Quizizz for Teaching and Learning About Adherence to Antipsychotics: A Pilot Study of Students' Perception and Their Level of Knowledge

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Digital gamification fosters high-level thinking. While other platforms like Jeopardy and Kahoot were frequently studied, the evidence against or in favour of Quizziz, a student-engagement software for use in classroom group assignments and formative assessments were limited. This study aimed at pilot-testing the use of Quizizz to assess its value or appeal as a gamification tool, and to assess the correlation between students' perceptions and their scores (knowledge). A Quizziz game entitled, "Adherence to antipsychotics" was developed and tested on undergraduates from health (pharmacy and health sciences) and non-health (control) related programs. Their responses to a 15-item validated questionnaire assessing perception were recorded. Students perceived the experience of learning about antipsychotics via Quizizz as positive. Their perceptions correlated positively with their game scores (r = 0.617, p= 0.004). Understandably, students enrolled in health-related programs scored higher than their counterparts (p<0.001), although the mean between-group perception scores did not differ. Quizziz could foster cognitive presence of millennials and equip them to be 21st-century healthcare providers capable of tackling non-adherent, psychiatric patients.

Keywords: adherence, antipsychotics, generation Z, pharmacy education, Quizizz, millennials

INTRODUCTION

The interaction between pharmacists and psychiatric patients is suggested to increase as the prevalence of psychiatric disorders and mental illnesses is on an upward trend. In Asia, existing literature on mental health literacy is limited among pharmacists and pharmacy students (Choo & Gan; 2018). To effectively address this challenge, the pharmacy curriculum can be structured to provide students with the knowledge and skills to recognize nonadherence and its complexities in patients with underlying psychiatric disorders (MacDonald et al., 2018). For example, effectively screening for nonadherence, identifying determinants

that often hinder patients' medication compliance, and subsequently offering appropriate counseling to a vulnerable group of patients and their careers, can be included as modules for third-year students enrolled in the Bachelor's in Pharmacy program. In parallel, the method of delivering the module and curriculum is of particular significance in this Covid-19 pandemic-endemic era, where most teaching and learning activities have shifted to online or asynchronous learning (Naimat et al., 2021). Hence, educators are driven to seek techniques that facilitate and promote students' virtual participation and engagement (Kandri, 2020). For example, games-based learning allows students to take risks, learn from their mistakes in a low-stakes yet competitive environment, gives them a chance to keep trying for the right answer, and a possibility to be rewarded for successful attempts (Choo et al., 2022). These advantages are analogs as to how one attempts to gain new knowledge and master a specific skill in their daily life. Final-year pharmacy students reported that after participating in a Kahoot game test, their understanding of fundamental psychopharmacology improved significantly (Gonzalez-Cuevas & Greciano, 2017). Similarly, authors reported a study where they had designed a power-point game called Jeopardy and had seen improvements in the recall of facts about schizophrenia, typical and atypical psychotics, and adverse drug reactions and monitoring. by third-year pharmacy students (Grady et al., 2013).

The aim of this study was to pilot-test the use of Quizizz to assess the value or appeal of the digital gamification tool, and to assess the association between students' Quizizz scores (level of knowledge) and their perceptions. The secondary aim was to evaluate whether or not there was a significant difference in the association between students enrolled in health and non-health-related programs.

METHODS

Platform Development
The stages from signing up to this platform and creating a basic level quiz are given below:
1. A free account was created on quizizz.com
2. The user clicked on "creates a quiz". A name was given to the quiz and the relevant subject was chosen as shown in Figure 1.
3. Questions and answers were added ("teleport questions or create a new question either multiple-choice, open-ended, poll, check-box, or fill-in-the-blank").
4. The language, grades, and title images were selected. Choosing a title image was optional.
5. The Quizizz is considered ready once "published".

FIGURE 1
A NEW GAME CREATED ON QUIZIZZ AND THE RELEVANT ASPECTS DEFINED
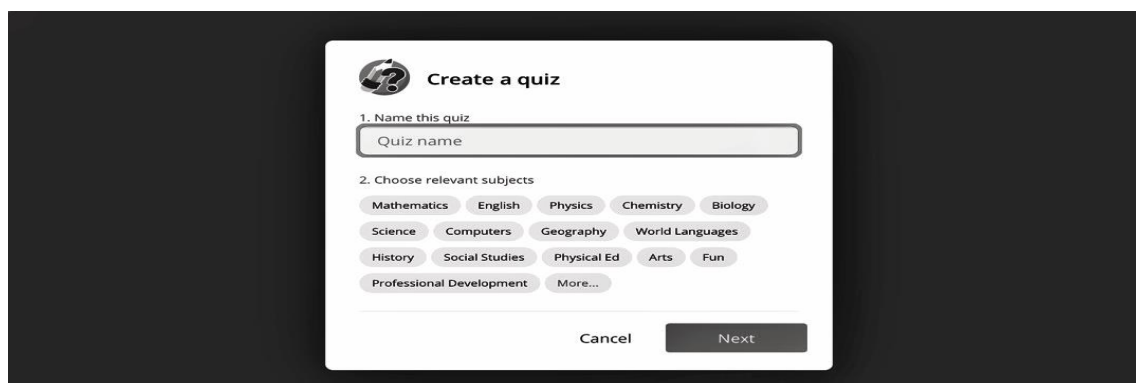

Quizizz Game Construct
Dimensions are divided into the following 3 subcategories: "Understanding medication adherence" (7 items), "Resolution to non-adherence" (2 items), and "Awareness of schizophrenia and antipsychotics" (8

items). The questions and contents were created based on the different themes as described in Appendix 1. The questions were also ordered by level of difficulty: easy, medium, and advanced. The contents were verified by two academic pharmacists ML and EU. Reliability was calculated and both the Kappa score and Cronbach alpha values were reported.

Instructions for Students to Join the Game

1. Students were instructed to click on a given link to join the game. They were expected to log in to quizizz.com, write their password and their nickname for the session and enter the game. For the general setting of Quizizz, the platform auto-sets a limit of 100 participants per session and when an attempt is made, the platform computes that as one player, and the allowable participant headcount is reduced to 99. In terms of duration and number of attempts, participants were given 30 seconds to answer each question. The game could be accessed for five days. Multiple attempts were permitted within this stipulated time. Participants will receive no points if the timer runs out. Throughout this period, the game code remained active.

2. *Leaderboard:* For the scoring system, after attempting each question, participants were able to view a leaderboard and their rank throughout and after completing the quiz as shown in Figure 2. A timer was also activated and players were rewarded for accuracy and speed in answering the questions. Students can earn a maximum of 600 points for every accurate answer. Between 0 to 400 points were awarded depending on the time taken to answer the questions. The quicker the questions answered, the higher the scores obtained. Regardless of the speed, a false answer was always 0. Aside from the timer, bonus marks known as 'power-ups' was added over time to enhance engagement and participation in Quizizz. For example, double jeopardy, eraser, and immunity were the means made available to allow participants to obtain double points for accurate answers or second chances after a failed attempt for a correct answer.

FIGURE 2
QUIZIZZ ON ADHERENCE TO ANTIPSYCHOTICS WAS LAUNCHED
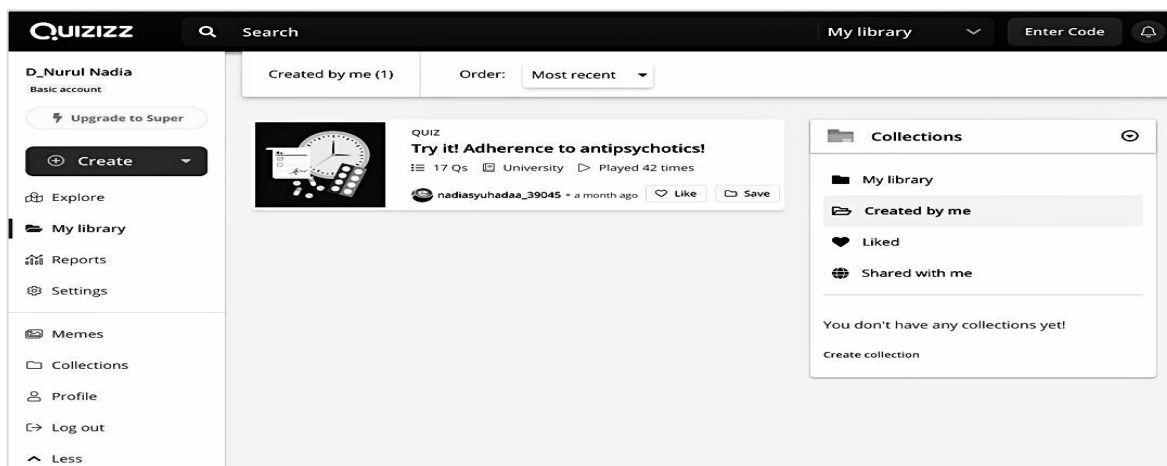
3. *Downloadable Results:* Once a session ended, a final leaderboard was displayed, and each student received personalized feedback after the game finished. Students could review all the questions (as well as their answers and solutions/ explanations). It is of an added advantage that the Quizizz performance reports were available on the website and could be downloaded as Excel files. From there, the students were able to view the number of questions they answered correctly, their ranking, total score as well as accuracy.

4. *Participants:* The Quizizz "Adherence to antipsychotics" game was pilot-tested on a group of 80 third-year undergraduate students from the Faculty of Pharmacy, n=28, Faculty of Health Science,

n=20, Faculty of Engineering, n=20, and Faculty of Business, n=12 from Universiti Teknologi MARA (UiTM). They were invited to attempt the game.

5. *Instrument*: Once they had attempted the game, NNSA obtained students' perceptions by requesting for the students to respond to a 15-item questionnaire with multiple-choice answers. Informed consent was obtained before they answer the questionnaire by placing the consent form on the first page of the questionnaire. The questionnaire or scale of measurement was adopted from Bicen et al who conducted a similar study using Kahoot (Bicen & Kocakoyun, 2018). The students evaluated two sections. The students were required to fill in the marks obtained from the Quizizz Leaderboard and this score determined their level of knowledge. Questions 1-12 were about students' demographic characteristics and perceptions of the use of Quizizz as a platform for digital gamification, and questions 12-15 were specific to the questions on Quizizz as a means to learning about medication adherence to antipsychotics. The students assessed the game by using a 5-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree) (Bicen & Kocakoyun, 2018). An answer of "Strongly agree" was associated with a score of 5 points. The students were anonymized and their scores from the questionnaire were then computed.

6. *Data Analysis*: Bivariate analysis of Spearman's rank order was utilized to evaluate the relationship between students' game scores (knowledge) and perception scores. The Mann-Whitney U Test was used to evaluate whether or not both the scores were significant between students of health and non-health (control) related programs. P value of <0.05 was considered statistically significant.

RESULTS

Frequency and Intensity of Feedback

One feature this game has is feedback which is defined both in its frequency and intensity. Feedback was almost constant either in the form of a timer, prompting one to speed up in addition to the features "double jeopardy, eraser, and immunity" which gave instantaneous feedback when one was performing well and deserved a reward. Students were able to do self-assessment followed by auto-feedback available via the system.

Platform Development

Figure 3 showed the scores of participants on Quizizz. The items and questions used were validated for their contents. Good inter-rater reliability was observed with a Kappa score of 0.65. Internal consistency of the items was moderate i.e., Cronbach alpha was 0.75.

FIGURE 3
LEADERBOARD DISPLAYING THE SCORES OF PARTICIPANTS
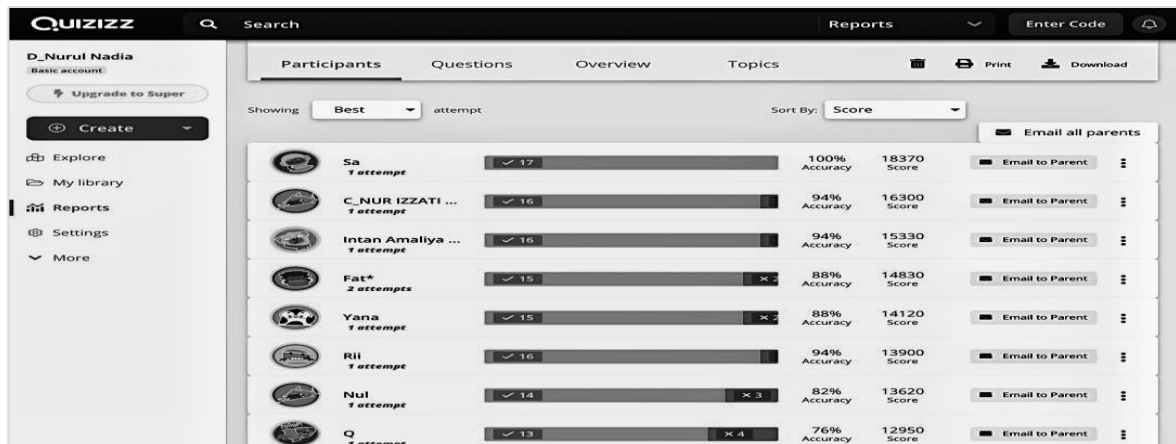
Demographic Profile

The demographic profile of the participants is shown in Table 1. The average age of the third-year students was 25.

Students' Knowledge of Adherence to Antipsychotics

The knowledge of antipsychotics and the importance of adherence of each student were evaluated through the score obtained after attempting all the questions in the game as shown in Table 2.

TABLE 1
DEMOGRAPHIC DATA, N=80

Category		Frequency, (%)
Age	21-23	24 (30%)
	24-26	56 (70%)
Course	Pharmacy	28 (35%)
	Health Science	20 (25%)
	Engineering	20 (25%)
	Business	12 (15%)
Study year	First-year	0
	Second-year	0
	Third-year	80 (100%)
	Fourth-year	0

TABLE 2
CONTENTS FOR THE QUIZIZZ GAME

Theme 1: Understanding and perception of medication adherence
1. I have an idea of what medication adherence is (Darbishire & Mashrah, 2018; Dwajani et al., 2018; Hamrick et al., 2020; (MacDonald et al., 2018; Rickles et al., 2012) Level: Easy
2. Is adherence the same as compliance? (Jimmy & Jose, 2011; Dwajani et al., 2018) Level: Easy
3. Medication non-adherence is: (Desai & Nayak, 2019; Xu et al., 2020) Level: Easy
4. Non-adherence can be classified into (Abdullah et al., 2020; MacDonald et al., 2018) Level: Difficult
5. According to the WHO, factors of non-adherence can be categorized into: (Brown & Bussell, 2011; Dwajani et al., 2018) Level: Difficult
6. Research has shown that the prevalence of medication non-adherence statistically was: (Desai & Nayak, 2019; Xu et al., 2020) Level: Difficult
7. The following are the risks for non-adherence: (Darbishire & Mashrah, 2018; Dwajani et al., 2018) Level: Moderate

8. Non-adherence is estimated to be associated with 125 000 deaths, 10 percent of hospitalization rates, and costed the United States $100 billion in healthcare services per year. (Hamrick et al., 2020; Kim et al., 2018)		
Level: Difficult		
Theme 2: Resolution to non-adherence		
9. Interventions that have been performed to improve medication adherence include : (Taibanguay et al., 2019; Lam & Fresco, 2015)		
Level: Difficult		
10. To what extent do you think smartphone application such as 'MyMeds' is significant in improving medication adherence? (Abdullah et al., 2020, Davies et al., 2015)		
Level: Difficult		
Theme 3: Awareness of schizophrenia and antipsychotics		
11. Schizophrenia is: (National Institute of Mental Health *» Schizophrenia*, 2020)		
Level: Difficult		
12. The following are the causes of medication non-adherence among patients with schizophrenia: (Semahegn et al., 2020; Tareke et al., 2018)		
Level: Moderate		
13. Is non-adherence to antipsychotic medications associated with the relapse of psychotic episodes? (Roseliza-Murni et al., 2015; Tareke et al., 2018)		
Level: Easy		
14. The following are the roles of pharmacists in the management of schizophrenia patients: (Danladi et al., 2013; Rubio-Valera et al., 2014)		
Level: Moderate		
15. The following are neurotransmitters that are associated with schizophrenia: (Bansal & Chatterjee, 2021)		
Level: Moderate		

See Appendix 1 for detailed questions and answer options

Feedback on Quizziz

The students' feedback and calculated perceptions of the Quizizz game are shown in Table 3. Referring to Table 3, the item which obtained the highest score was item 9, "I'm able to reflect on my errors after completing the Quizizz game" (Mean = 4.45 SD = 0.605). With item 1, ranking second highest, the majority of the students (95%) collectively agreed that Quizizz is interesting, motivating, exciting, and fun. (Mean = 4.25 SD = 0.550). Most of the students (80%) agreed that they felt positive when playing a game on Quizizz (Mean = 4.10 SD = 0.447), Quizizz was viewed as user-friendly (Mean = 4.15 SD 0.489), and Quizizz allowed friendly competition among participants (Mean = 4.15 SD = 0.489).

Table 3 also depicts that more than half (60%) of the students, agreed that they were motivated to answer the questions on Quizizz (Mean = 4.00 SD = 0.649) and most of them (70%) looked forward to playing again on Quizizz (Mean = 4.10 SD = 0.553).

TABLE 3
STUDENTS' FEEDBACK AND PERCEPTION TOWARDS THE QUIZIZZ GAME

No	Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	Std. Dev
1.	I find that using Quizizz is interesting, motivating, exciting, and fun	0	0	4 (5%)	52 (65%)	24 (30%)	4.25	0.550
2.	I am motivated to answer all the questions in Quizizz	0	0	16 (20%)	48 (60%)	16 (20%)	4.00	0.649

3.	I am looking forward to playing a game in Quizizz	0	0	8 (10%)	56 (70%)	16 (20%)	4.10	0.553
4.	I feel positive when playing a game in Quizizz	0	0	4 (5%)	64 (80%)	12 (15%)	4.10	0.447
5.	I find that Quizizz is user-friendly	0	0	4 (5%)	64 (75%)	12 (20%)	4.15	0.489
6.	I like the friendly competition in Quizizz	0	0	0	64 (80%)	16 (20%)	4.20	0.410
7.	I am eager to complete each question in the Quizizz game	0	0	16 (20%)	40 (50%)	24 (30%)	4.10	0.718
8.	I find that Quizizz reveals the real competence of the students	0	0	28 (35%)	36 (45%)	16 (20%)	3.85	0.745
9.	I'm able to reflect on my errors after completing the Quizizz game	0	0	4 (5%)	36 (45%)	40 (50%)	4.45	0.605
10.	I find that the prompt responses in Quizizz help me to identify my mistakes instantly	0	0	0	64 (80%)	16 (20%)	4.20	0.410
11.	My problem-solving skills are improved when I attempt to solve the game in Quizizz	0	0	24 (30%)	32 (40%)	24 (30%)	4.00	0.795
12.	I tend to think quickly when answering questions in Quizizz	0	0	4 (5%)	56 (70%)	20 (25%)	4.20	0.523
13.	I discover a lot of useful information about adherence to antipsychotics through Quizizz	0	0	28 (35%)	20 (25%)	32 (40%)	4.05	0.887
14.	I'm able to recall important points about adherence to antipsychotics through Quizizz	0	0	40 (50%)	8 (10%)	32 (40%)	3.90	0.968
15.	Quizizz helps me to remember the information about medication adherence better	20 (25%)	12 (15%)	8 (10%)	20 (25%)	20 (25%)	3.10	1.586

As demonstrated by the responses for item number 7, the majority (80%) of the students agreed that they were eager to win the Quizizz game. (Mean = 4.10 SD = 0.718). Item 8 was seeking student perception of competency and approximately 65% of the students agreed that Quizizz revealed the students' true competence on the topic (Mean = 3.85 SD =0.745).

The responses on item 10 showed that all the students agreed that Quizizz is effective in helping the students to identify their mistakes instantly (Mean = 4.20 SD = 0.410). In addition, over half of the students (70%) agreed that their problem-solving skills were improved when they attempted to solve the Quizizz questions (Mean = 4.00 SD = 0.795). Besides, for item number 12, 95% agreed that Quizizz also improved the speed of their thinking when answering the questions. New knowledge was also obtained when playing a game in Quizizz (item 13: 'I discovered a lot of useful information about medication adherence to antipsychotics) (Mean = 4.05 SD = 0.887).

In our study, as demonstrated by the response for item 14, half of the students (50%) agreed that they were able to recall important points about medication adherence to antipsychotics. Quizizz allowed them to (Mean = 3.90 SD = 0.968). Another item where only 50% of students agreed with the statement was item number 15, 'Quizizz helps me to remember the information about medication adherence better' (Mean = 3.10 SD = 1.586).

Correlation Between Game Scores (Level of Knowledge) and Perception

Students perceived the experience of learning about antipsychotics via Quizizz as positive. Their perceptions had moderate and positive linear correlations with their game scores (Spearman Corelation, r = 0.617, p= 0.004). Health-related students scored higher than those not studying health (Median scores in health-related and non-health-related groups were 139 and 110; the distributions in the two groups differed significantly (Mann–Whitney U = 1030, n1= n2 = 80, $p \leq$ 0.001 two-tailed, z-score= 7.40368), although the mean between-group perception scores did not differ.

DISCUSSION

Feedback on Quizziz

The ability to detect their error after completing Quizizz (Item 9) and finding that Quizizz is interesting, motivating, and fun (Item 1) were rated the highest in this survey. Similar findings have been observed by Basuki and Hidayati (Basuki & Hidayati, 2019). However, in their study, the authors compared the preference of the students and found that most of the students chose Quizizz over Kahoot! They reported that 75.9% of the students stated that they enjoyed the game and that the game was an efficient way of reviewing schizophrenia. However, only 34% of students mentioned that they learned more via the game method compared to didactic lectures and the game might be more useful if they were conducted in smaller classroom sizes.

Most of the students agreed they Quizizz was user-friendly and they felt positive when playing the game further elucidates the reasons why students had positive perceptions towards Quizizz as an online educational tool. This was in agreement with a study by Mohamad et al (Mohamad et al., 2020) who cited that their participants agreed that Quizizz was user-friendly.

The students were also motivated to answer the questions and surprisingly look forward to playing again on Quizizz despite the format of questions resembling exam questions. Similar findings have been reported by Pinto-Llorente (Pinto-Llorente et al., 2016) where the authors found that the students were also motivated and encouraged to utilize online quizzes for continuous assessment as well as self-assessment. The students were reportedly eager to win the Quizizz game (Item 7), which was in line with Basuki & Hidayati (Basuki & Hidayati, 2019) who concluded that Quizizz is preferred by the students over Kahoot! as it encouraged students to grasp the lessons taught in class or when self-directed to learn at home so they may top their class in total scores. This finding is also supported by Pinto-Llorente et al (Pinto-Llorente et al., 2016) who mentioned that the platform facilitated participants' focus on a particular subject.

The students also agreed that Quizziz revealed their true competence, matching the findings of a study by Basuki & Hidayati (Basuki & Hidayati, 2019) that considered Quizizz to be challenging and mind-stimulating, and that it revealed the students' competence. Quizizz was also found to be useful in helping the students to detect their mistakes immediately through prompt response or instantaneous feedback features. This finding was in line with the study by Mohamad et al (Mohamad et al., 2020) who found that most of the respondents (98.9%) agreed that Quizizz's instant response feature allowed the participants to quickly recognize their mistakes. In addition, their problem-solving skills and speed of thinking were improved when they attempted the questions. A similar finding was observed by other authors (Yan Mei et al., 2018) who reported that Quizizz improved problem-solving skills among students.

In this study, half of the students reported that new knowledge was obtained when playing Quizizz. This lower response was possibly attributed to the control group i.e. non-health related students sampled, who were unsure of the answers to this and other questions on adherence. Similarly, Mohamad et al (Mohamad et al., 2020) reported that their respondents managed to discover important information and gained new knowledge while using Quizizz as an online game for academic purposes. Bicen and Kocakoyun (Bicen & Kocakoyun, 2018), in their study, observed that using the gamification approach (they used Kahoot!) helped undergraduates to better understand their lessons as well as recall information.

Nevertheless, all the students sampled had the perception that a game in Quizziz is an effective method of learning (items 1-12). This demonstrated that, while Quizizz can assist in remembering facts, the target audience may need to be very specific and in this game, the questions were indeed more tailored towards a

group of students enrolled in health-related programs. This also indicated that the contents had intended construct and were valid.

Correlation Between Game Scores (Level of Knowledge) and Perception

The study reported a positively moderate perception of the experience of learning about antipsychotics via Quizizz. These findings support the notion by a systematic review which concluded that while teachers positively accepted Quizizz due to its effectiveness, feasibility, ease of use, the motivating nature for learners, and the focus on the benefits should be studied for students. (Lim, 2021)

CONCLUSION

Students from both health and non-health backgrounds found Quizizz to be an appealing gamification tool. Understandably, health-related students were more knowledgeable on psychiatry and therefore had better perceptions of psychiatric content than non-health-related students. Quizziz could foster cognitive presence of millennials and equip them to be 21st-century pharmacists and healthcare providers capable of tackling non-adherent psychiatric patients.

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APPENDIX

Theme 1 : Understanding and perceptions about medication adherence

1. **I have an idea on what medication adherence is?** (Darbishire & Mashrah, 2018; Dwajani, Prabhu, Ranjana, & Sahajananda, 2020; Rickles et al., 2012) **(Easy)**
    a. A simple concept which does not require greater teaching focus (MacDonald, Fejzic, & Cottrell, 2018) (Hamrick, Augustine, Pinkerton, Klein, & Elliott, 2020)
    b. Not necessary in patient care and reaching clinical goals.
    c. The extent to which the persons' behaviour such as medication taking corresponds with agreed recommendations from a healthcare provider

    Explanation: Answer is C. Medication adherence is defined as the extent to which a patient acts in accordance with a prescribed medication regimen.

2. **Does adherence the same as compliance?** (Dwajani et al., 2020) (Jimmy & Jose, 2011) **(Easy)**
   a. Yes
   b. No

   Explanation: Answer is B. The term adherence is defined as "the extent to which patients treatment related behaviours (taking medication, following a diet, modifying habits or attending clinics) correspond to health care professional's advice. Compliance is defined as the extent to which patients follow the instructions, prescriptions and prescriptions given by health professionals or the extent to which the patient's behaviour or attitude exactly matches with the prescriber's recommendations. Often, adherence and compliance are used interchangeably.

3. **Medication non-adherence is :** (Desai & Nayak, 2019) (Xu, Xie, Chen, Li, & Sun, 2020) **(Easy)**
   a. Patient not taking their prescribed medications as directed by the healthcare provider.
   b. Discontinuing their medication therapy.
   c. Careless or forget to the medication regimen.
   d. Stop taking the prescribed medications when feeling better.
   e. All of the above.

   Explanation: The answer is E. Medication non-adherence refers to a patient not taking prescribed medications as directed or discontinuing medication therapy altogether. Forgetfulness or carelessness were also reported as the most common factors causing non-adherence.

4. **Non-adherence can be classified into:**
   a. Intentional
   b. Unintentional
   c. All of the above
      (Abdullah, Halim, & Hamidi, 2020; MacDonald et al., 2018) **(Difficult)**

   Explanation: The answer is C. Non-adherence can be divided into two major categories which were unintentional and intentional non-adherence. The latter is described as patient own decision to deviate from the therapeutic plans agreed with the prescribers. Unintentional nonadherence is the passive type of nonadherence in which the patients are unable to take medications as indicated or instructed due to limited resource or capacity

5. **According to WHO, factors of non-adherence can be categorized into:**
   a. Patient-related factors
   b. Condition-related factors,
   c. Medication-related factors
   d. Physician-related factors
   e. All of the above
      (Brown & Bussell, 2011; Dwajani et al., 2020) **(Difficult)**

   Explanation: The answer is E. The determinants of non-adherence according to World Health Organization (WHO) are categorized into five factors: socioeconomic (e.g. poor socioeconomic status, illiteracy, unemployment), health system-related (poor medication distribution, inadequate or non-existent reimbursement or a lack of feedback on performance), therapy-related (complexity of medical regimens, duration of treatments or the immediacy of beneficial effects), condition-related (severity of symptoms, rates of progression or level of disability), and patient-related (knowledge and beliefs, motivations to manage or confidence).

6. **Research studies shown that prevalence of medication non-adherence statistically was:**
    a. Women were more likely to be non-adherence than man
    b. Men were more likely to be non-adherence than women
    c. Both are equivalence to each other
       (Desai & Nayak, 2019) (Xu et al., 2020) **(Difficult)**

    Explanation: The answer is A. According to studies, results showed that women were more likely to be non-adherence to antipsychotic medications than all other demographics.

7. **Below are the risks of non-adherence:**
    a. Decrease the risks for hospitalization
    b. Worsening disease
    c. Increase the quality of life
    d. Decrease cost of medical care
       (Darbishire & Mashrah, 2018; Dwajani et al., 2020) **(Moderate)**

    Explanation: The answer is B. Non-adherence leads to considerable morbidity, mortality and avoidable health care costs. It has been estimated by WHO in 2003 that, in developed countries' adherence averages to only 50 % in patients suffering from chronic medical illness and in developing countries the problem is much higher.

8. **Are you aware that non-adherence is estimated to be associated with 125 000 deaths, 10 percent of hospitalizations, and $100 billion in healthcare service per year in the United States?**
    a. Yes
    b. No
    c. Not sure
       (Hamrick et al., 2020) (Kim, Combs, Downs, & Tillman, 2018) **(Difficult)**

    Explanation: Non-adherence is one of the primary reasons for treatment failure and directly correlates to an increase in patient morbidity, mortality, and health care costs. According to studies, it has been estimated annually that medication non-adherence contributes to 125,000 deaths, 10% of hospitalizations, and $100 billion in healthcare costs in the United States. Besides, WHO stated that the magnitude and impact of poor adherence in developing countries is assumed to be even higher given the paucity of health resources and inequities in access to healthcare.

Theme 2: Resolution to non-adherence

1. **Interventions that have been performed to improve medication adherence include :**
    a. Providing reminder tools such as pill box to the patient.
    b. Self-report adherence
    c. Patient education such as counselling and disease-information pamphlet
    d. Laboratory assessment of urine, blood and saliva samples to measure drug concentration levels.
    e. All of the above
       (Taibanguay, Chaiamnuay, Asavatanabodee, & Narongroeknawin, 2019) (Lam & Fresco, 2015) **(Difficult)**

Explanation: The answer is E. Research shows that a number of intervention trials have been conducted to enhance adherence to treatment in patients with immune-mediated inflammatory disorders, including information about disease, medication reminders using pillbox or mobile phone and motivational interview. Patient education also significantly improves adherence. Other than that, provision of disease information pamphlet with or without directed counselling can equally improve medication adherence.

2. **To what extent do you think smartphone application such as 'MyMeds' is significant in medication adherence?**
   a. Could be a new platform to increase patient understanding about their medication regimen.
   b. As a reminder tool if the patient forget or careless about their dose and time to take the medication, thus negating problems related to non-adherence.
   c. Promote optimal treatment outcomes and decrease wastage of medicine.
   d. Enable effective patient monitoring and better healthcare services.
   e. All of the above
   (Abdullah et al., 2020) (Davies, Kotadia, Mughal, Hannan, & Alqarni, 2015) **(Difficult)**

   Explanation: The answer is E. In general, the common methods used to motivate patients to increase adherence are traditional reminder systems, education on medicine taking behaviour, counselling by healthcare professionals, simplifying the complex dose regimen, or a combination of these approaches. Smartphones could be a new platform for the healthcare system to reduce the barriers between the healthcare providers and patients. Mobile healthcare (mHealth) applications, or apps, may be used to support patient adherence to medication thus promoting optimal treatment outcomes and reducing medication wastage. For instance, the software packages can aid the diagnosis process, enable effective patient monitoring, provide medical information and even serve as a communication tool between patients and healthcare professionals.

Theme 3: Relevance of medication adherence in pharmacy curricular

1. **Is it relevant for medication adherence to be part of the syllabus/topic in pharmacy curricular?**
   (MacDonald et al., 2018; Rickles et al., 2012) **(Easy)**
   a. Relevant
   b. Not relevant

   Explanation: Pharmacists can optimise patients' medication adherence, hence pharmacy students should be acquiring professional competence to ensure they are prepared for their future professional role. Pharmacy curricula need to carefully address the concept of adherence. Therefore, ensuring the pharmacy curriculum is structured to provide students with the knowledge and skills to identify and manage nonadherence is vital to effectively address this widespread healthcare concern.

2. **As a future pharmacist graduate, job scope of pharmacists in order to improve medication adherence include:** (Hamrick et al., 2020; Rickles et al., 2012) **(Moderate)**
   a. Accountable for patient medication taking behaviour such as providing counselling.
   b. Identify the potential determinants of non-adherence among patients.
   c. Build a trust relationship between the patients and healthcare provider.
   d. All of the above

Explanation: The answer is E. As one of the most trusted and accessible healthcare professionals, pharmacists carry the responsibility to intervene on patients exhibiting medication non-adherence. Pharmacists have a significant impact on improving patient adherence due to their ability to educate patients, monitor adherence on a regular basis, and identify obstacles to adherence. Moreover, patients need guidance and support to maintain adherence, and it is vital for pharmacists to be empathetic toward patients.

3. **After medication adherence is a part of pharmacy curricular, does this increase your empathy towards patients and improve self-confidence on adherence counselling?** (Darbishire & Mashrah, 2018; Hamrick et al., 2020) **(Moderate)**
    a. Yes
    b. No

Theme 4: Awareness about schizophrenia

1. **Schizophrenia is :** (Solem et al., 2015), (National Institute of Mental Health, n.d.) **(Difficult)**
    a. Split-personality disorder
    b. Psychotic disorder
    c. Anxiety disorder
    d. Obsessive-compulsive disorder

    Explanation: Answer is B. Schizophrenia is one type of psychotic disorder. People with bipolar disorder may also have psychotic symptoms. Schizophrenia does not mean split personality or multiple-personality. It is a serious mental illness that affects how a person thinks, feels, and behaves.

2. **Below are the determinants of medication non-adherence among schizophrenia patients :** (Semahegn et al., 2020), (Tareke, Tesfaye, Amare, Belete, & Abate, 2018) **(Moderate)**
    a. Patient's attitude towards medication
    b. Patient's perceived stigma
    c. Lack of social support
    d. Substance abuse
    e. All of the above

    Explanation: The answer is E. This is because patients' attitude toward medication was a crucial factor affecting treatment adherence and therapeutic alliance. Patients having negative attitude towards their medication was a factor associated with psychotropic medication non-adherence. Next, the perception or the feeling of psychiatric patients being stigmatized by their families, neighbours, health professionals, and other community members was a factor associated with medication non-adherence. In one study, both internal and external triggering factors caused the patients to feel being stigmatized. Regarding substance use, patients who were using psychoactive substances after initiation of treatment were nearly twice as likely to be non-adherent to antipsychotic medication compared to those who had no history of substance use. Lastly, poor or lack of social or family support was associated with psychotropic medication non- adherence.

3. **Does non-adherence to antipsychotic medications associated with the relapse of psychotic episodes?** (Roseliza-Murni, Oei, Fatimah, & Asmawati, 2015), (Tareke et al., 2018) **(Easy)**
    a. Yes
    b. No
    c. Not sure

Explanation: Answer is A. People suffering from schizophrenia have often been reported to experience recurrent relapse of its psychotic episodes. In fact, many people who improved after an episode of schizophrenia tended to experience the psychotic symptoms again later in their lives.

4. **Below are the roles of pharmacists in the management of schizophrenia patients :** (Danladi et al., 2013), (Rubio-Valera, Chen, & O'Reilly, 2014) **(Moderate)**
    a. Enhance the effectiveness of antipsychotic medications in the psychosis management.
    b. Promote medication adherence towards antipsychotic medications.
    c. Detect, resolve and prevent the drug-related problems (DRP)
    d. Ensure the patients use medications in a safe and reasonable manner.
    e. All of the above

Explanation: Answer is E. Pharmacists are ideally positioned to play a greater role in supporting people with a mental illness. They have a broad range of skills in medication management, provision of drug information to prescribers, counselling patients about medicines, and facilitating medication adherence strategies in the delivery of mental health care. Also, they have role in supporting quality use of medicines in medication review, strategies to improve medication adherence and antipsychotic polypharmacy, and shared decision making.