A CONCEPTUAL FRAME WORK SUPPORTING OBESITY AWARENESS IN SERIOUS GAME

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ABSTRACT

There is an increasing number of Malaysians being overweight and obese over the years. Lack of health awareness on obesity issue primely, leads to the high number of people being unhealthy and obese. Hence, the need to raise health awareness on obesity. Conventionally, there are various programmes to create obesity awareness by various organizations. Since technology applications have been common among the people nowadays, implementation of serious game in supporting obesity awareness will be able to attract users to play the game whilst gain knowledge and lead to behaviour change. This paper aimed to develop a proposed conceptual framework in serious game that intends to raise health awareness on obesity. Previous research suggested only a few methodologies, frameworks and models have been proposed to guide the serious game design and development. In this study, the conceptual framework proposed is based on Information-Motivation-Behavioural (IMB) model that serve health promotion and influence change of behaviour. The development of this conceptual framework includes the implementation of game components suitable in creating obesity awareness game and could impact the players' cognitive and behaviour change.

KEYWORDS

Obesity, Health Awareness, Serious Game, Motivation, Cognitive, Behaviour Change

1. INTRODUCTION

The number of people with obesity has been increasing over the years in Malaysia. Factors that implied to the high number of people being obese are generally because of their high intake of energy-dense foods which contained high fat and lack of physical activity due to their sedentary lifestyle [1]. These inactivity and uncontrolled food consumption bring negative consequences and risks to the individuals. Besides that, obesity can pose a major risk in getting non communicable diseases such as cardio-vascular diseases, diabetes, musculoskeletal disorders and cancers [1]. Thus, the increased number in BMI among the public can affect their body weight and lead to health problems. Even for normal healthy children, obesity could happen when they get older if they did not start eating healthy food and performing active lifestyle.

According to [2], Malaysia is ranked top for the most people being obese in Southeast Asia region based on Economist Intelligence Unit's "Tackling Obesity in Asean" report. Malaysians's busy working life and sedentary lifestyle are a few reasons for the high number of people being obese. These cause the people to opt for an easy access to unhealthy foods that are widely available throughout Malaysia. Furthermore, lack of physical activity also leads to these people being overweight or obese. In Malaysia, most people think obesity is just a cosmetic issue which does no harm to their health. However, it is actually a serious health issue [3]. The wrong perception about obesity shows lack of awareness among the public about the issue. Various programs and campaigns related to obesity awareness have been implied by the government, private sectors and non-governmental organization (NGO) such as Juara Sihat programme, MASCOT, Nutrition

Month, World Obesity Day and MASA 10k Steps Challenge. Besides, Ministry of Health Malaysia also had launched Program Pinggan Sihat Malaysia which focused on the theme "SukuSuku Separuh" in year 2017. The programme implements the healthy eating plate based on nutrition proportion and recommended by the Ministry of Health Malaysia. However, these do not deter the increasing number of people being obese in Malaysia and essential solution has to be made so that knowledge on obesity awareness can be spread among the public.

In this study, it is crucial to create awareness in obesity among the people through common technology platform such as serious game. Awareness varies in meaning from different fields. For example, in education, awareness is "knowledge from milieu without direct teaching". It also means common understanding or public knowledge on issues such as social, scientific, or political issues [4]. Examples of awareness in this context are public awareness such as awareness on danger of smoking, breast cancer awareness, nutrition awareness and obesity awareness. Based on McCallum et al. [5], knowledge domain and awareness domain are referred as a single continuum which posits oppositely. The continuum for knowledge domain refers to general knowledge awareness that sits at the lower end of continuum whilst detailed and specific knowledge sits at the higher end of the continuum. In addition, an awareness domain refers to low personal awareness at one end of the continuum whereas high personal awareness sits at the other end [6]. Figure 1 and 2 show the representation of knowledge and awareness as continuum on a single domain separately. Thus, knowledge and awareness are interconnected and associated to one another. In the context of obesity awareness, a study by [7] defined obesity awareness as mental activities for the action of checking, tracking and evaluating ones eating behaviour and commitments towards staying healthy. Thus, in general, awareness is the state of being aware of something, which in this case means being cognizant with social issues such as obesity issue.
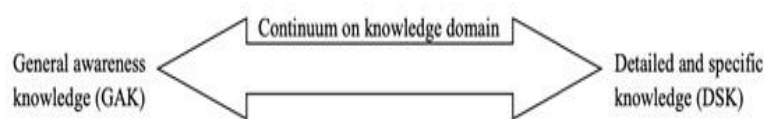

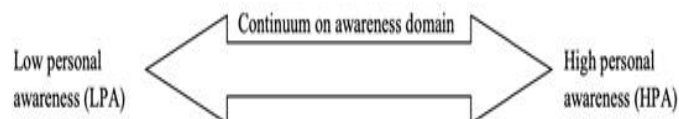Figure 1. Representation of knowledge as a continuum on a single domain [6]

Figure 2. Representation of awareness as a continuum on a single domain [6]

In today's world, the advancement of technology creates many opportunities to curb the increasing number of people being obese. Various technology platforms have been developed such as video games, mobile application, 2D, 3D virtual and augmented reality game, Kinect and even robotic technology. For example, Pokemon Go is one of the well-known and widely played game application globally and it indirectly creates awareness on the important of physical activity to the users when they play the game. Other similar technology applications that improve obesity problem are virtual game that offers virtual shopping experience in choosing healthy products [8], healthy food menu planning [9] and health and fitness application [10]. In these modern days, games are known to be popular among the young generation. Games normally offer entertainment purposes with fun and interesting features to the players. There are many types of games that serve different purposes to their target users. Serious game for example, is a game that provides both educational learning and entertainment purposes simultaneously, with education is the main objective [11].

Hence, learning should be the primary goal. Besides that, serious game can also effectively improve knowledge acquisition and cognitive skills, besides potentially improved fine motor skills and behaviour change [12]. Nowadays, many game applications gave opportunities to the user to develop self-awareness skills. Based on [13], there are two core components of self awareness that are very vital that are reflective (or meta-cognitive skills) and self-recognition. A study by [14] had developed a serious game on raising awareness in flooding issues. They found that the implementation of serious game has potential to raise awareness among the population. Therefore, this shows serious game can benefit players in creating health awareness on public health issues such as obesity. Thus, implementing serious game in raising obesity awareness is potentially effective for learners' to cognitively gain knowledge as well as to improve their affective state including one's attitude and behaviour.

Therefore, the contribution of this study is the proposed framework supporting obesity awareness in serious game. The list of components is derived from analysis of the existing literature. The elements particularly focus on behaviour change and knowledge gaining through playing the game. The framework is based on Information-Motivation-Behavioural Skills (IMB) Model.

This paper is organized as follows: Section 2 provides previous researches from the research study area on obesity awareness and serious game. Section 3 gives an overview on theoretical foundations that details out the model and theories related to this study. Next, Section 4 presents the proposed conceptual framework supporting obesity awareness in serious game that explained each component in the framework. Then, Section 5 that concludes the paper and Section 6 for future work.

2. PREVIOUS RESEARCH

In relation to obesity intervention using technology platforms, most studies focus on diet nutrition intake and the importance of performing physical activities. However, there are few of the studies that implemented both; nutrition intake and physical activity in their studies. A recent study by [15] implemented robotic technology whereby robotic bottle and plate act as tools to motivate children from low-income families to eat healthily. Other studies focus on importance of diet nutrition intake such as study by [16] that incite the importance of having breakfast before school through interactive game application. Next, a virtual game that teaches groceries shopping for healthy products by [8] and food menu planning for children's meal schedules [9]. There are also studies that implement both; diet nutrition and physical activity such as study by [10] which tracks user's nutrition and physical activities movements and another study by [17] which developed a video game that provides motivational learning and behaviour change among Latino children. Overall, various studies from different technology had been implemented for the purpose of obesity intervention. However, only few studies combined both vital elements in curbing obesity problem which is diet nutrition and physical activity. Other studies focus more on either diet nutrition or physical activity implementation. Besides that, these studies do not solely tackle on the obesity awareness in general but more on providing guidance in getting individuals to be healthy through game application, tracking tools, persuasive and motivational learning. Thus, in order to raise awareness in obesity, it is crucial to implement both elements in providing specific information and details to the players so they will be able to retrieve correct and useful information which then leads to the influence in behaviour change.

3. THEORETICAL FOUNDATIONS

In order to drive behaviour change and cognitive gain through creating framework on serious game that supports awareness in obesity, there are several existing theoretical foundations related to this.

There are a wide range of behaviour methods to improve ones' behaviour and health status. Based on Hardeman et al. [18], behavioural or social learning and cognitive model are mostly used. There are common elements with proven health behaviour change method. About 10% of online users' behaviour could be impacted through online behaviour change technologies [19]. Therefore, through providing information online, it could lead to knowledge enhancing which then able to act as a prompt, creating a comprehensive environmental context that will triggers behaviour [20]. Game platform in healthcare education and health-related behaviour change provides healthcare information dissemination through game-playing [21]. Implementation of cognitive and behaviour methods in the development of the conceptual framework in game context may inspire health status through knowledge gaining and behaviour change.

Theories and models should be seen as an integral part in game design implementation. In this study, there are a few theoretical foundations related to the proposed conceptual framework supporting obesity awareness in serious game. Those are Information-Motivation-Behavioural Skills (IMB) Model, Social Cognitive Learning and Self-Determination Theory. These theoretical foundations are aim to better understand of health behaviour change and cognitive gains in the proposed conceptual framework.

3.1. Information-Motivation-Behavioural Skills (IMB) Model

Information-Motivation-Behavioural Skills (IMB) model is a model proposed by J. D. Fisher & Fisher [22]. It is well-known for its health behaviour change purposes. Various studies have widely implemented IMB model in their research studies, especially in the field of health. The model is suitable to improve health status based on individual's psychological determinants of their behaviour's performance [23]. The model consists of components as mentioned: (i) Information (ii) Motivation (iii) Behaviour Skills and (iv) Health Behaviour. [23] stated that in order to initiate and maintain health positive behaviour, a well-informed information, motivated to act and possession of the requisite behaviour skills are the fundamental determinants. Thus, to influence a health behaviour change, a well-information and the motivation to act, as well as the enaction of wanting to take action (behavioural skills) will result in health behaviour performance. Table 1 shows the determinants in IMB model.

Table 1. The Information-Motivation-Behavioural Skills (IMB) Model

Determinants	Description
Information	The specific knowledge or facts about health information
Motivation	The ability and influences towards the inclination of health behaviour action when well-informed
Behaviour skills	The capability to impose behaviour change when well-informed and well-motivated

3.2. Social Cognitive Learning

Social cognitive theory focuses heavily on cognitive concept on their social experiences and how these cognitions influence their behaviours and developments. Hence, this theory provides for understanding, predicting and change of human behaviour [24]. Originally, social cognitive theory and social learning theory both are known to be developed based on three main factors that are one's behaviour, cognitive and situational factor as shown in Figure 3. These factors are dynamic and reciprocal interaction between one another [25]. Furthermore, cognitive concept is the main focus in social cognitive learning theory. It is a cognitive learning in social environment that influence one's change of behaviour [24]. Thus, this theory combined three factors that integrated

to one another to improve one's cognitive learning. The integration can also be applied in various field to achieve cognitive knowledge gaining and behaviour change. Hence, beneficial in cognitive knowledge gaining behaviour change.
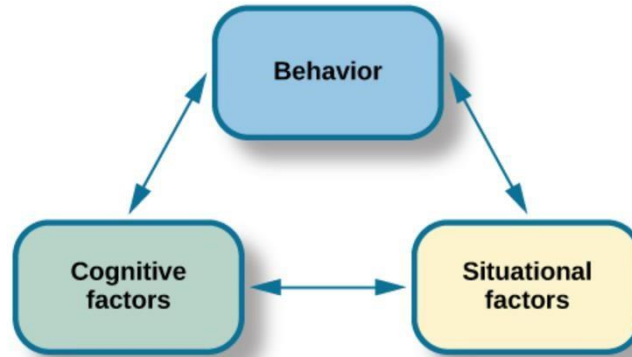

Figure 3. Social cognitive learning [25]

3.3. Self-Determination Theory

Self-determination theory (SDT) defines motivations influencing in situational responses from different domains which include social, cognitive, behaviour development and personality [26]. SDT is essential psychologically in requirements of autonomy, competence, and relatedness. Furthermore, this theory also involves critical role in self-determined motivation, well-being, and progress [26]. Motivation is one of the affective outcomes, and it is linked to motivational disposition, goal-setting, and self-efficacy, laying the groundwork for the motivating part of many serious games [27]. The common belief is that when one's attitude or opinion changes, so will one's behaviour [28]. In a game context study, self-determination theory was used to examine game motivation from the standpoint of a player meeting their wants [29]. [30] explored the game's motivational, interactive, enjoyable, and multi-media features, which enhance commitment and have a direct impact on players' motivation and learning. According to [31], games' motivational effects can affect both psychological and behavioural consequences [28], [31]. Hence, the theory can be mapped to the proposed conceptual framework which implement motivation in hu-man and game design.

4. THE PROPOSED CONCEPTUAL FRAMEWORK SUPPORTING OBESITY AWARENESS IN SERIOUS GAME

This study intends to develop a conceptual framework based from the Information-Motivation Behavioural Skills (IMB) Model by [22] as shown in Figure 4. This conceptual framework could help the process of designing and development of a serious game that supports obesity awareness that could lead to knowledge gaining and behaviour change. The proposed conceptual framework is presented in Figure 5. The conceptual framework in this study integrates obesity awareness game context in the Information determinant. The components in this game context provides a systematic and useful information in designing and development of obesity awareness game. In this study, the components are based on the elements suitable in designing serious game that focus on raising awareness. The components in the conceptual framework are Purpose, Content and Information, Game elements, Narrative and Aesthetics.
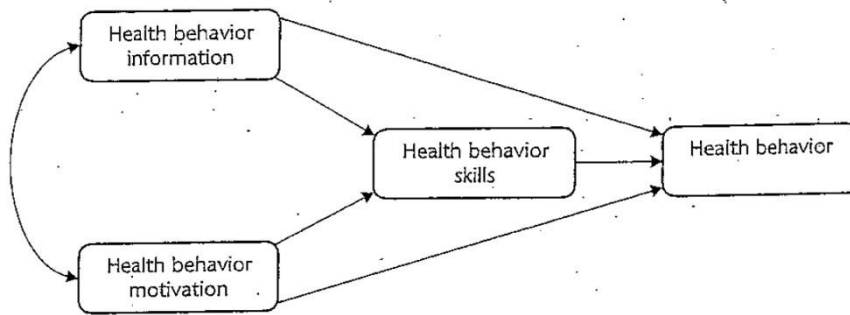
Figure 4. The Information-Motivation-Behavioural Skills Model of health behaviour [22]

4.1. Purpose

Social awareness requires purpose in order to achieve future change. In this component, a purpose acts as a driving force that shapes dynamic and coherence game system through the game's aim and impact to the players [32]. Besides, the purpose can also achieve a given set of learning goals by playing the game [27]. Hence, the aim and impact in providing a purpose in a serious game is vital.

4.2. Content and Information

Information In raising obesity awareness through game implementation, content and information are important as it crucial to the player to retrieve the correct health in-formation which then lead to knowledge gaining and perceived behaviour change. Based on Mitgutsch & Alvarado [32], information, facts and data offered that are used in the game context are visible and are made approachable to the player. Easy retrievable information make ease to the player in getting specific information, facts and data about health promotion and relevant heuristics information [23].

4.3. Game Elements

Game elements can be found in most games. They are associated with games and are also important in gameplay [33]. Based on Ferro [34], game elements are referred to as components or parts. Game elements have the ability to significantly alter people's perceptions of a cognitive activity, such as affective experience, motivational conflict, and subjective effort experience. People can be motivated to stay engaged in cognitive work by incorporating game elements, which will help them achieve a higher reward in the future [35]. In this study, six game elements have been identified to be implied in the game elements of the proposed conceptual framework. The elements are (1) Goals, (2) Interactions, (3) Challenge, (4) Points, (5) Feedback, and (6) Rules as shown in Table 2 below.

Table 2. The Game Elements

Game Elements	Description
Goals	Goals define the objective of the play and how a game is won or lost.
Interactivity	Interactions are actions perceived between player and the game world.
Challenge	Challenge consisted of game rules, game goals, and allowable action and interaction for player.
Rewards	Points or score given to player when player progress or achieve goals and challenge of the game.
Feedback	Feedback provides player additional information or encouraging and motivational statements.
Rules	Rules are statements and directions that must be followed within a given game in order for it to be played correctly.

4.4. Narrative

Narrative is the setting, theme, story, scenario, characters, back story and problem in the game play. These enables players to create their own stories in the game [32]. In the game play, narrative context assists players in identifying or constructing patterns of cause and effect [36]. Thus, enabling the player to immerse in the game play and allow them to connect with the real and abstract details in the game plot.

4.5. Aesthetics

Aesthetics include the audio and visual representation for visualization and the display of the elements in the game [32]. It is also said to be the look and feel of the game interface. Aesthetics are closely linked to how the game's overall environment appears. The players' experience has a direct beneficial correlation. Hence, the aesthetic features through the visual technology enables players to have game immersion and assured sense of being in the game [36].
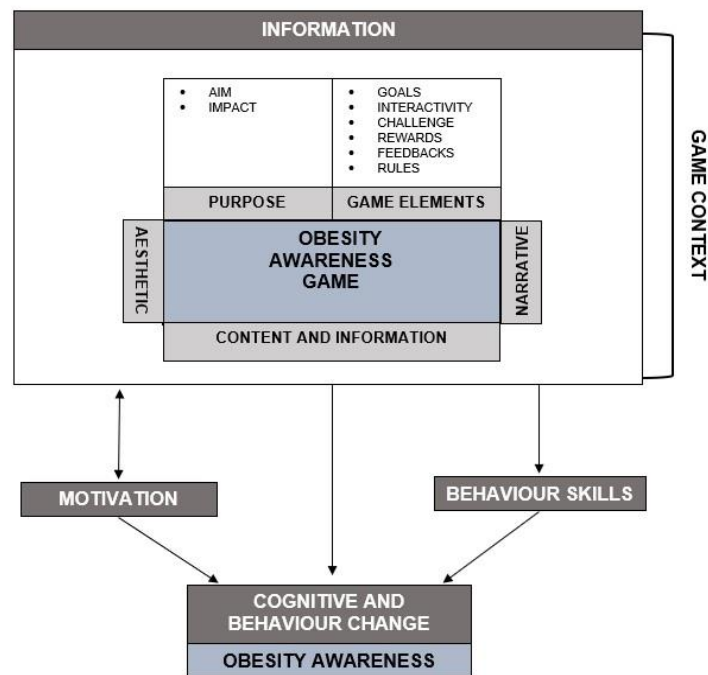
Figure 5. The proposed conceptual framework supporting obesity awareness in serious game

5. CONCLUSIONS

Previous research suggested only a few methodologies, frameworks and models have been proposed to guide the serious game design and development. Therefore, this study employs Information-Motivation-Behavioural (IMB) model in the development of a conceptual framework supporting obesity awareness in serious game since IMB model serve health promotion and influence change of behaviour. The component Information in IMB model is further improved with the implementation of obesity awareness game context. Hence, the proposed conceptual framework sup-porting obesity awareness in serious game. The integration between components of this conceptual framework allows meaningful and unique experience in gaining knowledge on obesity awareness game while also has the ability to improve one's behaviour change. Therefore, we have proposed a conceptual framework that supports obesity awareness in serious game to improve knowledge gaining and to achieve behaviour change.

6. FUTURE WORKS

The proposed conceptual framework on supporting obesity awareness in serious game is yet to be validated. It will be validated by the experts in areas related to game design and health nutrition. The validated framework will then be improved based on experts' feedback and we will further apply the framework on a prototype game on obesity awareness. Therefore, the aforementioned above are left for future works.

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