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# The Saltomachy War - A Metaverse Escape Room on the War Against Salt

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Abstract. Excessive salt intake is a risk factor that leads to cardiovascular diseases. Public education on healthy eating habits and maintaining a healthy lifestyle can enable consumers to make better informed choices. This study developed a Metaverse Escape Room to increase public awareness on the "War Against Salt". Known as "The Saltomachy War" (TSW), 29 participants played the game in teams to solve puzzles across five "worlds" (rooms) to "escape" the game. Median post-game knowledge quiz scores were significantly higher than the pre-game quiz scores (12/15 versus 9/15, p<0.001). All players agreed that the content in TSW was useful in daily life (100%). TSW was easy to navigate (93.1%) and majority were engaged and actively participated in gameplay (96.6%). The storyline was creative and interesting (93.1%). Almost all players liked TSW to be in their curriculum and would recommend TSW to friends and family (96.6% each).

Keywords. Education, escape room, metaverse, virtual reality, war against salt

#### 1. Introduction

Excessive salt intake is one of the risk factors that leads to cardiovascular disease (CVD), which is the leading cause of death globally [1]. Reduced salt consumption to less than 5 grams (<2 grams sodium) per day can reduce the risks of CVD, such as hypertension, heart attack and stroke [1,2]. In recent years, the World Health Organization [2,3] and US Food and Drug Administration [4,5] have released new guidance on healthy sodium intake as part of a healthy diet. Public education on the levels of salt in foods, healthy eating habits and maintaining a healthy lifestyle can enable consumers to make better informed choices.

Escape rooms are a fun and engaging activity that has gained popular traction worldwide. Traditionally, players in physical escape rooms attempt to gather clues and solve puzzles in order to find the key or solution to break out of the room they are in and move on to the next room [6]. The advantages of using escape rooms for education include [7]: (i) providing a way for learners to apply their knowledge and skills in a more complex context; (ii) training of 21st century skills such as critical thinking, initiative, group dynamics, creativity and problem-solving; and (iii) making the experience fun, engaging and motivational. Studies have shown that millennials prefer to learn in

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informal settings, such as escape rooms, because of their flexibility and abilities to engage and motivate, thus enhancing their learning of the content, yet also developing their critical thinking, team-building and communication skills [8]. The COVID-19 pandemic has accelerated the shift towards online education/e-learning. Various institutions have also started to explore virtual escape rooms for education using digital technologies such as Zoom [9,10]. However, such technologies have their own limitations, such as providing immersive, collaborative and engaging social learning experiences [11]. Furthermore, learners may suffer from Zoom fatigue [12].

Since the end of 2021, the "Metaverse" has become a new buzzword after Mark Zuckerberg (CEO of Meta, formerly Facebook) presented his vision for it [13]. The Metaverse is envisioned to bridge the physical and digital worlds by enhancing immersive experiences through device-independent platforms that are not owned by any single vendor [14]. Although there is much hype about the Metaverse, from our knowledge, there is currently no published studies that have identified the usefulness of using the Metaverse and learner perceptions for health education. Therefore, this study aims to identify the usefulness of the Metaverse and perceptions of learners regarding an in-house developed Metaverse escape room for increasing public awareness on the "War Against Salt".

# 2. Methods

### 2.1. Design of the Metaverse escape room

The Metaverse escape room, known as "The Saltomachy War" (TSW), was developed on a Metaverse event platform [15]. Learners could join as avatars and play the game in teams of 4 to 5 in virtual reality (VR) or augmented reality (AR). The entire story consisted of five "worlds" (rooms) in which two-dimensional (2D) and threedimensional (3D) artifacts that contained facts, clues and puzzles related to the "War Against Salt" were embedded (Figure 1). Players could explore a 360-degree view of the worlds through their avatars and interact with the artifacts, as well as communicate with other avatars in real-time through text-based or voice chats. They had to navigate and solve the puzzles within the worlds by documenting their answers in a set of Google Forms, in order to "escape" the game. The teams would be introduced to the storyline and a background description of each world, as well as provided with clues to solve the puzzles.

# 2.2. Pilot user experience study

Learners from a local polytechnic in Singapore were recruited to participate in the study during the period of end August to mid-September 2022. Participants had to complete a Google Form-based pre-game and post-game knowledge quiz that contained 15 multiplechoice questions on the topic of "War Against Salt". The questions focused on the risks, signs and symptoms of excessive salt intake, ways to reduce salt consumption, maintaining a healthy diet and lifestyle, and local government initiatives in Singapore to increase public awareness about the "War Against Salt" (Figure 1). In addition, they had to complete a user experience survey on TSW by rating their level of agreement on a 5point Likert scale regarding 14 statements on the understandability of the content, usefulness, ease-of-use and satisfaction with their gameplay. Descriptive statistics were used for analysis. Wilcoxon signed-rank test was used to calculate the differences between the pre-quiz and post-quiz scores. Chi-square and Mann-Whitney tests were used to determine the associations of the players' gender, educational backgrounds, and year of study with their gameplay experiences and quiz scores respectively.



Figure 1. The five "worlds" and examples of a puzzle, in-game feedback and pre- and post-quizzes in The Saltomachy War (TSW) Metaverse escape room.

# 3. Results

Twenty-nine students from a local polytechnic participated in the gameplay. Majority were between 17-18 years (34.5%) and 19-21 years (62.1%). The gender distribution

was similar (51.7% males, 48.3% females). Half had a life science (51.7%) and informatics (48.3%) background.

Majority (82.8%) had an increase in their post-quiz scores after playing TSW. They scored significantly higher in their post-quiz scores (median=12/15) than pre-quiz scores (median=9/15, p<0.001). All players agreed that they learnt something new, and the content in TSW was relevant to the topic and useful in daily life (100% each). Most of them felt that TSW was easy to navigate (93.1%) and faced no technical problems (96.6%). They indicated that the content was easy to understand (100%), and the storyline was easy to follow (89.7%). Most enjoyed playing TSW (96.6%), were engaged and actively participating in gameplay (96.6%) and found the storyline creative and interesting (93.1%). Almost all would like TSW to be part of their curriculum and would recommend it to their friends and family (96.6% each). Players with a life science background were more likely to enjoy playing TSW (78.6% versus 35.7% strongly agree, p=0.022) and more open to TSW being used as a teaching tool in their curriculum (80.0% versus 23.1%, p=0.003).

#### 4. Discussion

A Metaverse escape room game (TSW) was developed to increase public awareness on the "War Against Salt". The advantages of learning in the Metaverse are that learners are able to learn remotely and interact in a more social and engaging manner through virtual chats/discussions and real-time collaborations/sharing [16,17]. The Metaverse is envisioned to support multiple technologies, including AR/VR, artificial intelligence and advanced connectivity to link the physical and digital worlds [17]. In fact, isolated user activities currently carried out in VR/AR are expected to eventually take place in the Metaverse, which will be the future of the internet. Despite challenges in terms of implementation and adoption of the Metaverse for education due to issues related to the cost of technologies, cybersecurity and regulation [18], its role in health education can potentially be a game-changer to learner experience and pedagogical practices.

The main limitation of this study was its small sample size. In addition, purposive sampling was carried out. This led to a participant cohort that was self-selecting, as the respondents would generally be those who were gamers, interested in playing escape rooms and/or interested to know more about AR/VR technologies and the Metaverse. Therefore, caution should be taken when extrapolating the results to other learner populations. Future work includes recruiting a wider cohort of participants and improving the engagement factor of TSW so that it is more attractive to players with non-science-related backgrounds.

#### 5. Conclusions

In general, TSW was useful for increasing public awareness about the "War Against Salt" among students in a local polytechnic. However, the game was more attractive to players with a life science background. Despite the teething issues of Metaverse technology, the Metaverse can potentially make learning more immersive and effective. In a post-pandemic world where it is becoming clear that hybrid and digital learning is the way to go for educating the younger generations, the potential of the Metaverse to take digital education to the next level is definitely attractive.

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