is with erroneous beliefs and stereotypes ($r = 0.186$, $p < .001$), suggesting that SGs may have limited impact on changing deeply held misconceptions. The summary results are presented in Table 5 below:

Table 5. Relationship between attitudes towards learning MH via games and components of MHL

Relationship		Relationship Coefficient (r)	Significance (p-value)
Attitudes towards learning MH via SGs	MHL	0.495**	< .001
	Knowledge of MH Problems	0.400**	< .001
	MH Erroneous Beliefs and Stereotypes	0.186**	< .001
	First Aid Skills and Help-Seeking Behaviour	0.397**	< .001
	Self-Help Strategies for MH	0.413**	< .001

**. Correlation is significant at the 0.01 level (2-tailed).

3.5 Influence of Demographic Factors on MHL and Attitudes Toward Game-Based Learning

The study examined whether MHL and attitudes toward SGs for MH education varied by gender, academic program, or age group. No statistically significant differences were found across any of these demographic categories, suggesting that perceptions of game-based learning are relatively consistent among Malaysian youth regardless of background. These findings suggest that MHL and openness to SGs are broadly consistent across gender, academic level, and age among Malaysian youth. This uniformity supports the potential of game-based MH education as an inclusive and universally accessible approach, particularly in diverse or heterogeneous populations.

3.5.1 Gender

Female respondents reported slightly higher MHL scores ($M = 4.20$) compared to males ($M = 4.15$), but this difference was not statistically significant ($t = -1.20$, $p = 0.231$). Conversely, males showed marginally more positive attitudes toward game-based learning ($M = 4.00$) than females ($M = 3.92$), though this difference also lacked significance ($t = 1.03$, $p = 0.305$). Detailed results are presented in Table 6.

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Table 6. Gender affecting MHL and attitude towards learning MH using game

Demographic	Group	Mean (MHL)	Mean (ATT)	t/F	Sig. (P)
Gender	Male	4.15	4.00	t=-1.20 (MHL) t=1.027 (ATT)	0.231 (MHL)/ 0.305 (ATT)
	Female	4.20	3.92		

ATT= Attitude towards learning MH using game

3.5.2 Academic Program

Diploma students (M = 4.19) and degree students (M = 4.20) demonstrated nearly identical levels of MHL (t = −0.38, p = 0.701). Attitudinal scores were similarly comparable (M = 3.96 vs. M = 3.89, t = 0.93, p = 0.353), indicating no meaningful variation by academic level enrolment. As presented in Table 7.

Table 7. Program enrolment affecting MHL and attitude towards learning MH using game

Demographic	Group	Mean (MHL)	Mean (ATT)	t/F	Sig. (P)
Program	Diploma	4.19	3.96	t= -0.38 (MHL)/ t= 0.93 (ATT)	0.701 (MHL)/ 0.353 (ATT)
	Degree	4.20	3.89		

3.5.3 Age

One-way ANOVA revealed no significant differences in MHL across age groups (F = 2.24, p = 0.108). Participants aged 18–19 had the highest MHL (M = 4.21), while those aged 20–21 scored slightly lower (M = 4.14); respondents aged 22 and above reported the highest mean (M = 4.25). Similarly, attitudes toward game-based learning did not differ significantly by age (F = 1.03, p = 0.360). As shown in Table 8

Table 8. Age affecting MHL and attitude towards learning MH using game

Demographic	Group	Mean (MHL)	Mean (ATT)	t/F	Sig. (P)
Age	18-19	4.21	3.99	F= 2.24 (MHL)/ F= 1.03 (ATT)	0.108 (MHL)/ 0.360 (ATT)
	20-21	4.14	3.89		
	22 and above	4.25	3.90		

4. DISCUSSION

This study addresses a critical design challenge: How can SGs be meaningfully tailored to reflect the lived experiences, engaging, and sociocultural values of Malaysian youth while promoting MHL? The findings reveal that Malaysian youth possess moderate to high baseline MHL and hold generally positive attitudes toward game-based MH education. These insights affirm the potential of SGs as inclusive, scalable, and culturally adaptable tools for youth engagement. By interpreting user data through the MDA framework, this study translates empirical findings into actionable design principles that align with user preferences, behavioural trends, and cultural context eventually laying the foundation for evidence-based, user-centred game design and development.

The assessment of MH revealed strong awareness of common psychological conditions such as depression and anxiety yet also uncovered persistent misconceptions particularly around substance abuse and stereotypes linking mental illness to socioeconomic status. This blend of accurate understanding and enduring misbeliefs underscores the need for educational strategies that move beyond simple factual delivery. Game mechanics should therefore support progressive learning, starting with foundational concepts and gradually introducing more complex ideas. A well-designed serious game can guide players step-by-step, challenging misconceptions through features such as micro-learning modules, interactive scenarios, and branching narratives that reinforce accurate information and promote reflective thinking. Dietvorst et al. (2022) exemplify this approach by combining cognitive behavioural exercises with progress

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tracking to facilitate skill development and self-awareness. However, transforming deeply held attitudes requires more than information alone as it demands repeated cognitive engagement and emotionally resonant experiences. SGs offer these through immersive storytelling and perspective-shifting scenarios, supporting meaningful shifts in both knowledge and belief systems (Nicholas et al., 2022).

Despite being open to gaming, respondents expressed uncertainty about the educational value of SGs (mean = 3.81), even as they reported high enjoyment (mean = 4.08). This disconnect highlights a central design urgency to create experiences that are not only fun but also cognitively enriching and emotionally resonant. The MDA framework clarifies how this can be achieved. Game dynamics such as goal setting, feedback loops, and pacing challenges must be carefully structured to generate desired aesthetic experiences, including empowerment, emotional resonance, and cultural relevance (Hunicke et al., 2004). For instance, clear tracking, meaningful rewards, and reflective prompts can help players connect gameplay to learning outcomes, reinforcing the perception of educational legitimacy. As Schilt et al. (2022) observed, SGs that fail to communicate their purpose risk low engagement and may struggle to retain users. To prevent this, design should incorporate interesting narratives, relatable characters, and culturally grounded decisions that reflect the realities of Malaysian youth. Such features enhance perceived relevance and trust factors further supported by Almeqbaali et al. (2022), who advocate for expert co-design in MH apps to ensure clinical accuracy and user confidence.

The study reveals key behavioural insights that can guide the design of accessible and engaging SGs. Most respondents were casual gamers, with 45.1% playing less than one hour per week and a preference for puzzle and action genres, suggesting that effective games for this audience should feature short, episodic formats and simple onboarding to enable quick engagement and sustained use. Motivations such as stress relief (27.4%) and calming thoughts (26.5%) further indicate the importance of incorporating mechanics that support relaxation, self-expression, and introspection such as ambient sound design, breathing exercises, and relatable characters, as seen in *The Guardians* (Sriwatanathamma et al., 2023) and *BlueLine* (Sriwatanathamma et al., 2023). These mechanics shape core game dynamics, including reward pacing, progression systems, and feedback loops, which in turn foster positive aesthetic experiences like safety, curiosity, and personal growth, as defined by the MDA framework. By aligning game design with users' actual behaviours and emotional needs, developers can create experiences that are not only easy to access but also meaningfully engaging.

The main finding of this study is a moderately strong positive correlation between MHL and positive attitudes toward SGs (r = 0.495, p < .001), particularly regarding self-help strategies and help-seeking behaviours. This suggests that SGs can do more than just teach facts; they have the potential to encourage proactive, positive MH actions. Importantly, no significant differences were found based on gender, academic program, or age, indicating that well-designed games can be effective across diverse groups. This supports the use of universal design principles to ensure inclusivity. As Dietvorst et al. (2022) and Nicolaidou et al. (2022) emphasize in their work on MH apps, features like adjustable difficulty levels, multilingual support, and culturally relevant scenarios can enhance both accessibility and user engagement. However, the weaker correlation between MHL and the reduction of incorrect beliefs (r = 0.186) highlights a limitation that digital games alone may not be enough to change deep-seated stigma. Consistent with Liu (2023), integrating SGs with social or community-based learning may provide richer context and deeper reflection to shift long-held misconceptions.

Equally important, embedding cultural narratives and relatable characters ensures that lived experience perspectives are represented within gameplay. By mirroring the challenges faced by Malaysian youth including stigma, family expectations, and social pressures, players are encouraged to engage with decision points and storylines that reflect their realities. Beyond narrative relevance, incorporating youth gaming preferences, casual play habits, and motivations such as stress relief, relaxation, and creativity helps align the game's structure with how they naturally interact with digital media. This alignment fosters recognition, emotional resonance, and trust, thereby strengthening engagement through both mechanics and

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aesthetics. In doing so, the study demonstrates how sociocultural values, lived experiences, and youth-specific gaming behaviours can be systematically integrated into serious game design for MH education.

Ultimately, this study translates user-centred evidence into culturally grounded, educationally effective design strategies aligned with the MDA framework. By mapping empirical findings to mechanics, dynamics, and aesthetics, it offers developers a structured pathway to create SGs that are not only engaging but also meaningful and inclusive. Table 9 summarises these insights by linking survey findings to MDA layers and proposing actionable design features into three key columns:

1. Identifying key thematic areas based on survey findings and links them to relevant MDA components.
2. Outlining the specific user data that include knowledge gaps, attitudes, and gaming behaviors
3. Proposing actionable game design features that correspond to these insights.

Table 9. Design implications informed by the MDA framework for a MH serious game

Theme (MDA Layer)	Survey Insight	Proposed Game Design Feature
MH Knowledge (Mechanics)	High understanding of common MH problems; gaps in complex topics	Quizzes, puzzles, fact-based storytelling, CBT microlearning missions
Misconceptions and Stigma (Mechanics + Aesthetics)	Persistent misconceptions example substance abuse and mental illness linked to poverty	Branching narratives and dialogue choices that reframe misconceptions through culturally grounded scenarios and lived experience reflections. Example: characters facing stigma within family or community
Attitudes Toward Games (Dynamics + Aesthetics)	Openness to games, but uncertainty about educational value	Progress tracking, immediate feedback, rewarding learning loops
Gaming Habits (Mechanics)	Casual gamers: most play <1 hour/week; prefer puzzle/action genres	Short, modular sessions with optional reminders
Motivational Triggers (Dynamics)	Play for stress relief, calming thoughts, creativity	Breathing exercises, soothing visuals, creative expression tasks and journaling
Self-Help & Help-Seeking (Dynamics + Aesthetics)	Strong link between game openness and help-seeking/self-care behavior	Role-playing or real-life scenarios with self-help and peer support options
Inclusivity and Demographics (Mechanics + Aesthetics)	No significant differences across gender, age, or academic program	Adjustable difficulty, localization content (language/culture), diverse characters and cultural narratives

5. CONCLUSION

This study demonstrates that Malaysian youth are receptive to SGs as tools for MH education, provided the design reflects their game preferences, lived experiences, cultural context, and emotional needs. Findings reveal a meaningful association between openness to games and key MHL behaviours such as self-care and help-seeking indicating that well-designed gameplay can extend beyond entertainment to support positive MH engagement. Rather than assuming appeal, this research empirically shows that enjoyment and perceived educational value in SGs are linked to psychological readiness to learn and act. A critical contribution lies in the application of the MDA framework to translate user data on knowledge gaps, gaming habits, motivations, and attitudes into concrete, theory-driven design strategies. This structured approach bridges research and practice by aligning game elements such as micro-learning quizzes, puzzles, branching narratives, and progress feedback with desired cognitive and emotional outcomes, ensuring that educational content is embedded within engaging, non-didactic experiences. The results support the development of SGs featuring short, modular sessions; culturally relevant storytelling; calming mechanics such as breathing exercises; and inclusive features like multilingual options and diverse characters design choices that directly address users' casual gaming patterns and need for emotional safety. These insights are particularly valuable in contexts where stigma, limited access to services, and cultural silence around MH persist, offering scalable, low-barrier interventions tailored to Southeast Asian youth, specifically Malaysia.

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It is important to acknowledge the study's limitations. The sample, while diverse in geographic and academic background, is not nationally representative and overrepresents female and diploma-level students. Additionally, data were self-reported and cross-sectional, limiting causal inferences regarding the impact of gameplay on behavior. Future research should adopt participatory co-design methods, involving young people and MH professionals in iterative prototyping to refine game content and usability. Longitudinal studies and randomized trials can further examine how gameplay influences attitude change, knowledge retention, and real-world help-seeking over time. Cross-cultural comparisons could also explore how different populations respond to MDA-aligned designs, particularly in relation to aesthetic preferences and learning outcomes. As digital MH solutions become increasingly integrated into public health strategies, grounding serious game development in empirical evidence, user-centered insights, and validated frameworks such as MDA will be essential to ensure they are not only engaging but also effective, equitable, and culturally meaningful.

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This study did not involve clinical or biomedical research, sensitive personal data, or interventions requiring formal ethics approval under the Malaysian Guidelines for Good Clinical Practice (2018). The research complies with the Malaysian Code of Responsible Conduct in Research (MCRCR 2nd Edition, 2021) and adheres to the principles of ethical and responsible research practices. The authors have no relevant financial or non-financial interests to disclose.

7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

8. AUTHORS' CONTRIBUTIONS

Nurul Ulfa Abdul Aziz led the study by conceptualizing the research, developing the methodology, conducting the investigation, analysing the data, preparing visualizations, and drafting the original manuscript. Roslina Ibrahim, as the main supervisor, provided guidance on research design and ensured methodological accuracy. Firdaus Abdullah, as the co-supervisor, offered scholarly supervision, validated the study direction, and contributed to the refinement of the manuscript.

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