

Kaizen: Interactive Gaming for Diabetes Patient Education

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Abstract

Objective: An estimated 100 million Americans have diabetes, undiagnosed diabetes, a high risk of being diagnosed with diabetes, or prediabetes. Many complications can arise if diabetes is poorly managed. Hence, the need for adequate knowledge, skills, and ability to care for oneself, known as diabetes self-care management, is needed to reduce complication rates. We used an interactive platform that incorporates principles of gamification to enhance user engagement to enhance diabetes knowledge. The purpose of this descriptive pilot study was to discover what adult patients with diabetes thought about this novel educational approach to diabetes education.

Materials and Methods: We collected focus group data from participants at a diabetes clinic after they played an interactive diabetes trivia game, on our software platform (Kaizen Education). Transcripts were coded and common themes were identified.

Results: We conducted 9 focus groups that included 33 adult (age >18) participants who had diabetes. An overarching theme of play/gaming as a form of learning was apparent, and after analyzing the coding several themes emerged, including preferences and desired environments (clinic and home) for learning, desired players (including family, significant others), and a good balance of question difficulty.

Conclusions: Participants were overwhelmingly positive about gamified education and felt empowered to lead discussions with their health care providers about diabetes self-care education, in a sense “flipping” the traditional clinic patient education paradigm. These results suggested that a flipped clinic approach could be beneficial, empowering, and engaging for patients.

Keywords: Game platforms, Kaizen, Diabetes education

Introduction

APPROXIMATELY 30 MILLION American adults have diabetes mellitus with an additional 79 million at high risk of developing diabetes.^{1–5} The rates and risk for diabetes mellitus are particularly elevated in the US Southeast, an area with concurrent high rates of obesity.⁶ Possessing adequate knowledge, skills, and ability to care for oneself, known globally as diabetes self-care management, is of utmost importance to reduce complication rates of diabetes mellitus and to limit the negative impact of this chronic disease.⁷

Diabetes self-care management includes education on a vast array of topics (e.g., diet, exercise, blood glucose monitoring, interpretation of glucose results, preventing or managing acute and chronic complications, taking medication, managing psychosocial concerns, and promoting health).^{7,8} Interactive, creative, patient-centered delivery methods for diabetes education have been shown to be ef-

fective.^{8,9} One interactive, patient-centered delivery method that needs further exploration is gamification. In recent years, gamification has increasingly gained acceptance as an innovative teaching method that incorporates principles of game design into education and adds entertainment, engagement, and motivation to learning.^{10,11} Gamification and game-based learning can therefore be utilized to teach patients critical concepts necessary for self-management to improve overall health.^{12,13}

Various games have been developed for patients with diabetes, and many studies have found that playing games can help patients with diabetes to gain knowledge about their condition, communicate with peers who have diabetes, and increase self-efficacy for managing self-care.^{13–16} Most of these studies have focused on “exergaming,” or teaching aspects of diabetes management, or reinforcing habits that foster diabetic control through virtual reality or other types of videogames. In addition, many games have been geared

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toward children and adolescents,¹⁷ and almost all are designed to be played outside the clinical setting. One study used a virtual world game for adult African American women patients with diabetes to promote self-care¹⁸; however, few if any, studies focus on game playing for high-risk, low-income adult patients as real-time preparation to empower patients and enhance the quality of interaction between patients and providers in clinical settings.

For this study, we utilized an interactive gaming platform, known as Kaizen Education, to educate patients in a clinic setting about diabetes self-management. Developed at the University of Alabama in Birmingham (UAB), Kaizen Education has been used with students throughout the spectrum of undergraduate and graduate education across multiple disciplines.^{19,20} Using principles of gamification, the Kaizen Education software taps into intrinsic (self-efficacy, personal challenge, socialization, etc.) and extrinsic (points, badges, reputation, etc.) motivators to engage students in learning educational material in the context of a knowledge-based competition. In a previous study conducted by Wingo et al., students reported enjoying the competition and believed that playing Kaizen enhanced their learning.²¹ Kaizen has been successful in engaging students in their learning,²² hence, this study was used to determine if similar engagement would take place among patients. The purpose of this qualitative descriptive study was to discover what adult patients with diabetes think about the use of gamified education in the context of a diabetes self-management trivia game (Kaizen Education) as an approach to diabetes education.

Materials and Methods

Setting

The study was conducted at the Providing Access to Healthcare (PATH) Clinic and approved by the UAB Institutional Review Board (protocol no. X160929005). The PATH Clinic, located on the UAB campus, serves uninsured adult patients with uncontrolled diabetes who are referred to the clinic at the point of transition from an inpatient stay at the UAB Hospital. Presently, the clinic provides care to over 400 adult patients. PATH patients have clinically complex medical and social needs, comorbid behavioral health conditions, are frequently readmitted, and incur high health care costs.^{23,24} The need for education in diabetes self-care management in this high-risk, high-needs cohort is great.

The clinic enables these patients with diabetes to have a medical home, free of charge.²⁴ The clinic provides care, medical supplies, and medications for free through the use of pharmaceutical company patient assistance programs and a local medication dispensary for indigent patients. Presently, the clinic provides care for patients over the age of 18 with diabetes, many of whom actively seek opportunities to participate in research. The clinic utilizes an interprofessional team-based care delivery model, including nurse practitioners, dietitians and certified diabetes educators, social workers, physicians, optometrists, a physical therapist, an exercise physiologist, a psychiatrist, and students from many of these disciplines.

Kaizen Education game

Kaizen Education is an interactive gaming platform infused with principles of gamification that allows educators to create their own educational trivia games with questions

followed by explanations to engage students in knowledge-based competitions. Development of the Kaizen Education software platform began at UAB in 2012 with support from an institutional NIH Clinical Science Translational Award. Faculty use the Kaizen gaming platform to deliver questions followed by explanations focused on teaching, at pre-determined intervals to students competing as individual players and/or teams. Immediate feedback, including a rationale for the correct answer, is provided. Users can achieve milestones for days of daily usage (Marathons) and number of consecutive correct answers (hot streaks) while gaining reputational levels by achieving predetermined threshold scores. These achievements may be rewarded with customizable badges and additional points determined by the educator's specific trivia game design on the platform. In this study, the Kaizen Education game was used to teach foundational competencies needed for long-term success in diabetes self-management. The questions used in the diabetes education game address multiple facets of diabetes self-care (e.g., diet, exercise, blood glucose monitoring, etc.).⁷ While, in this study, used for diabetes education, the Kaizen Education software platform itself is customizable and flexible to focus on specific audiences and/or disease processes.

Aim. The purpose of the qualitative descriptive pilot study was to discover what adult patients with diabetes think about gamification, specifically using the Kaizen Education platform as an approach to diabetes education.

Research question. How would adult patients with diabetes respond to diabetes education using principles of gamification delivered in clinic through the Kaizen Education (Kaizen) software?

Recruitment. After obtaining IRB approval, researchers recruited participants from the PATH Clinic by placing flyers in the waiting rooms, triage area, exam rooms, and office areas. Patients who expressed interest in participating were referred to a research staff member.

Eligibility. The research staff reviewed the study consent form and collected data from the potential participant regarding eligibility on a standardized form. The research staff provided a copy of the consent to the patient, and a copy of the eligibility form to the principal investigator (PI) for review. The PI determined the eligibility of the potential participant and considered only those patients who were over the age of 18 years, had a diagnosis of diabetes, spoke and read English, had used a computer or tablet device in the past, and were free of major cognitive impairment. Participants were determined to be free of major cognitive impairment if they denied a history of mini strokes, strokes, traumatic brain injury, or dementia.

If the patient was eligible and at least 24 hours had passed from the issuance of the consent, the research staff contacted the patient to confirm continued interest in participating. At this time, the potential participant's medical appointment and study visit were jointly scheduled. Same-day scheduling was a priority as the PI had noted from prior research with this population that access to transportation was a significant barrier. Hence, coupling research participation and a clinic appointment eliminated the burden of two separate trips to the clinic.

Each study session lasted 2–2.5 hours and consisted of informed consent, a session answering questions on diabetes self-care followed by explanation of answer on the tablet running the Kaizen Education software, and participation in a focus group. On the day of the study, potential participants saw the clinic provider as they normally would for routine care and then were escorted to a conference room for the study.

Informed consent. Upon arrival, participants were given a boxed lunch. While the participants ate, a member of the research team read the consent and answered questions the participants had. If they wished to proceed, the participants signed the consent and were provided with a copy. The original consent was retained by the PI. Next, the participant completed a demographic questionnaire. To assist with confidentiality and privacy, each participant chose an alias to use within the game. The aliases were recorded for tracking purposes and then converted to participant numbers. Only the PI and research assistant had access to the consents, aliases, and demographic questionnaires.

Demographics of players

A sociodemographic questionnaire was used to determine age, race, sex, household income, level of education, and duration of diabetes. Players self-reported their age (in years), race (Black = 1; Caucasian = 2; Other = 6), sex (women = 0; men = 1), annualized household income before taxes (\$0–10,000; \$10,001–20,000; \$20,001–30,000; \$30,001–40,000; \$40,001–50,000; and above), level of education (8th grade; 9th grade; 10th grade; 11th grade; 12th grade; some college/vocational training; Associate’s degree; and Bachelor’s degree), and duration of diabetes (in years).

Gamified education. Once the consent process was completed, a member of the research team reviewed the purpose of the study and issued each participant a tablet containing a link to the Kaizen education software-hosted diabetes self-education questions. After accessing Kaizen, the PI practiced two questions with the participants and then instructed them to play the game for 30 minutes.

The game delivered one multiple choice question at a time (Figs. 1–4). After a participant chose an answer, the game

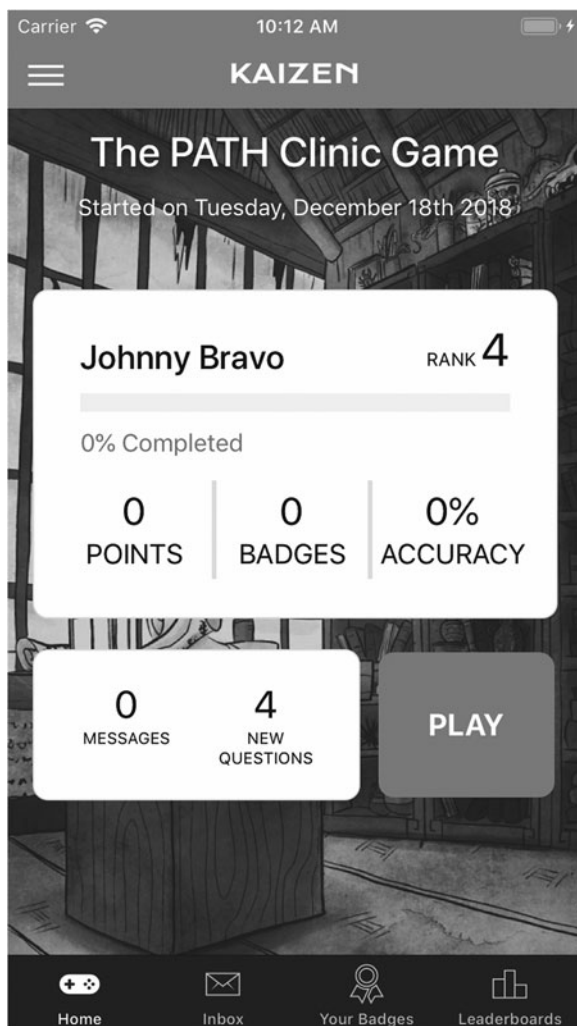


FIG. 1. Individual player home screen with individual stats.

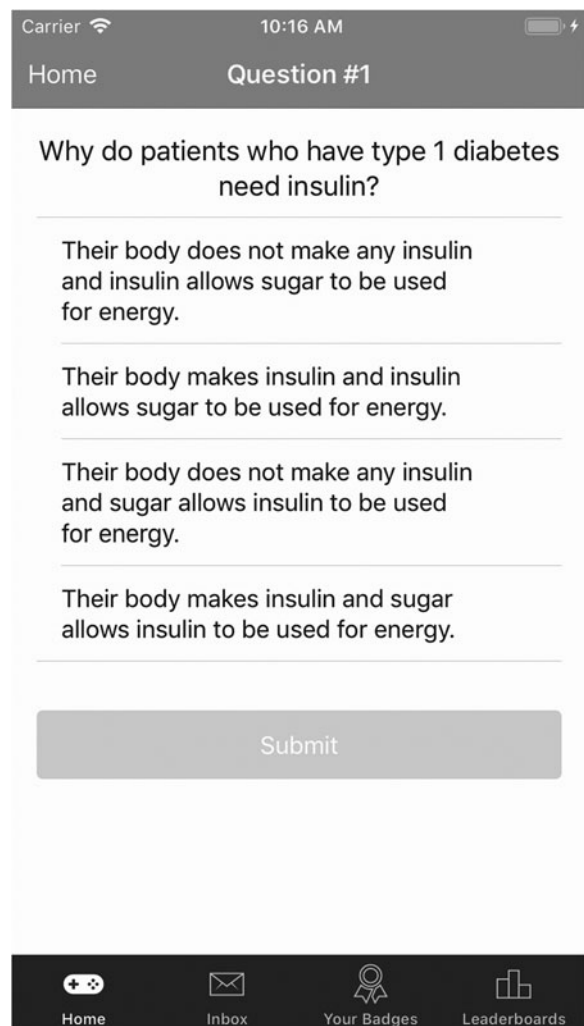
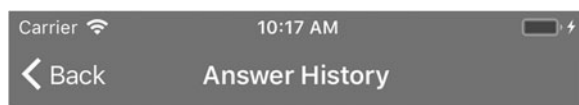


FIG. 2. Example of multiple-choice question and potential answers.



Question:

Why do patients who have type 1 diabetes need insulin?

✓ Their body does not make any insulin and insulin allows sugar to be used for energy.
(You selected this)

Their body makes insulin and insulin allows sugar to be used for energy.

Their body does not make any insulin and sugar allows insulin to be used for energy.

Their body makes insulin and sugar allows insulin to be used for energy.

Explanation:

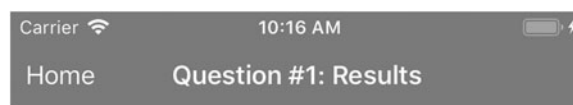
Insulin allows the body to process sugar to be used for energy.

FIG. 3. Question with answer and rationale.

indicated whether the chosen answer was correct or incorrect and provided feedback in the form of an explanation. Each correct response earned points for the participant. The Kaizen software tracked the points on its leaderboard and at varying point accumulations, incentives in the form of level badges were awarded to the participant. On the contrary, if a participant missed a question, the game provided encouraging words to keep the participant engaged and provided access to the explanation. An explanation followed each question, detailing the desired teaching points and re-emphasizing the key takeaways for each patient. After 30 minutes had passed, the research team collected the tablets.

Focus group sessions. The PI reviewed the rules for the focus group and explained its purpose. The PI facilitated the 1–1.25-hour focus group using a semistructured interview guide (Table 1) to elicit feedback on this method of patient education. The focus group was recorded using a hand-held recording device as MP3 or MP4 files.

During the focus group session, the participants used their aliases to ensure anonymity. At the closing of the focus group, participants were given \$40 cash for participation. Nine focus groups were completed.



CORRECT

OTHER PLAYERS

Answered by 0 other players

100% answered correctly

Next



FIG. 4. Individual results of question.

After the study, the recordings were uploaded to a secure site. The recordings were transcribed. The deidentified transcriptions were shared with the coinvestigators and the Kaizen team.

Data analysis

Demographic data. To analyze the demographic data, Statistical Package for the Social Sciences, Statistics Data Editor, version 24, was used. Missing data were reported and omitted from the analyses.

Qualitative analysis

A three-person research team-composed of individuals with expertise in qualitative research conducted the analysis of the transcripts. To inductively code the data, the transcripts were organized and loaded in NVivo, version 11. Each coder read all transcripts before coding. Next, each transcript was thoroughly reviewed, and categories were established independently by each coder for each question asked, to organize the data. Questions were grouped based on content (Table 1). For example, Question 1 and 2 were asked to gain insight on the player's preferred method of learning. The interviews were reviewed by content category (method

TABLE 1. INTERVIEW GUIDE AND CONTENT

| Content | Questions/prompts |
|--|---|
| Method of learning: This section is about your preferred method of learning. | Q1: How do you prefer to learn new things about diabetes? Prompts: Do you like to read material on your own at home, have someone teach you in person, or learn at your own pace on a device or computer? |
| Gaming: This section is about using the Kaizen game. | Q2: What did you think about the questions that you were asked? Prompts: Do you feel like you knew the answers? |
| Environment: This section asks about where you would play Kaizen. | Q3: What are some things that you liked about the game? Q4: What are some things that you did not like about the game? Q5: If you have this game at home, would you take time to play it? Why or why not? |
| Incentives/badges: This section asks about incentives and motivation to play the game. | Q6: What did you think about playing the game at the clinic? Prompts: If the game was available to play in your exam room or waiting room, would it be something you were interested in playing. Why or why not? Q7: What motivates you to learn? Q8: What did you think about the badges that you were awarded at the end of the game? Q9: Did you feel that the level you achieved was consistent with how much you know about diabetes care? |

of learning, gaming/gamification, environment, incentives/badges).

The categories were further reduced until common themes emerged. The coders met, until they reached agreement, to discuss the themes and draw connections between the themes. Lastly, a conceptual map was developed with the identified themes (Fig. 5).

Results

Demographic data

Thirty-three participants were enrolled and included in the analyses. The majority of players were black, males, had some college or vocational training, and had less than a

\$10,000 annual household income before taxes. The overwhelming majority had also been diagnosed with diabetes for longer than 5 years (Table 2).

Qualitative analysis

Sample size. The sample size of participants in qualitative studies depends on the saturation of themes. Saturation is dependent upon the quality of data as well as the usefulness of the data; both of which were received and allowed saturation after 33 participants.

Themes. An overarching theme of play/gaming as a form of learning was apparent in this study (Table 3). After

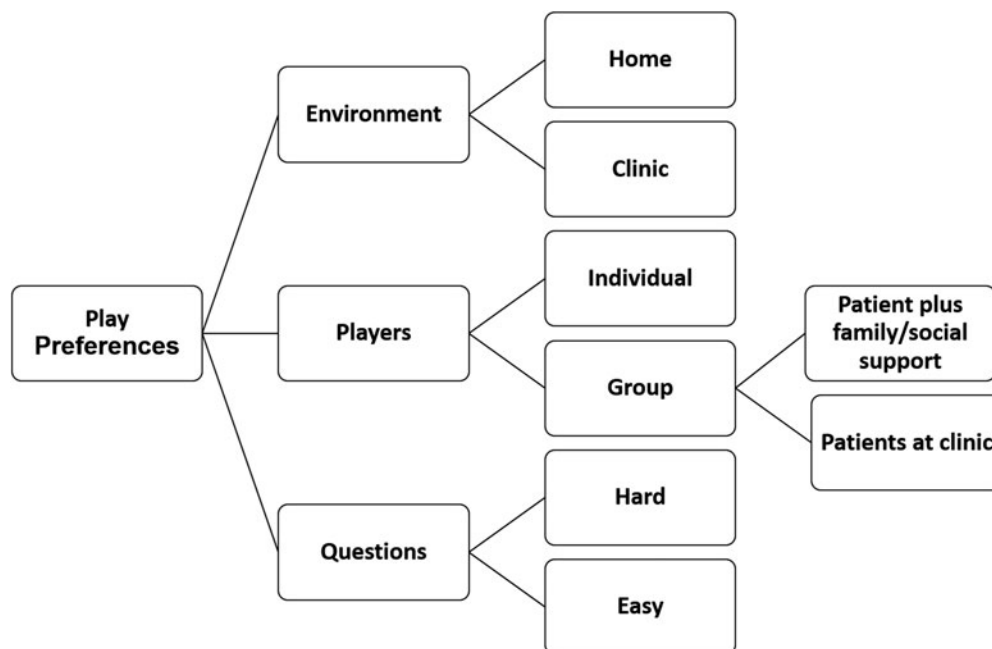


FIG. 5. Conceptual map.

TABLE 2. DEMOGRAPHICS OF PLAYERS

| Variable | n (%) |
|----------------------------------|----------------------|
| Age, years | 40 ± 13 ^a |
| Race | 33 |
| Black | 21 (64%) |
| White | 11 (33%) |
| Other | 1 (3%) |
| Sex | 33 |
| Men | 20 (61%) |
| Women | 13 (39%) |
| Household income | 31 |
| \$0–10,000 | 27 (87%) |
| \$10,001–20,000 | 2 (7%) |
| \$20,001–30,000 | 1 (3%) |
| \$40,001–50,000 | 1 (3%) |
| Level of education | 33 |
| 8th Grade | 1 (3%) |
| 9th Grade | 2 (6%) |
| 10th Grade | 2 (6%) |
| 11th Grade | 3 (9%) |
| 12th Grade | 10 (30%) |
| Some college/vocational training | 11 (33%) |
| Associate's degree | 3 (9%) |
| Bachelor's degree | 1 (3%) |
| Years of diagnosed diabetes | 33 |
| Less than 5 years | 10 (30%) |
| Greater than 5 years | 23 (70%) |

^aMean ± standard deviation.

researchers analyzed the coding, several themes emerged. Participants identified their preferences for learning (P1, P3, P4, P6, P7, P10, P11, P13, P15–P17, P19–P33). One participant stated, “there should be more games like this or even a game that’s where we’re more active... you could be playin’ this game. You havin’ fun while you’re exercisin’ at the same time, and you learn about diabetes” (P5). Another said the game provided “good up-to-date (information using) technology ... to learn stuff” (P15).

Preferences. Most participants preferred to be taught or read materials while learning (P8, P19–P21, P23–P29, P31–P33). Some participants had favorable comments about learning new things through a “device” (P3, P11, P14, P19, P31) or new “technology” (P3). One participant stated that learning through the game was “cooler than just pencil and paper” (P15) and another said he “didn’t wanna stop” (P24) while another “wanted to keep goin’... and see all the badges they had” (P14). One participant liked “how, even whether you got the answer correct or incorrect, how it explained the reason certain stuff did certain things” (P4).

Environment. The majority of participants expressed a desire to play the game at the clinic and at home (P1, P3–P6, P8, P10, P11, P15–P26, P33). One participant stated that he would “probably do it more at the clinic, because I am going there already about my diabetes. If I could do it in the waiting room, kill some time” (P15). Additionally, one participant said the game would give him “something to look forward to” (P26).

The timing of the play was important. Some participants expressed a desire to play before seeing their provider (P19–P22, P25–P27, P29, P30, P32, P33) so they could ask the provider to explain more about the questions that they missed. One participant shared, “I feel like it would be able to help doctors to know what I do know and what I need to know to help me better” (P33). Participants also expressed an interest in playing the game at home (P1, P3–P6, P8, P10, P11, P15–P26, P33).

Players. The participants reported that they wanted to play Kaizen with others at home listing their “fiancé” (P30), “wife” (P3), “family” (P5, P10, P21), “four boys” (P10), “children” (P4), “little daughter” (P19), “boyfriend” (P29), “mom/mother” (P27, P29, P30), “little brother who’s eight” (P31), and “two boys” (P29) as potential players. Some participants expressed a desire to play the game in competing groups (e.g., “Type 1 and Type 2 ... against each other because there’s different rules” related to the different types) (P5), and some preferred to play as a group (P27, P28, P30, P31) so they could “talk to people that have diabetes” (P29) and “learn from (them)” (P30).

Balance of questions. The game was reported to have a good balance of easy questions and more difficult questions (P17, P19, P20, P23, P24, P28–P30, P33) as evidenced by participants stating that they got some right and some wrong (P17, P19, P20, P25, P26). According to one participant, “the game is educational, even though...some of the questions are intuitive, still there’s some that’s not” (P9). To summarize, participants felt that the game promoted learning and was a good gauge of their knowledge.

Dislikes about the game. Overall, participants did report several things that they did not like about the game. The dislikes could be grouped into the following themes: questions, features, and usability. Complaints related to the questions included one participant reporting that he did not like to answer the questions about females as he “(felt) a little put upon” (P27). Additionally, on occasion the same questions appeared more than once (P8). Another participant did not like how the questions were trying to “throw you off” (P20). Complaints related to features included one participant would have liked to have “ear buds (that will help you read)” (P29). Two participants wished the game had characters (P1, P2) and another wanted more eye-catching graphics (P33). Complaints related to usability included one participant reporting that the tablets (e.g., Acer) chosen for the pilot study were slow to advance questions. Additionally, participants complained that the tablet did not properly sense their touch (P8, P26) and “bumped you out” of the game (P23). Another participant stated that the print was small (P14).

Discussion

The novelty of our study includes the application of game-based learning to a high-need, high-cost vulnerable population. While gamification and game-based learning methods have been used for diabetes education in the past, our approach is unique because it seeks to empower resource-limited patients to engage providers at the point of care. Our

TABLE 3. ILLUSTRATIVE QUOTES FOR THEMES

| Themes | Illustrative quotes |
|--------------------------------------|---|
| Play | <p>“The game is—well, you learn some, and it teach me a lot, ‘cause it a lot of stuff I didn’t know. I liked playing the game.” (P10) “It wasn’t hard. It was easy to do, and you did learn some things, so it was all right with me. It’s a good teachin’ method, really.” (P13)</p> <p>“I thought it was enlightenin’, really. You learn stuff.” (P13)</p> <p>“I liked everything about the game...” (P14)</p> |
| Learning preferences | <p>“I do a lotta research on the computer and look stuff up but I did like the game, too.” (P4)</p> <p>“I’m a hands-on learner, so me actually sittin’ down with my provider, and we sittin’ there talkin’ about it, and I ask questions just to make sure I understand, like this. It’s like you get to actually do somethin’. You learn somethin’. I’ve learned, actually a lot from this game. I thought I knew pretty much everything when it came to diabetes, but it was, like dang, I didn’t know this answer, so it’s hands-on.” (P5)</p> |
| Gaming environment (home vs. clinic) | <p>“I think it would be great to have something like that you can play at home or do at home, because my boyfriend, he’s trying to educate himself on what’s goin’ on with my, and how to help me.” (P29)</p> <p>“...people would definitely play it in the waiting room, absolutely.” (P1)</p> <p>“I probably would do it more at the clinic, because I’m going there already about my diabetes. If I could do it in the waiting room, kill some time. Wouldn’t be just sitting there bored. Man, they need to hurry up. I’d actually be having my mind focused on something. Time would go by. It’d be a win-win.” (P15)</p> <p>“...that would give us somethin’ to pass the time but also give us somethin’ to ask questions about if we had a question once the provider came in.” (P20)</p> |
| Players | <p>Group—“...if y’all do it in the clinic, it should be a game day, and we do teams. You could actually discuss what you don’t know. You got somebody you can turn around to—it’s like, hey, do you know this answer - actually talk about it.” (P5)</p> <p>Group—“You got to have a group. That way you can be here to tell your story...” (P28)</p> <p>“Play as a group cuz you’re learnin’ more from each other.” (P30)</p> <p>“I would actually suggest people who aren’t diabetics to play the game a little bit. That way they can better understand the disease and stuff.” (P22)</p> <p>Family—“I would actually let my family play it so that they could learn about diabetes as well.” (P5)</p> |
| Kaizen Game questions | <p>“A lotta stuff you knew about diabetes, but there was a lotta stuff you didn’t know either.” (P14)</p> <p>“The game is educational, even though some of the stuff, some of the questions are intuitive, still there’s some that’s not. Ones you get wrong, that teaches you where you’re wrong.” (P9)</p> <p>“If you did get it wrong, it’s teach you more about what you need to know about your diabetes, and what level you’re on.” (P10)</p> <p>“I did find some answers in there that I did not know either, and I’ve been a diabetic for 12 years.” (P5)</p> <p>“I’d been diabetic a long time and lotta stuff I just learned today that I didn’t know. I’d known about steroids because I can’t take steroids because of my sugar.” (P4, P6, P7, or P8; speaker did not identify himself on transcript)</p> |
| Dislikes | <p>“(Felt) a little put upon” with the questions about women (P27)</p> <p>Questions appeared “two or three times” (P8)</p> <p>Questions were trying to “throw you off” (P20)</p> <p>Desire for “ear buds (that will) help you read” (P29)</p> <p>Desire for game “characters... like Galaga” (P1)</p> <p>Desire for “more interactive with more graphics, something eye-catching” (P33)</p> <p>Reports that “on the tablet, it was too slow, and I’d touch it, and it didn’t move quick enough. It gave me hesitation, causing me to get kind of like a little frustrated, because I couldn’t move as quick as I want to” (P26)</p> <p>Complaint about having to “restart it twice” because it bumped her out of the game (P23)</p> <p>Complaint about “the print was kinda small” (P14)</p> |

study supports the use of game-based learning to empower and prime patients with questions before they see their provider leading to more engagement in every visit and more meaningful patient-led discussions.

The feedback from the participants underscores the high acceptance of education delivered through a gamification-infused software platform at the point of care. Patients were enthusiastic about learning content in this fashion and

recommended additional family members and close contacts be asked to play the game, in particular for learning to manage emergent situations that would place them in danger such as low blood sugar (hypoglycemia). Our study findings point to acceptance of this modality for teaching diabetic self-care to help navigate wait times as well as to prime questions patients would subsequently ask their health care provider later in that visit. An engaged patient,

driving a diabetes self-care conversation, flips the traditional paradigm for health care professional-led education in clinical settings. This represents a new application of our Kaizen Education platform, previously used in a traditional classroom or graduate medical education learning environments and shows the potential for using gamification to further patient education at the point of care.

The authors refer to the transformation of a clinic visit from a provider-led to a learner-led educational interaction driving the exchange of ideas as the flipped clinic. A flipped clinic is analogous to a flipped classroom, an instructional strategy that shifts the focus to a learner-centered model, which eschews traditional instructor-led lectures and provides instructional content alternatively (online or in this case through the Kaizen Education platform). In a flipped clinic, students (patients) first engage with key health concepts (in this study through Kaizen Education software), they then engage a clinician (teacher) in the exam room (classroom), furthering the knowledge and understanding critical to their successful management of a chronic illness.²⁵ The flipped classroom instructional method has been used extensively in education, and if used in clinical settings in conjunction with gamification, it could potentially improve the patient centeredness of education for diabetes self-care and ultimately for other chronic health conditions. This flipped clinic model proved especially novel in our clinical setting, as patients with socioeconomic and health care access disadvantages described feeling empowered to lead discussions with their health care provider as a result of playing the Kaizen Education game.

Initially, we anticipated issues with computer literacy and were unsure if our participants would be accepting of using the tablets to answer questions. Even though the interview did not include specific questions about the tablets and their usability, participants reported that the tablets used for the pilot study were slow to advance questions and that they did not properly sense their touch. Therefore, in future studies, a different device will be chosen. Perhaps due to the broad penetration of smartphones across the US population,²⁶ interaction with the tablets was not listed as a reservation by any of our participants.

As a single site, single clinic study in the US Southeast, questions remain about the applicability of this strategy across patients in different care settings and different chronic diseases (e.g., the study is limited to uninsured patients and may not be representative of the entire population). Furthermore, the use of focus groups introduces a risk of moderator bias.²⁷ However, questions were left open-ended and probing questions were utilized to gain responses. Additionally, not all participants participate equally²⁸ and, hence, coerciveness from researchers and experts can be imposed.¹⁷ These experts are typically participants who have more knowledge about a topic causing others to feel embarrassed for speaking out.

Future studies focused on comparing the outcomes of our approach to gamified education to more traditional teaching methods are needed. Likewise, studies comparing the effectiveness and preferences of differing methods of education for patients with chronic illnesses at the point of care are needed. In conclusion, gamification as a tool for educating patients on diabetes self-care was broadly accepted. Participants felt empowered to speak with their health care providers, poten-

tially enhancing education in clinical encounters and patient learning. Finally, patients encouraged an expansion of this educational strategy to their family and friends, potentially engaging members of their support network to aid them in adhering to the important lifestyle modifications diabetes self-care demands.

Acknowledgments

This study was supported by an intramural UAB School of Nursing Dean's Scholar Award. The National Center for Advancing Translational Sciences of the National Institutes of Health supported this research in part under award number UL1TR001417. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Author Disclosure Statement

M.H.T., C.R., N.W., and J.W. have no competing financial interests. M.H.T., PI, and C.R., coinvestigator, had full access to the data and take responsibility for the integrity and analyses of the data.

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