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Fostering Growth Mindset Principles in the Prevention of Type 2 Diabetes Through a Narrative Game

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Abstract. The number of overweight school-age children facing the risk of Type 2 diabetes from obesity is rising at an alarming rate worldwide. Studies have shown that adopting a healthy lifestyle by following a nourishing diet and engaging in frequent physical activity is vital in tackling the problem. However, knowing about it does not equate to knowing how to do it. Hence, through design research, we employed a cross-disciplinary approach in creating an educational simulation to inform and provide the how-to on making health-related choices for teenagers. This study was aimed at constructing an interactive visual novel by intertwining growth mindset principles with the game's narrative using the integrative behaviour prediction model as the framework. Upon completion of the prototype, we asked four students to test the game, and their feedback was analysed for emerging themes. Discovery learning, the thrill of the game, and empowerment by information each coincide with the three essential design elements of successful educational experiences: simulation, game, and pedagogy. The findings suggest that the potential for growth mindset principles to be used to reinforce healthy decision-making among teenagers through a narrative game is highly promising, while at the same time providing the learners with a meaningful and engaging experience.

Keywords: Type-2 Diabetes; healthy lifestyle; growth mindset; educational simulation; narrative game

1. Introduction

School-age children and adolescents with obesity have increased from 11 million to 124 million worldwide within the last 40 years (NCD Risk Factor Collaboration, 2017). Related to many medical, psychological, and social conditions, obesity can

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be a precursor to a more devastating health issue – Type 2 diabetes (Algloban et al., 2014). Globally, close to half a billion people suffer from the condition (International Diabetes Foundation, 2021), with an increasing occurrence among adolescents and young adults (Lynch et al., 2020, as cited in Mohd Asraf et. al, 2022). In addition, individuals with diabetes increase their risk of getting hypertension, cardiovascular disease, chronic kidney disease, and chronic liver disease (Bragg et al., 2017). The growing penchant for highly processed snacks and sugary drinks, and reduced physical activities are among the factors that contribute to this major health problem (World Health Organization, 2019). It is thus crucial for effective and systematic measures to be promptly taken to prevent this major health issue from exacerbating – and affecting the future of the world, *vis a vis*, the youth of today.

Adopting a healthy lifestyle, which involves eating a nourishing, balanced diet and taking part in frequent physical activity is crucial in warding off Type 2 diabetes. The Global Education Monitoring Report Team also posits that supportive surroundings and the promotion of optimal nutrition in schools where children often gain lifelong habits can encourage them to adopt healthy diets or increase physical activity (UNESCO, 2017). However, when it comes to health promotion for teenagers, learning about it does not equate to learning how to do it (Tamanal & Kim, 2020). Health problems such as obesity still prevail among the younger generation, even with health education already incorporated into the national curriculum from primary to secondary school. Clearly, there is a need to tackle this issue differently.

Dweck (2017), a renowned scholar in motivation who proposed and developed the concept of a growth mindset, states that people who possess this type of mindset consider their talents and abilities as qualities that they can improve through education, hard work, and effort. Stemming from her extensive study on why people succeed and what motivates them to succeed, Dweck discovered that how people view themselves profoundly influence how they lead their lives. Those with a growth mindset, she observes, are motivated and propelled by their beliefs that they *can* change their present set of circumstances, and hence, will exert the effort and hard work to realise their goals. In contrast, those with a fixed mindset, that is, those who believe that their intelligence is a fixed trait, often dislike challenges, and have trouble coping with setbacks. Dweck (2016) contends that “a growth mindset fosters a healthier attitude towards practice and learning, a desire for feedback, a greater ability to deal with setbacks, and significantly better performance over time” (para. 3). Given the rising incidence of diabetes among adolescents and the potential of the growth mindset in helping people make healthy decisions to bring about positive change, we decided to carry out a study that was aimed at designing an educational simulation in the form of a narrative game that trains high-school students to make healthy decisions using growth mindset principles. This paper describes the results of the study.

2. Theoretical Framework

Several studies have successfully demonstrated how the principles of a growth mindset can be instilled through educational technology (Park et. al., 2017; O'Rourke et. al., 2014; Wilkins, 2014; Ricci & Lee, 2021; Shirazi & Rahimi, 2023). In addition, research on game-based interventions for health learning goals reveals promising benefits in improving students' understanding of them (Ebrahimi, 2018; Gan et. al., 2019). Given the power of the growth mindset in motivating people to make positive changes, and given the favourable outcomes of using educational technology and game-based interventions to foster a growth mindset among students, we undertook the study to uncover how using the growth mindset principles in a narrative game would reinforce healthy decision-making among teenagers—encouraging them to adopt a healthy lifestyle by practising self-regulation through health concepts repeated in multiple contexts, and dealing with choices that may require them to approach or avoid certain health-related situations in the simulation

3. Methodology

The threat of diabetes plaguing the young because of poor decision-making in their daily eating habits and their reluctance to engage in physical activities warrants an urgent call to action. To achieve the aim of this study and to answer our key research question, “How would using the principles of a growth mindset in a narrative game reinforce healthy decision-making among teenagers?”, Educational Design Research (EDR) was chosen as the methodological approach. Unlike quantitative educational research methods, which are often designed to examine the effectiveness of a particular approach or intervention in a controlled setting, EDR is concerned with trying to understand and document how and why the design works in practice (Ford et. al., 2017). In the context of our study, this research focused on documenting our journey in creating a novel digital program—a narrative game—to generate a possible solution to the identified problem and to explore the participants' experiences in playing the game without empirically measuring any learning outcomes.

The analysis and exploration phase of this study began with identifying a problem and its diagnosis and continued with a review of the literature to uncover theoretical viewpoints and develop scientifically relevant angles for the research (McKenney & Reeves, 2019). The strategy of using growth mindset principles as a scaffold to train students to make healthier choices and using a narrative game as the medium of instruction germinated from this process.

Next, the design and construction phase involved exploring and considering potential solutions and using various techniques to map out the output. First, we formulated the fundamental theoretical and practical ideas underpinning the narrative game design and put together all the components to create the prototype. To maintain our focus on discovering the feasibility of incorporating growth mindset principles within the game, we limited the prototype to the nutrition component of the health education content and the importance of being physically active. The game, called 'Better Bites', was developed to educate players on leading a healthier life and exacting a mindset shift for better self-

regulation in making healthy choices in their daily lives through a visual novel – a text-based interactive story application with static graphics and some elements of point-and-click adventure games. In brief, the game player takes on the character of a student who had recently lost a teacher to heart disease caused by diabetes. The teacher was a significant figure in the lives of the members of the club to which the player belongs. Upon the teacher's passing, the club members no longer had the zeal to continue their activities. With the threat of their club being closed, the protagonist must find ways to save it while motivating the other members towards becoming more health conscious. In the process, the player will adopt a lifestyle change that involves making healthy choices for the protagonist and his friends, such as choosing a more nutritious meal over a less healthy option as exemplified in Figure 1.

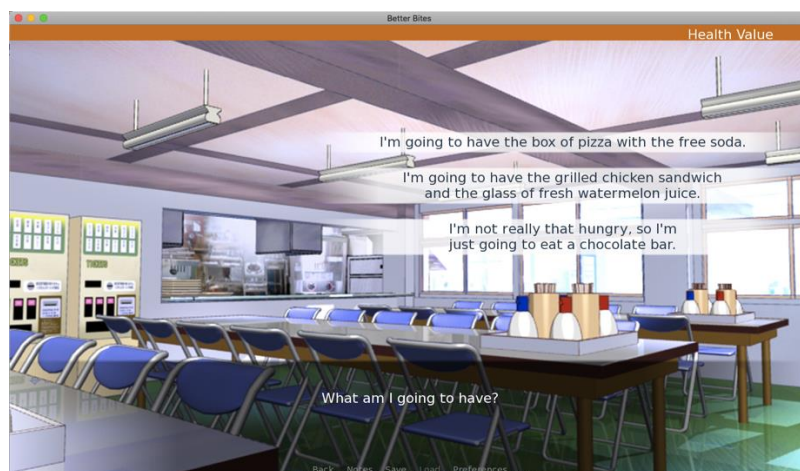


Figure 1: A screenshot from the game where the player must choose which meal to have.

We designed and developed the narrative game using a software engine powered by Python, a popular programming language. Ren'Py is a free tool used to construct a visual novel, a subset of computer-mediated storytelling. The program can create a story that branches out (like a hyperlink within a program), show images, play videos, record screen time, and save game data. The objectives of the game were aimed at having the player:

1. internalise the growth mindset principles, such as working hard, never giving up, and asking for help (Nottingham & Larsson, 2019).
2. master health-related concepts such as nutrition and physical exercise
3. predict the consequences of bad health choices.
4. make healthy decisions based on reasoned arguments.

To ensure that such objectives are met, we designed the game to project the underlying theory of a growth mindset: the belief that personal changes are possible through effort over time. Applying Fishbein and Ajzen (2009)'s Integrative Model of Behavioural Prediction, which proposes that the three elements – attitude, perceived norm, and self-efficacy – contribute to the intention of adopting a specific behaviour, we devised the framework for mapping the concepts and designing the content of the narrative game, particularly the feedback and feedforward in the story structure.

As shown in our concept map (See Figure 2), the game seamlessly incorporates the three elements – attitude, perceived norm, and self-efficacy – into its narrative or storyline. The Main Character’s (MC) internal monologues will address attitude, in which he or she explores the outcomes of performing specific behaviours – that is, his or her assessment of whether committing a specific behaviour is beneficial or detrimental (Yzer, 2012) – and whether they are good or bad (Figure 3a). Perceived norm, which is the social pressure one anticipates regarding carrying out the behaviour, will be portrayed by the in-game social interactions among the characters to provide the necessary communal environment for promoting the desired behaviours. It is divided into two aspects. The first is the injunctive norm, which is the degree to which relevant social networks are expected to provide support to the actor. In the game, the MC interacts with other characters who give feedback and feed-forward that would reflect on the intention of the MC (Figure 3b). The second aspect is the descriptive norm, which is concerned with how members of those networks perform the behaviour themselves. The actions and inactions of others in the game would demonstrate this, mainly through the observation that the MC’s friends are performing the behaviour in question or not (Figure 3c). Finally, self-efficacy reveals whether a person is deemed competent to perform the behaviour effectively – but it is not to be misconstrued as being actual competence. Hence, the game is embedded with growth mindset messages to enhance one’s self-efficacy or one’s own perceived ability as he or she furthers the belief that anyone can affect change (Figure 3d). Hence, these three components amount to influencing the player’s intention to move towards or away from the desired behaviour.

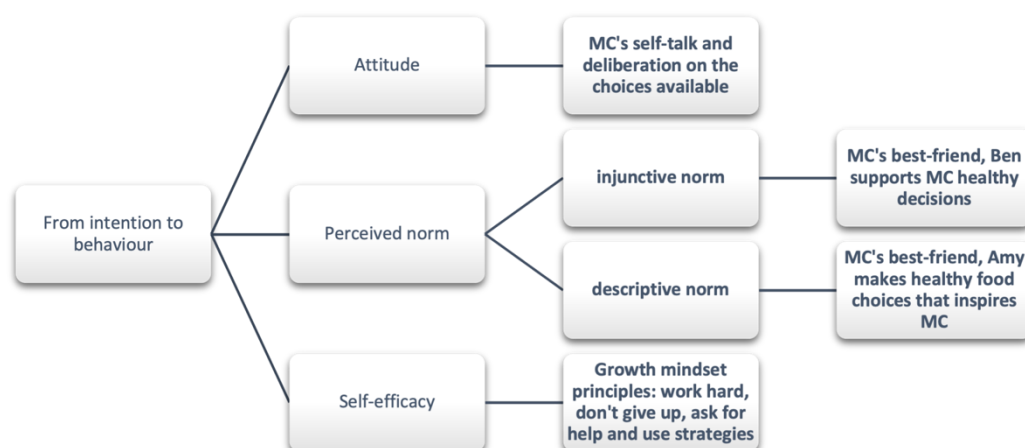


Figure 2: Concept map for the narrative game

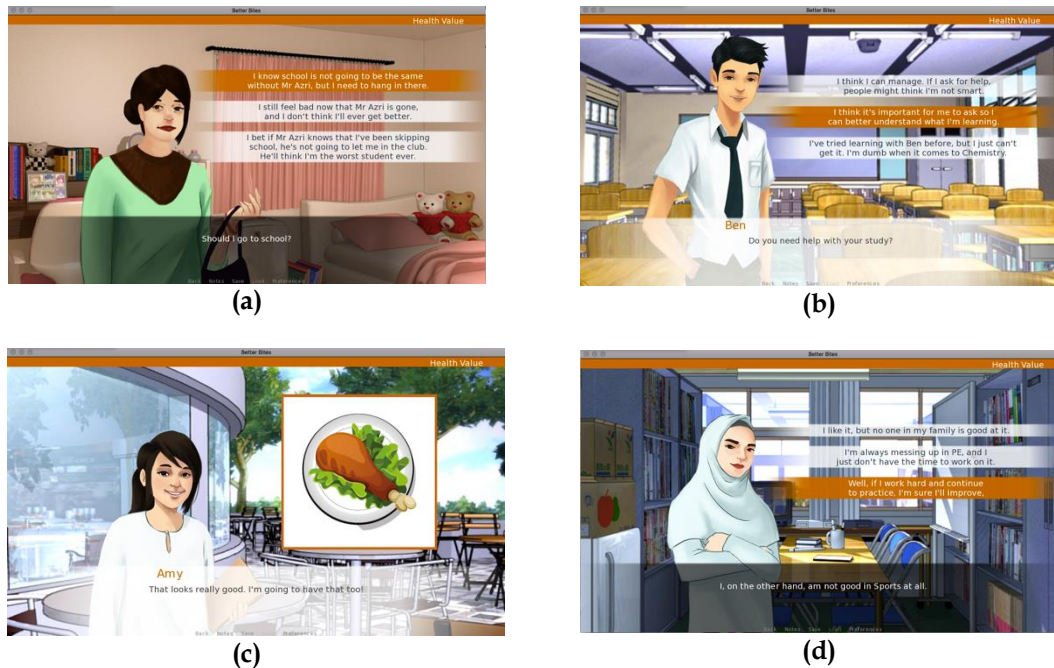


Figure 3: Screenshots from the narrative game: (a) MC contemplates what would be the best thing to do; (b) A character provides support to MC in making the right choice; (c) A character displays the desired behaviour of eating healthily to reinforce the message; (d) MC uses growth mindset language for positive self-talk.

In terms of the content of the narrative game, we believe that not only was it crucial to compile the health-related information and materials to be used, but also to align the growth mindset principles with the instructional materials. To ensure that the two categories of content generated for the game fulfil their intended outcomes, we consulted two subject matter experts periodically while writing the script to help with validation. Specifically, we corresponded with a medical doctor with ten years of experience in medicine for the health content and a primary school teacher with twelve years of teaching experience for the growth mindset content. Their feedback was invaluable to the improvement of the game.

The final phase of the study was the evaluation and reflection phase, which involved assessing the soundness, practicality, and immediate efficacy of the game. This involved the use of the qualitative approach to provide meaningful and rich details about the processes of learning through the intervention and contribute to creative ideas for improvement (Middleton et al., 2010). Therefore, to evaluate the potential for growth mindset principles to be used to reinforce healthy decision-making among teenagers through the game that we had created, we asked four 15-year-old students from two Malaysian public high schools to test the game and share their gaming experiences. Using the purposive sampling method, we selected the participants based on the following criteria: They had to be 14 to 15 years of age; have an intermediate level of English proficiency to understand the game; have access to a computer with stable internet connection; and be willing participants of the study. The last criterion is also important to the selection process as this would enable us to obtain the participants' honest responses, thus enhancing the credibility and trustworthiness of the study

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(Jessiman, 2013, as cited in Mohd Asraf et. al., 2022). Prior to the testing, we gave letters to each of the participant's parents requesting their consent to allow their child to participate and outlining the details of the research process and ethical considerations involved. Upon receiving their consent, we gave the participants the computer version of the prototype application, which consisted of up to 2 hours of gameplay, divided over three days. This schedule allowed for a certain number of hours to pass to reinforce the concept in the next play. However, all participants reported having played the game at least more than once after completing the first playthrough. Following the play experience, the researchers gave the participants an online questionnaire (Appendix 1) via Google Form, a tool that collects information using a personalised survey. Subsequently, we conducted a semi-structured focus group interview (Appendix 2) on Zoom Meetings, an online video teleconferencing software. The students took part in the discussion to explore their experiences in playing "Better Bites", reaching a consensus on what is good and bad about the application and what needed improvement. Finally, we analysed the data using thematic content analysis and presented the findings by synthesising the emergent themes, categorised into three interconnected components.

4. Results

This research was aimed at discovering how using embedded growth mindset principles in an educational simulation would reinforce healthy decision-making in teenagers. Having explored the notion that growth mindset principles can be embedded in a narrative game to foster healthy decision-making among teenagers, the analysis of the data collected provided a rich resource to inform us of the feasibility of using a narrative game to encourage a healthy lifestyle. We discovered three emergent themes from the data analysis to support this presupposition.

4.1. Theme 1: Discovery Learning

The first of these themes is that of discovery learning, whereby problem-solving is enhanced through the information gathered from an independent search for meaning from available materials (Alfieri et. al., 2011), which is inherent within the game. The aspects that we found pertaining to discovery learning are outlined below, reflected in the words of the participants verbatim.

4.1.1. Safe Experiment

From the group discussion, the participants reached a consensus on gaining first-hand experience through playing. As the game requires them to choose the food that they eat at different times of the day, they could explore viable options. Interestingly, most of the participants enjoyed making the wrong choices just to see the outcome. The game acts as a safe experiment for players to learn without having to do anything and face the potential risks and detriments of acting unwisely. When asked why they had picked a particular choice even though they knew it was wrong, one of them commented that it would not harm them or their lives.

Participant 1:

"More like because we know that it's a game ... would not affect anything in real life, so we get to experiment on what will happen."

4.1.2. Instant Confirmation

As the game progressed, the students could identify healthy choices from unhealthy ones through the feedback within the narrative game. Although more bad choices are given than good ones, all were designed to be learning points as part of the health education content. Therefore, students were able to learn and distinguish between the health benefits and risks from the decisions that they made. At this point, opinions diverged between picking the proper meals to maintain the health score and choosing the wrong dishes to have it played out for the story's sake. When we asked why they would choose the unhealthier dishes, one person said he was simply curious.

Participant 3:

"It's like it's a matter of curiosity."

The participants gained the opportunity to seek instant confirmation on any decision made throughout the game to satisfy their curiosity. This feature is significant for memory retention and engagement. In addition, they could immediately find out if they had made the right choice through trial and error, which also gave an element of suspense. A student was even taken aback to realise that she instinctively knew the best options among what was presented.

Participant 1:

"I was pretty surprised how ... many healthy options I picked because I just picked what I think is very kenyang (filling) for me."

The students enjoyed learning about health through their own choices rather than solely having to read about other people's mistakes, which was the method used in the traditional Health Education class. We asked what health education as a subject was like in school, and one of the participants related that it was boring.

Participant 2:

"We stay in class, and people talk, and we get bored ... every once in a while, we'll have to do a presentation, but that's about it."

4.1.3. Real-life Application

The process of personal discovery encourages players to interact with the story by making choices based on the available information. This promotes critical thinking and problem solving. For example, when asked if the students prefer learning by experiencing the narrative game, they were unanimous in agreeing that they learned more about nutrition and health on their own through the game than at school.

Participant 2:

"When you learn in class, you don't really understand what happens when you do [inaudible] fried fish over grilled chicken, you don't really know, or you don't really understand it."

Furthermore, it seemed that allowing the students to explore the story without explicitly explaining the consequences of their actions was what the students

preferred as they felt more involved in discovering the elements of the game. We asked if they were aware of what was happening within the game.

Participant 1:

"You can just see it how ... the game is ... trying to make you choose if you wanna (want to) give up or not. You can just see the impact that will happen."

In addition, there was no disagreement on the fact that the game has a real-life application, especially on the part of the growth mindset messages. The fact that they were able to practise what they had learned to improve their lifestyles was also an added advantage. One student positively responded when we asked whether the choices in the game were relatable.

Participant 3:

"To me ... the choices were interesting because it applies to real life. Some people ... has a mindset like: 'I want to diet' but ... then in the next following day ... just completely gives up ... so ... it's a matter of mindset."

The theme of discovery learning points to the notion that the narrative game in this research had allowed the participants to explore the topic of healthy eating through an immersive personal experience in a secured virtual environment. The students also received timely feedback on the consequences of their actions. The health and nutrition knowledge they gained from the game has practical implications in terms of their daily interactions with food, as it could help them to make better choices.

4.2. Theme 2: The Thrill of the Game

The thrill of the game is the second theme identified in the analysis. In essence, educational computer games are seen as appealing as it immerses student-players in an environment that compels them to learn by doing, as opposed to learn-by-telling. In addition, doing something fun facilitates memory retention and retrieval (Perkins, 2016). We found three aspects of this theme that suggest that the participants were engaged in an activity that they deemed enjoyable and intrinsically rewarding.

4.2.1. Fun Time

Firstly, all the participants in this study affirmed that they enjoyed learning about healthy eating as they progressed through the game. One participant particularly relied on the health point indicator to ensure that she was on the right track and did not stray from the game's objectives. In addition, when asked how it felt like, knowing that actions impacted the outcome, the participants responded that the game gave them a sense of excitement and made it a fun thing to play.

Participant 2:

"It took me a while to realise that I was gaining points from picking the right food ... when I realised, I was like: 'Oh, okay, let me try something else.'"

Although it is packed with an abundance of health-related information that can be somewhat dry when presented in a different circumstance, the idea of the game itself made the participants not feel intimidated by the educational aspects. So, we asked what was it that made the experience different.

Participant 1:

"First of all, it's a game. Who doesn't like games? So, it's fun to play."

Participant 3:

"The game just tells you more like in-depth. Since like our generation don't really like reading books, I read fictional books more than like schoolbooks."

Hence, from the participants' responses, the narrative game delivered an enjoyable experience that fits the preferences of the younger generation.

4.2.2. Story-driven

When asked how they are taught health education at their respective schools, the students agreed that it could be more exciting than what they were currently experiencing in their schools. Furthermore, it seemed as if learning about health is not considered necessary compared to physical education, where the students can play sports or engage in athletics.

Participant 1:

"In my school, we don't really learn physical health. We just learn physical education, which is like sukan (sports). We only learn [health and nutrition] during rainy days."

On the other hand, the participants welcomed the game as something more meaningful that could improve the quality of their learning. The story-driven structure of the game with parts personalised to each player allows for a more engaging learning experience than what a textbook could offer. This is what one of the participants answered on how he found the game different from what he had experienced before:

Participant 3:

"I feel like doing a game is actually better than doing books because instead of reading you can actually ... know about the story and ... the game can tell you a story about health and health issues, health problems instead of you have to read about it."

4.2.3. Role-playing

Some of the students felt that the story drew them into exploring the game. By taking control of the character and being responsible for the story's outcome, the students experienced a more substantial impact from the health message than could be achieved from any other classroom method. Since they had spent the time getting into the role of their characters, they developed a connection with the persona they were playing. In addition, the time and emotional investment that had been put into the game encouraged the participants to be more selective in their decision-making. We asked how the freedom to decide what the playable character does affected their playing.

Participant 1:

"I mean, even if ... it doesn't do any impact in my life when I pick it, during ... those times where my character ... wants to give up on dieting, I'm like no. Because I just, I don't like to have ... a closed mind."

They actively thought about their choices and how they could affect the turn of events. This quality of the game promotes more interaction with the content on the part of the students. It deepens learning toward higher order thinking skills, especially during problem-solving events in the game. One student responded to the question of whether the game offers personalisation.

Participant 2:

"Basically, you put yourself as a character that is experiencing all this instead of just hearing what happened ... you're the one who's experiencing what's gonna (going to) happen if you pick the right choice or ... the wrong choice."

The theme of the thrill of the game is explored through the students' feedback on the program's being more fun than the traditional chalk-and-talk method of a health education class. In addition, the participants enjoyed how the story was able to impart critical information on healthy living and provide an avenue to actively interact with the story.

4.3. Theme 3: Empowerment by Information

The last theme that emerged is empowerment by information and relates to how scaffolding the materials is crucial in ensuring that all students can progress accordingly (Lipscomb et. al, 2010). Furthermore, positioning repetitions appropriately is also vital in strengthening the retention of the content that is being learned. These two elements are prevalent in the narrative game, and their effects on the participants' overall experience are documented below.

4.3.1. Autonomy on Direction

Using a textbook as a reference point for whole-class or group discussions can be limiting. It may only benefit students in sharing their current knowledge, not forging new experiences on a personal level (Eyler, 2009). The narrative game in this study allowed the students to take control of their learning experiences. The students could lead the game into dispensing information based on their preferences. We asked if they enjoyed being able to decide on the story's direction.

Participant 3:

"Certainly, I feel ... in control of what I was eating ... I don't know how to put this in words, but like you just have the feel of power that you can control your body however you want it to be."

4.3.2. Positive Attitude

Equipped with the necessary details on the nutritional compounds of the available food they may choose at a particular time, some students felt empowered to direct their story to the best possible outcome. The participants quickly caught on to the game's objective of getting players to normalise healthy decision-making. They responded positively to our question on how they perceived the feedback within the narrative game.

Participant 3:

"Ya, because it helps you live and think in a different way ... if life gives you something that's bad, you just have to make it positive."

Participant 1:

"Find the light in the darkness, I guess."

The recommended choices reflect their willingness to learn from the content presented. They were also more inclined to extend this positive attitude towards other game decision points involving effort or confidence. Having been prompted to choose between growth mindset and fixed mindset statements or calls to action, students were able to identify the ideal option that encourages them to adopt a better attitude in the face of adversity or when dealing with self-doubt.

Participant 1:

"I always ... want to improve ... so whenever I see something like my character wanting to ... stop and just ... not do it, I'm like hell no, you're doing it."

4.3.3. Mindset Matters

It is rather interesting to note that the participants were able to connect the growth mindset messages embedded in the game with the development of the character they were playing.

Participant 1:

"I mean, I saw that the main player wanted to walk to school. And ya, that's a good option because you wanna (want to) be healthy right so. It has a little bit of a message."

Participant 3:

"The more you grow, ... you have better options ... when you ... don't have a good mindset, you will opt for the bad option, but when you have like a good mindset, you can just ... choose like the healthier version instead."

Interweaving the growth mindset principles with the game's events helped shape the narrative so that it could be seen as imparting strategies rather than indoctrinating the players. As a result, the participants gathered enough of the implicit principles to form their opinions on how the right mindset can help them lead healthier lives than before.

Participant 2:

"I think the mindsets can help because I think you have a different mindset for everything you do, like for instance ... if you have a mindset for the exam, so you'll study hard and all that, but you also have a mindset for your health and everything, so you'll be cautious of what you eat and what you do."

The theme of feeling empowered is explored through the sense of freedom felt by the participants in paving the outcome of the game by making informed decisions. In addition, the students adopted a positive mental outlook that would aid them in practising the good eating habits that they have discovered. Such points are further supported by the realisation that mindset plays a pivotal role in establishing desired habits and, therefore, must be cultivated to achieve the desired goals.

5. Discussion

Discovery learning, the thrill of the game, and empowerment by information are the three emergent themes that arose from the data in our search for an answer to whether and how using embedded growth mindset principles in an educational simulation would reinforce healthy decision-making in teenagers. The themes indicate that although each participant had undergone a unique experience based on their individual choices, they all had the same view—that the learning experience was more effective and enjoyable than that of their conventional class. Similar results were reported by Akselbo and Aune (2022) and Tawfik et al. (2020). The results suggest that educational simulation can fill in the gaps in the health education curriculum for secondary and high school students. It also highlights the need for more experimentation and exploration on how growth mindset

principles can be incorporated into an educational simulation to encourage healthier habits, especially for the younger generation.

The literature also highlights that educational simulations are beneficial in the teaching and learning process as they can demolish the artificial barriers between the things that we learn and the things that we do (Aldrich, 2005; Smetana & Bell, 2012; Vlachopoulos & Makri, 2017; Lateef, 2021). As a result, students can connect content to real-world applications. Furthermore, at a time when the younger generation is becoming highly pragmatic, desiring more personalised interaction and less waiting time, we must deliver practical knowledge in a manner that would sustain their interest and promote engagement. This is particularly important when it concerns health awareness in preventing non-communicable diseases such as Type 2 diabetes. The study found that the three themes that emerged from the data, that is, Discovery Learning, Thrill of the Game, and Empowerment by Information coincide with the three essential elements to successful educational experiences, as outlined by Aldrich (2005), consisting of simulation, game, and pedagogical elements, respectively (See Figure 4), suggesting that the game that we had developed has met these criteria.

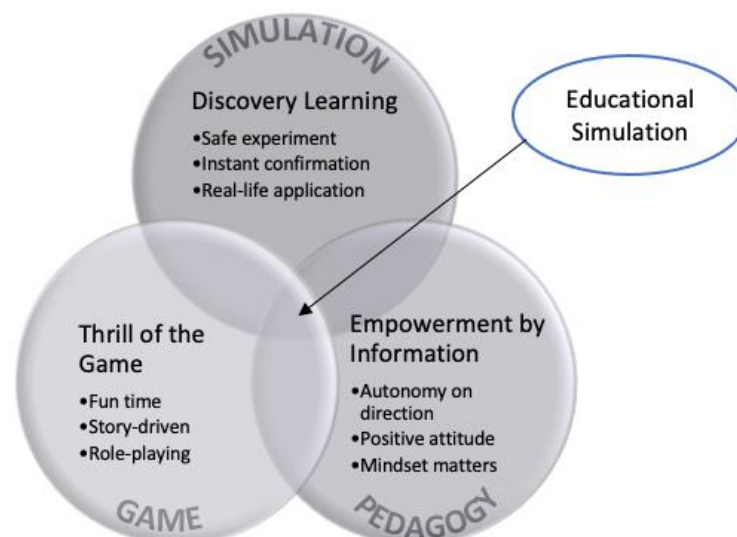


Figure 4: Study's emergent themes aligned with Aldrich's elements to successful educational experience.

As highlighted in Aldrich's (2005) framework, simulation elements such as discovery learning are an important aspect of a successful learning experience. Indeed, this is corroborated by numerous studies such as that of Campos et. al, (2020) and Alinier and Oriot (2022) as they enable discovery, experimentation, and practice, which ensures transferability to actual conditions and circumstances outside of the learning environment. In the case of our study, the narrative game is contextually aligned with the target audience – teenagers who are constantly faced with having to make decisions about eating healthily. Thus, the game takes players through several problem-solving situations. Having completed the game potentially allows students to recall the situations in which the knowledge and skills they had garnered through discovery learning could be applied.

Furthermore, in developing an educational simulation, it is important to include game elements that compel users to seek engagement with an experience that goes beyond intrinsic motivation (Aldrich, 2009; Alexiou & Schippers, 2018). These elements increase the enjoyment derived from the educational experience, thus driving more engagement, which expands the time allocated for learning. Participants of our narrative game experienced a sense of thrill as they played while connecting with the story that requires their personalisation and input as the main character. Additionally, game elements such as health points create suspense for the players as each wrong decision reduces the score, providing a sense of achievement when choosing the right options. This study indicates the importance of content being presented with fun and amusement as part of the equation so that learners are not bored by the educational experience and would spend more time interacting with the material.

Finally, pedagogical elements, which are the learning objectives and reasoning behind the educational simulation's construction and development, complete a successful educational simulation. They include background materials, scaffolding, and prompts for reflections to ensure that time is spent productively rather than wasted on moments of confusion (Aldrich, 2005; Guralnick & Levy, 2008; Van Broeckhoven et. al, 2015). The game uses growth mindset principles as the core didactic approach. As knowledge on healthy eating and physical exercise is being imparted through the interactions within the game, the belief that everybody can adopt a healthier preference for food and exercise through practice over time acts as the convention. Participants can derive the underlying messages of the game, one of which is that the more they learn and practice, the better the decisions they make and the easier it is to recall what they have learnt. This study suggests that having growth mindset principles embedded rather than called out at the onset of the game, allows them to be discovered organically, adding more significance to the learning points.

6. Conclusion

An educational program that supports simulation, game, and pedagogical elements that are holistically combined, can provide learners with a meaningful and engaging experience. Based on the findings and related discussion of this study, it can be concluded that the potential for the principles of growth mindset to be used to reinforce healthy decision-making among teenagers through a narrative game is highly promising. Respectively, each element is responsible for making the narrative game contextually relevant, exciting, and rewarding, as well as engagingly informative. The principles of growth mindset that are embedded in the narrative game consist of working hard, never giving up, asking for help, and using strategies. Together, these constituents serve as the driving factors towards the adoption of better self-regulated behaviour in health promotion. By practising this growth mindset-related conduct within the game, one can establish healthier habits to combat the lure of a detrimental lifestyle that includes eating unhealthily and avoiding physical activities. As the game amplifies the content and practical strategies for healthy living, increases the frequency of assessing the player's understanding, and provides immediate feedback, it allows for a much

more robust educational experience for individual students. They can thrive in a more personalised and active learning environment, which the game, in its full and completed form, aims to achieve. Thus, equipped with the knowledge and strategies, and fuelled by positive mindset attributes, teenagers can practice healthier lifestyle choices and ultimately prevent their possible suffering of any non-communicable diseases such as Type 2 diabetes, heart attacks, and stroke. The potential for this study to be expanded echoes the notion that adequate intervention can help teenagers retain healthy lifestyle knowledge and behaviours.

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Appendix 1: Online Questionnaire Items

The participants were asked the following questions before the focus group interview through a Google Form.

1. What was the most frustrating moment or aspect of the game?
2. What was your favourite moment or aspect of the game?
3. Was there anything you wanted to do that you couldn't?
4. How would you describe this game to your friends and family?
5. What area or aspect of the game needs to be improved the most?
6. What can you summarise about your experience playing the game?
7. If you were to recommend this game to others, what would be your reason?

Appendix 2: Focus Group Interview Sample Questions

Below is a set of questions drafted for the focus group interview.

Probe Questions

- How familiar are you with the game?
- What do you think about the story in the game?
- What do you understand about making health-related decisions?
- What do you understand about growth mindset principles?

Follow-Up Questions

- What did you like about the game?
- Which part of the game was your least favourite?
- How do you make decisions related to your health?
- How do you make sure that your decision is the best?
- How would you encourage your friends to make healthier decisions?

Exit Questions

- Is there anything else you'd like to say about the game?