CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Chapter 2 discusses the fundamental theory involved in this study. A few studies and theories related to the development of food poisoning prevention programme are deliberated. Sidek and Jamaludin (2005) argues that literature review is necessary as it underpins the research direction. Previous literature analysis also aims to recognize important themes of the research area (Creswell, 2012). The author begins the literature review by defining food poisoning, exploring the food poisoning trend worldwide and local and subsequently discusses the preventive measures taken to curb the issues.

In addition to literature review, incorporation of related theory is crucial. Fox et al. (2014) argue that the incorporation of theoretical underpinnings in research may prevent repetition of previously explored concepts and it allows a rigorous examination of the phenomena to be studied. Furthermore, the use of theoretical framework provides the rational of how and why the research is to be conducted and it allows transferability of research process across the settings (Fox et al., 2014). With this respect, two theories or models were employed in this study. The first theory used was Health Belief Model of which this model describes belief variables that aim to find explanation of why some healthy individuals embrace health – protective behaviors, whilst others are unwilling to do so (McArthur et al.,, 2006; Rosenstock, 1974). The second model was the Sequential Iterative Modelling (SIM). SIM was used in the module development

of which this model emphasizes three elements of effective; efficient; and engaging (Milano & Ullius, 1998). Both models will be elaborated in the next section together with other health promotion models. It then outlined a few strengths and limitations of each theory. The subsequent section is a review on previous related studies on food poisoning and its possible intervention.

2.2 Food safety: Definition

Food has become an energy source in our life and eating has become part of social interaction. The increase in demand for food in our society has pushed its production massively and with this regards cleanliness and safety can become an issue (Abdul Mutalib et al., 2015). The assurance of food safety does not entail at one point only. It covers the entire food chain from seed or livestock, through processing, formulation, packaging, distribution, retailing, domestic storage and finally consumption (Dudeja & Singh, 2017). In the principles of 'halalan tayyiba' food, food safety does not only protect the food production process but also protect consumers from harmful constituents (Syuhaida et al., 2018). Codex Alimentarius Commission (CAC) defines food safety as the assurance that food will not harm the consumer when it is prepared and/or eaten according to its intended use (CAC, 2003). The harmful elements or what are called as hazard in this context include the biological, chemical and physical hazards.

Biological hazards have become the most prominent reason for food poisoning worldwide. This includes the microbiological safety of the food consumed. Common microbiological that is associated with food poisoning are *Salmonella sp*., *Escherichia coli*, *Bacillus cereus* and *Staphylococcus aureus* (Al-Mamun et al., 2018). These

microbiological hazards can emerge from the food source or the failures of the hygiene (Al – Mamun et al., 2018). On this premise, it is hard to identify the source of infection whether the food poisoning is foodborne or from personal hygiene failure. Hence, good measurement control should be implemented from the early point until the consumption in the food chain that is by eliminating any hazards at the source (Dudeja & Singh, 2017). A few food safety systems are developed and recognized worldwide and one of them is Hazard Analysis and Critical Control Point (HACCP). At the micro point of food safety management, the food personnel or food handlers that are involved in the process in the food chain should be aware of their role and responsibility in protecting food from contamination. Therefore, those who are involved in food operations who come directly or indirectly in contact with food should be well – trained, especially in controlling microbiological hazards to appropriate level with respect to the operations that they are performed. For this purpose, the author elaborates the concept of HACCP and food safety training in the subsequent paragraph.

2.2.1 Food safety: The management system

The management system of food safety often involves the quality assurance of the food processing. The term assurance itself describes the control, evaluation, and audit of the food processing system. In order to achieve a certain standard for food production, the quality management for each stage of agro-food chain is very crucial (Rosak –Szyrocka & Abbase, 2020). With this regard, quality assurance systems such as good practices and Hazard Analysis and Critical Control Point (HACCP) are applied for assuring food safety.

These two food quality assurances are the fundamental element that every food manufacturer should achieve first (Rosak – Szyrocka & Abbase, 2020).

The good practices are described as activities of the quality assurance that ensures food products and food-related processes are consistently controlled in order to assure the quality procedures in food systems (Rosak – Szyrocka & Abbase, 2020). Similarly, to standards, good practices also can be categorized with regards to their purpose that is private and public good practices. Public good practices are protecting the consumers whilst private are more wholesomeness whereby it not only protects consumers but also the brand reputation and consequently the remunerative business. (Rosak – Szyrocka & Abbase, 2020). Overall good practices have the intention to provide consumers with safe and quality products. Nonetheless, Raspor et al. (2013) stressed that among the good practices that are implemented by the food industries; none of them integrate consumers within them. This could be the lacking as consumers should be integral of the food system due to its vital link between retail and home (Raspor et al., 2013).

Apart from the good practices, the HACCP also provides a framework to the food manufacturers on managing risk. The risk management is solely based on the identification of the critical control point along the food chain and the control parameters. The selection of the critical control point and the control measure are largely depending upon judgment that does not assess the relative risk (Rosak - Szyrocka & Abbase, 2020). Furthermore, Lorenzo et al. (2018) emphasize that pathogenic microorganism detection and identification has become the vital area in food and water microbiology. The ability to control microbial food safety risks has clearly benefited from the knowledge pertaining to the types of pathogens found in food and the effect of environmental condition on the

behavior of those microorganisms (McMeekin et al., 2006). Due to this, McMeekin et al. (2006) proposed that microbiological risk assessment tool development is warranted to prioritize risk elimination or containment throughout the food chain in conjunction to the objective of the HACCP objective that is to ensure the appropriate level of controls are implemented.

From the food safety management discussed above, there is clearly lack of consumer involvement in the system. Consumers may not be able to comprehend the good manufacturing or retail practices in general as well as applying the control measures according to the critical control point along the food process. In addition, implemented food safety guidelines are not purposely designed for informing the consumers, hence this could be the gaps in food safety knowledge regarding food handling especially at home (Feng & Bruhn, 2019; Young et al., 2015; Sivaramalingam et al., 2015; Chow & Mullan, 2010; Byrd – Bredbenner et al., 2007). Gustafon et al. (2014) outlined that the major tools for food poisoning prevention are the proper sanitation and disinfection education and appropriate supervision, together with continued investigation of food poisoning outbreaks. The author also stressed that consumers should be informed and follows the basic instructions on storage, temperature, cooking and control measures designed in preventing food contamination (Gustafon et al., 2014). Furthermore, other researchers supported that delivery information, education or advice to the role across the food chain is necessary for the food control systems (Raspor et al., 2013).

Insufficient product information can lead the product mishandling at the later stages in the food chain that can contribute to food poisoning and it is crucial that consumers should be well informed and aware about the food safety principles (Raspor et al., 2013).

Hence, in the following section, the author will discuss the element of knowledge, attitude, risk perceptions and environmental assessment with regards to consumers' preventive behavior towards food poisoning.

2.3 Food safety knowledge: The concept and impact towards food poisoning preventive behavior

Consumer's knowledge on food safety is defined as a person exposure to information sources and personal effort in obtaining information (McIntosh et al., 1994). Consumers' knowledge on food safety is associated with their current behavior, which can affect their willingness to change behavior if they perceive that the behavior is safe (Kennedy et al., 2005; Al-Sakkaf, 2013). Few studies have highlighted that many consumers were unaware of the basic rules of food safety (Al-Sakkaf et al., 2013; Ruby et al., 2019a). Nonetheless, there is a study that demonstrates that consumers acquire food safety behavior does not necessarily implement them (Redmond and Griffith, 2003).

Ruby et al. (2019 a) suggest that consumers who frequently prepared food at home were more likely to have better knowledge on food safety in comparison to those who seldom prepared food at home due to their daily routine that helped them construct their self-efficacy towards preparing and selecting safe food. On the other hand, Evans and Redmond (2015) agree that although they might be no significant association between knowledge and actual food preventive behavior, an insight into consumers' knowledge may provide information on whether the consumers are aware of food safety practices.

From the discussion, the author found that knowledge does not directly impact consumer's preventive behavior. With this regards, further review on the relationship of

knowledge and behavior was performed. The relationship between knowledge, attitude and behavior was first acknowledged by Schwarts (1975) in a nutrition study among the school students. He proposed four types of relationships namely: (i) knowledge was directly influenced by attitude but not directly influenced by behavior; (ii) knowledge and attitude influenced each other at the same time; (iii) knowledge and attitude independently influenced behavior and (iv) knowledge shared direct and indirect influences on behavior. To prove on these relationships, a study on health education model and hygiene education demonstrate that individual's behavior was dependent on his or her knowledge, of which such information would lead to a change in attitude and resulted in behavioral change (Rennie, 1995). However, this was contradicted with Huang (1995) and Lim et al. (2016) that argued knowledge and attitude were not positively influenced, and knowledge and behavior did not share a positive relationship.

It clearly demonstrates that knowledge of food safety itself may have a direct association with preventive behavior. These differences may be caused by food safety incidents and public health events. For instance, Qiao et al. (2012) found that most consumers had low knowledge on Food Safety Law and those with children were more concerned about melamine intoxication and two communicable diseases namely SARS and H1N1. Furthermore, consumers with less knowledge were more likely to distress towards food hazard issues due to mass media reports (Jin & Han, 2014). On the other hand, Liu and Ma (2016) found that the effect of food issues on citizens' food safety worry was more prominent among residents with higher education level. This was supported by Losasso et al. (2012) that demographic variables such as educational level as well as gender have a significant effect on consumers' food safety behavior.

The authors have discussed the impact of food safety knowledge on consumers' preventive behavior. Although a few studies suggest that knowledge may not have a direct impact towards food poisoning preventive behavior, food safety knowledge together with attitude may have a positive impact on consumer's preventive behavior. With this regard, the author attempts to explore attitude variables and how this variable impacts consumers' preventive behavior on the following section.

2.4 Food safety attitude and risk perception impact on food poisoning preventive behavior

Attitude refers to individual feeling or opinion about food safety and it describes the amount of effort consumers put in order to conduct food safety handling behavior (Ruby et al., 2019b; Soon et al., 2020). Ruby et al. (2019 b) describes the combination of attitude and personal importance on food safety will enhance individual's behavioral intention (Ruby et al., 2019b). In addition, the positive impact of attitude depends on individual interest, social identification, and value (Howe & Krosnick, 2017).

It is demonstrated that attitude along with knowledge increases the likelihood of performing a certain behavior. For instance, consumers who are more aware of the food quality, possess a good knowledge on food safety or food integrity when buying food are more likely to adopt food hygiene practice when preparing food at home (Mihalache et al., 2021; Lim et al., 2016). In a few KAP (knowledge, attitude, practice) studies, attitude was postulated to be associated with knowledge (Lim et al., 2016; Ruby et al., 2019b; Mihalache et al., 2021). Knowledgeable consumers tend to act and behave in manners that affirm their knowledge level and vice – versa, thus, knowledge level is a crucial factor in

indicating the association between attitude and practices (Zanin et al., 2017). Sani and Siow (2014) posit that when individuals have adequate information on food safety and become knowledgeable about its practices, it is possible to translate such knowledge during food preparation and handling.

In addition, attitude also represents a set of beliefs that can be a mediator between knowledge and practices (Ruby et al., 2019b; Soon et al., 2020). Attitude is described as how consumers view something favorably or unfavorably; to an extent how a person likes or dislikes an object and the degree to which the object is liked or disliked (Bohner & Wanke, 2002). Attitudes can be emerged from the experience and formed as a result of consumers' knowledge and beliefs (Maio & Haddock, 2010) and are one of the determinants of behavior. Attitudes predispose consumers to certain behaviors (Gross, 2005), and although the relationship between attitude and behavior is not clear (Maio & Haddock, 2010), it can give an indication about how consumers feel about certain practices. Consumer attitudes, particularly toward food safety, influence behavior (Redmond & Griffith, 2004), and study of attitudes can give insight as to why some food safety practices are implemented. This can be further explained that consumers who exhibit high food safety knowledge and good food safety behavior demonstrate a positive attitude (Soon et al., 2020). Kuo and Weng (2019) demonstrated that 29.1% of the effect of the knowledge on food safety practice was mediated by attitude among the school children. Similarly, more than 75% of the food safety behavior was mediated by attitude towards food safety among university students in Malaysia (Sayuti et al., 2020).

Understanding consumer's risk perception towards food poisoning prevention on the other hand, is complex due to their perception of risk may be equivocal (deAndrade et

al., 2019). In addition, people tend to be overly optimistic about risks, especially those who think they are in control (Miles & Scaife, 2003; Weinstein, 1989). This phenomenon is known as optimistic bias and is represented by the belief that individuals are less prone to experience negative events or risky situation than their peers (coworkers, friends, and family) and they believe they are subjected to more positive consequences than their peers. Weinstein (1989) argues that this phenomenon occurs due to cognitive error of estimation risk by comparing ones with high – risk stereotypes. An over –optimistic individual tends to neglect health preservation attitudes and practices. The consumers' food poisoning preventive behavior might be shaped due to the feeling of familiarity with the place, in addition to a heuristic feeling of affection and social identity (Fischer & Frewer, 2009; Tiozzo et al., 2018). Therefore, this feeling may impose greater confidence in the food premises, and as a result, the risk perception is depreciated (Fischer & Frewer, 2009; Tiozzo et al., 2018).

It is postulated that good risk communication should raise consumer's risk perception without causing anxiety (Breakwell, 2000). Other element that should be considered when formulating effective risk communication is to understand consumer's belief, perceptions and knowledge of the communication topic. A study on consumer risk perception related to campylobacteriosis and domestic food safety argued that consumers 'who perceived themselves less susceptible to campylobacteriosis and least knowledgeable on food safety exhibited low adherence to food poisoning mitigation measures (Bearth et al., 2014). This might be due to lack of perception of being endangered by specific behavior that can be the drive for behavioral change (Schwarzer, 2008). Furthermore, consumers should be able to perceive the food poisoning problem to increase the willingness to pay

attention to communication about food safety and initiate food safety behavior intention (Bearth et al., 2014).

Having to know the consumers' risk perception also assists in identifying effective intervention to improve their risk perception and awareness towards food poisoning prevention. For example, the application of personal kitchen audit to assess consumer's safe food handling behavior can be a promising strategy in improving their food safety knowledge and behavior (Bearth et al., 2013; Bearth et al., 2014). Another example that can be illustrated by incorporating risk communication is from Bearth et al. (2014) and Bearth et al. (2013) whereby these studies incorporating cue reminders at the point of unsafe food handling behavior execution among the consumers' who identified themselves as 'intermediate cook'; a group with significant knowledge on food safety who might pay less attention to latest information related to food handling.

The studies clearly stipulated that consumer with positive attitude and high – risk perceptions are able to transform food safety knowledge to effective hygienic practices. Thus, focused intervention on shaping consumer's attitude and risk perception is not only necessary but important in ensuring that consumers not only possess head –knowledge of food safety but understand how to transform this knowledge into practices (Zanin et al., 2017).

In addition, consumers' roles in handling the food after they acquired and influence the supply chain are impacted by their knowledge, attitudes and risk perceptions that result behaviors and actions. It is demonstrated that consumers who possess these elements may influence the food safety practices among the food vendors. The interaction between the food vendors and consumers in food safety assurance is significantly important as both are

the main actors in the food supply chain (Nordhagen et al., 2022; Bass et al., 2022). This will be discussed in the subsequent sub section.

2.5 Food safety risk mitigation: Using consumers to persuade food vendors to prepare safe food

The food poisoning risk can be exacerbated by the origin source of the food consumers choice either from the street vendors or the wet markets where the handling of food at point of sale seldom complies with the food safety guidelines (Grace, 2015). Thus, reducing the risk across the food chain from the "farm" (raw food) to the production and subsequently distribution to the preparation and consumption at home is necessary to reduce the negative impact of food contamination (Bass et al., 2022). With this respect, building a strong relationship between consumer and food vendor by using consumer to persuade food safety practices among the vendor may be beneficial to improve behavior on both sides (Bass et al., 2022; Chalak et al., 2019).

WHO have regarded consumers as the final food safety gatekeeper (Milton & Mullan, 2010); hence, this role can be extended to the potential 'agent of change' in the food supply chain by elevating their aspiration for a positive 'food safety culture' which subsequently influences food handlers and food vendors (Bass et al., 2022). Hence, for this to happen, trust should be leveraged between them. There are a few studies enlightened the example of consumers' trust that influences consumers' willingness –to – buy based on their food safety judgement. One example from Kenya investigated consumer's judgement of buying kale from wet market by providing fact sheet that promote safer kale purchase (handwashing, glove, proper storage) at the point of sale (Lagerkvist et al., 2015). The

field experiment observed that, customers in the intervention group (those who were provided with information sheet) in comparison to those in control group (whom did not expose to the information) reported less perceived risk and higher volitional control, which led them to choose vendors who had taken measures (Lagerkvist et al., 2015). They were also willing to pay more for safe kale consumption (Lagerkvist et al., 2015). Similar findings were observed from Chalak et al. (2019) in their choice – experimental design research whereby consumers preferred to buy 'shawarma' from the street vendors in Lebanon whom possessed food safety certification. Bai et al. (2013) also denoted consumers in China were most likely to choose traceable milk that was related to associate certificate issuer.

The three exemplars discussed clearly exhibit how consumers' food safety judgement depends on vendors' food safety initiatives or practices which subsequently develop continuous trust in the vendors to safeguard their food consumption from any contamination. Trust was found to be the primary antecedent in food safety risk perception in meta-analytic review conducted by Nardi et al. (2020). Consumers who trust their suppliers subsequently will reduce the amount of other information they need to believe that a given food supplier or food product is safe (Nardi et al., 2020). For instance, a lot of consumers rely on 'clean' or 'neat' vendors or stalls when buying food in the market in Nigeria of which cleanliness was seen as the appearance of the vendor, stall, and surroundings; that include aspects related to food safety (e.g., not placing goods on the floor) (Nordhagen et al., 2022). A similar prioritization of aesthetic appearances of cleanliness as the social indicator of food safety was observed among street vendors in Ghana (Rheinländer et al., 2008). Besides that, consumers in Ethiopia, South Africa and

Brazil set cleanliness as a marker of health when buying foods from the street vendors and dining in restaurants (Trübswasser et al., 2021; Dastile et al., 2017; Passos et al., 2017).

Previous discussion has identified cognitive and psychosocial elements that influence consumer's food poisoning preventive behavior that subsequently underpinned the need to empower these elements among the consumers in order to select clean and safe food vendors. Hence, leveraging consumer demand to improve vendors' food safety behavior is promising. With this regard, the subsequent section elaborates on the related theories that incorporate both cognitive and social factors and its interaction within. The strength and lack of each model were then discussed in the following section.

2.6 Theoretical review

The use of social cognitive models would develop a better insight in implementing a behavior and bridge the discrepancy between knowledge and behavior (Chow & Mullan, 2010). Food safety behaviors have been acknowledged to be influenced by cognitive and or social factors. Hence, a few social cognitive models were incorporated in the research of food safety among consumers and food handlers. (Chow & Mullan, 2010; Milton & Mullan, 2010; Hanson et al., 2015; Nik Rosmawati et al., 2016). The wide usage of social cognition model related to food safety includes Health Belief Model (HBM), Theory of Planned Behavior (TPB) and Health Action Process Approach (HAPA).

Subsequent discussion will be focused on the related model used in developing an educational module. For this purpose, three models will be elaborated that include ASSURE model, Sequential – Iterative Model (SIM) and Educational Model ADDIE.

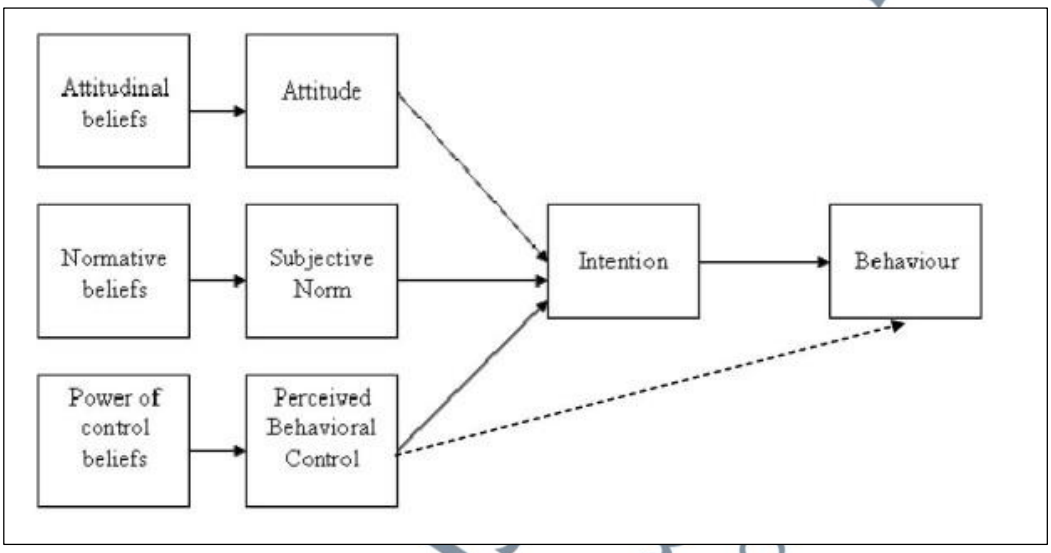
2.6.1 Social Cognitive models

2.6.1a Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) emphasised a person's intention and consequent behaviors depend on combinations of his or her beliefs related to consequences of the action and likely important reactions of other referents. The model adds in the degree of control of the individual feels they possessed over the behavior (Perceived Behavioral Control) (Figure 2.1). In food safety, TPB has been used to investigate different aspects of food hygiene in a number of studies (Milton & Mullan, 2010; Nik Rosmawati et al. 2016). Milton and Mullan (2010) in their pilot intervention study observed significant increase of perceived behavioral control and observed behavior during interventional stage. Similarly, Nik Rosmawati et al. (2016) ascertained significant impact on school canteen sanitation from food safety intervention developed using TPB. Nevertheless, the TPB failed to predict food safety behaviors (21%) in comparison to food safety intention (66%), suggesting there may be a missing variable between intention and behavior (Milton & Mullan, 2010).

Lucas and Lloyd (2005) argued that this model assumed that different behavioral beliefs were independent of each other. The author gave an example of "My doctor would like to see me stop smoking" as normative belief, whilst "My smoking cessation would please my doctor" as behavioral belief. As such, these components lead to 'double counting' in statistical analyses of which the model would have greater predictive ability than the actual (Lucas & Llyod, 2005). Sutton (1997) added that even though the two components are conceptually distinct, they might be typically correlated. On the other

hand, the outcome evaluation as one of the attitude components is known to contribute little predictive power to the model, hence does not contribute meaningfully to the predictive model (Lucas & Lloyd, 2005).



Source: Ajzen (1991).

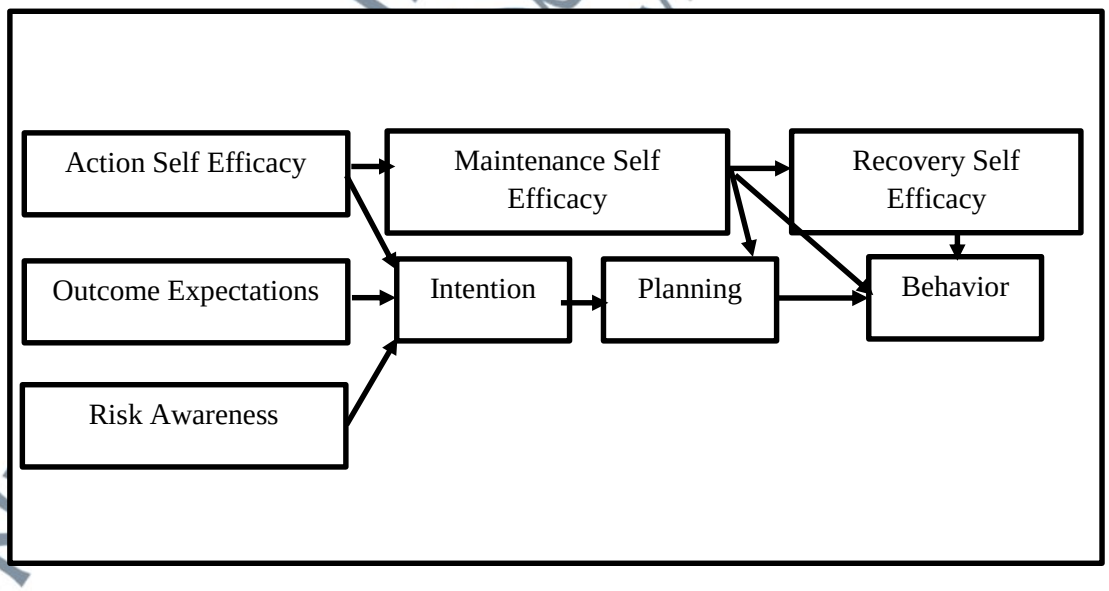
Figure 2.1: Theory of Planned Behavior (TPB).

2.6.1b Health Action Process Approach (HAPA)

HAPA theory is a staged model that incorporates action planning with two distinct phases: motivational phase and volitional phase (Chow & Mullan, 2010). In motivational phase, the intention to implement behavior is influenced by risk awareness (risk awareness vulnerability and risk awareness severity), outcome expectancy (perceived advantages to adopt the behavior) and self – efficacy (individual's perceived capability to implement the new behavior). The volitional phase of HAPA highlights the incorporation of action planning as the bridging component of intention to behavior. In fact, HAPA also suggest that perceived capability in maintaining the behavior (self –efficacy maintenance) and

perceived capability in recovering after a period of absence in behavior (self – efficacy recovery) to be dependent on the implementation of food safety behavior (Chow & Mullan, 2010) (Figure 2.2).

HAPA has predicted 30.8% variance intention, 17.0% of the variance in food safety behavior and 17.2% variance in action planning (Chow & Mullan, 2010). The authors suggest that the incorporation of HAPA model in food safety intervention is able to predict the intention and behavior (Chow & Mullan, 2010). However, the small variance of behavior reflects that the food safety behaviors was not determined by intention (Arbour-Nicitopoulos et al., 2017). Arbour-Nicitopoulos et al. (2017) emphasized that the best intentions do not always lead to behavior. As such, HAPA model that includes intention may reflect similar 'intention-behavior' gaps (Arbour-Nicitopoulos et al., 2017; Lucas & Llyod, 2005).



Source**:** Chow and Mullan (2010)

Figure 2.2: The Health Action Process Approach (HAPA) model.

2.6.1c Health Belief Model (HBM)

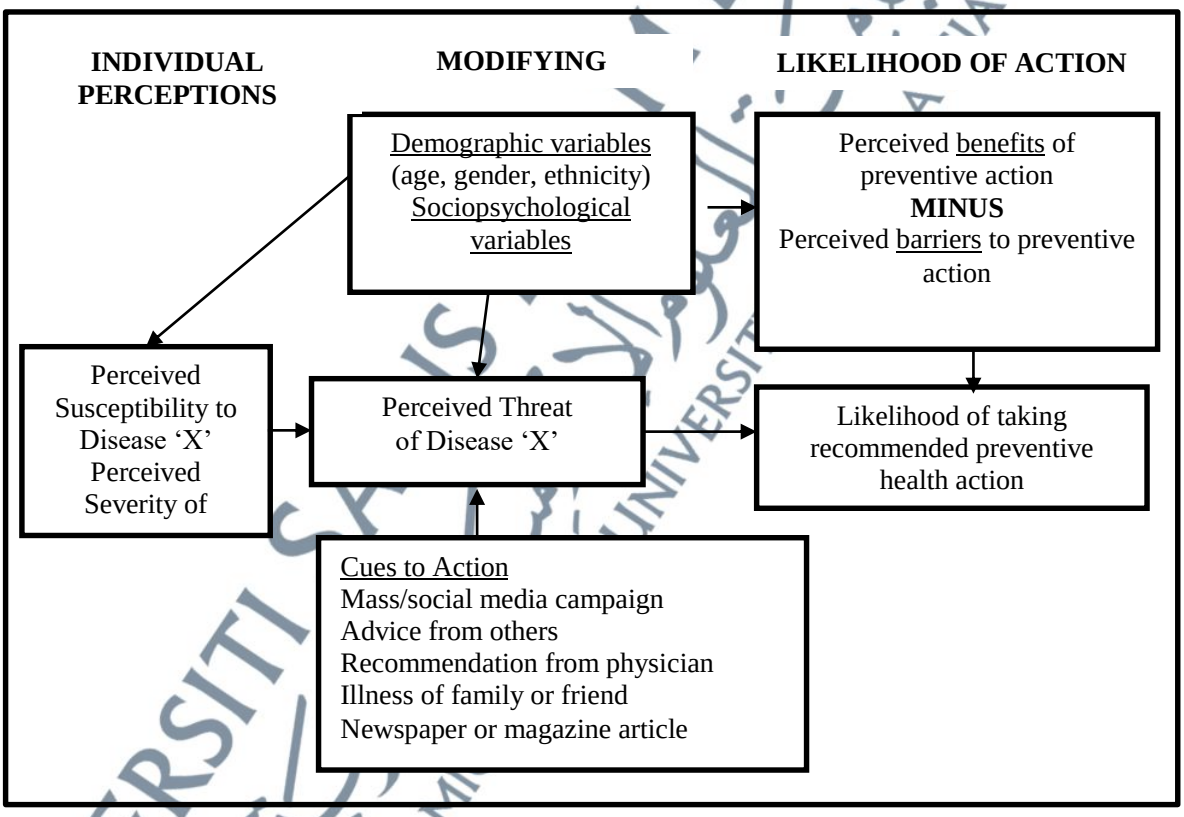
The Health Belief Model is a theoretical model that explains the condition of which a person might engage in individual health behavior. This model is concerned on individual's health decision making that includes preventive behavior or health seeking treatment (Rosenstock, 1966; Luger, 2013). Rosenstock (1974) developed this model in response to enhance effectiveness of health education programmes in the United States (US). It is noted that demographic or socioeconomic status could not be modified through health education, but other potentially modifiable individual characteristics associated with health – related behavior could be changed via educational interventions (Abraham & Sheeran, 2015). Hence, this helps to mediate health-behavior patterns at population level (Abaraham & Sheeran, 2015). The HBM was widely used in the 1970s in the US for health promotion design. For instance, Kegeles (1963) demonstrated that perceived susceptibility to the worst dental problems and awareness that dentist visits might prevent these problems is the significant predictor for the frequent dental visits over the next three years. This was further supported by Kirscht et al. (1976) that exhibit HBM – based health education intervention that was designed to increase consumers' perceived susceptibility, perceived severity and anticipated benefits resulted in a greater number of check-up visits to doctor as to compare to those without intervention over an eight-month follow up.

The HBM focused on two aspects of individuals' health behavior which were: threat perception and behavioral evaluation. Threat perception was developed based on two key beliefs that were perceived susceptibility to health problems or illness and anticipated severity of the consequences of the ailments. Similarly, behavioral evaluation also

consisted of two sets of beliefs: (i) benefit of recommended health behavior and (ii) cost or barriers to perform the suggested behavior (Abraham & Sheeran, 2015). In addition to the two aspects, the model proposed that cues to action promote health behavior when appropriate beliefs are held. The cues to action involved a variety of triggers such as individual perceptions of symptoms, social influence, and health education campaigns. Finally, an individual's general health motivation was included in the later versions of the model. In summary, there are six distinct constructs in the HBM as illustrated in Figure 2.3.

A few previous studies had reported the application of HBM in determining food safety behaviors (Hanson, 2002; Hanson et al., 2015; Mc Arthur et al., 2006; Schafer et al., 1993). This model had successfully identified older adults who willingly adopt safe food – handling behavior (Hanson, 2002; Hanson et al., 2015; Schafer et al., 1993). Similarly, McArthur et al. (2006) in their finding among college students identified perceived severity and barriers as the significant predictors of compliance with food-safety recommendations. Nevertheless, Bandura (1977) noted that perceived severity has a weak correlation with health and action and even results in avoidance of protective action. With that respect, self – efficacy (the need to feel competent before affecting long-term change) was incorporated in the model. On the other hand, each of the components in HBM has not been explicitly defined and the relationships between these components or combinations are not clearly constructed (Munro et al., 2007). The model assumed that the components are not moderated by each other and have additive effect (Stroebe & de Wit, 1996). For example, if the perceived seriousness is high and susceptibility is low, it is still assumed that the likelihood of the action will be high and vice versa (Stroebe & de Wit, 1996).

Despite being criticized for its general assumptions of individual's perceived susceptibility and perceived severity related to illness, HBM has been adapted and successfully applied in informing and explaining range of behaviors connected to health outcomes (Metta, 2016). Therefore, this model was adapted for this study in aiding the understanding of the decision – making processes and food poisoning preventive behavior at individual level.



Source: Rosenstock, Strecher and Becker (1988)

Figure 2.3: Health Belief Model theoretical framework

The summary of the social cognitive models used in food safety promotion is illustrated in Table 2.1. The summary includes the model component or constructs, strengths and limitations.

Table 2.1: Summary of social cognitive models in food safety promotion

No.	Model	Summary of theory	Constructs	Strengths	Limitations
1	Theory of Planned Behavior (TPB)	i. It was first introduced in 1980 as the Theory of Reasoned Action (TRA). ii. It is used in predicting a person's purpose to engage in a behavior at a particular place and time. iii. The behaviors are the one that people can have self-control.	This model has six constructs: i. *Attitudes:* a level in which an individual possesses a satisfactory or uncomplimentary behavior evaluation. ii. *Behavioral intentions:* motivational factors that affect a specific behavior when the chances of the intentions of performing a behavior are high the higher likelihood of performing that behavior. iii. *Subjective norms:* These are beliefs on whether of others may accept or reject the behavior. iv. *Social norms*: A group's customary codes of behavior.	The theory allows practitioners to conclude the particular beliefs for a specific population	i. The theory failed to predict food safety behaviors as compare to intention. This suggests that there might be a missing variable between intention and behavior (Milton & Mullan, 2010) ii. Different behavioral beliefs were independent to each other. Sutton (1997) argued that the beliefs might be correlated.

Table 2.1: (continued)

No.	Model	Summary of theory	Constructs	Strengths	Limitations
			iv. *Power of control belief:* factors that encourage or prevent the performance of a behavior. v. *Perceived behavioral control*: The perception of an individual regarding the easiness or struggle of doing the behavior of interest.		
2	Health Action Process Approach (HAPA)	The Health Action Process Approach (HAPA) suggests that the adoption, initiation, and maintenance of health behaviours must conceive as a process that consists of at least a motivation phase and a volition phase. The latter might be further subdivided into a	This model incorporates two phases and each phase has the following contructus: a) Motivational phase (Goal setting) i. Risk perception ii. Outcome expectations iii. Intention iv. Self – efficacy	Prominent role for self - efficacy as the key determinant of intentions, and intentions as the key determinant of behavior (Hamilton et al., 2020)	i. The model lack of explicit consideration of non-conscious processes.

Table 2.1: (continued)

No.	Model	Summary of theory	Constructs	Strengths	Limitations
		planning phase, action phase, and maintenance phase (Chow & Mullan, 2010).	b) Volitional phase (Goal pursuit) i. Self –efficacy maintenance ii. Recovery self – efficacy iii. Plannning		ii. The use of HAPA in food safety has predicted 30.8% intention and 17.0% of food safety behavior. Small variance of behavior suggesting an intention – behavior gap (Arbour – Nicitopoulus et al., 2017).
3	Health Belief Model (HBM)	i. It is a psychological health behavior change model that was introducedto give an explanation or prediction of the health-related behaviors.	i. *Self-efficacy*- amount of confidence an individual has in an effort or ability to perform a behavior magnificently.	i. Important in discussing health behavior change ii. Useful for designing health promotion programming	i. It adopts the fact that every person gets access to equal amounts of a disease's information

Table 2.1: (continued)

No.	Model	Summary of theory	Constructs	Strengths	Limitations
		ii. The major components of the model are the desire to get well or avoid disease and conviction that a particular health action will prevent the disease.	ii. *Cues to action*- cues can be internal or external and they act as a stimulus to prompt a decision-making process for accepting a certain suggested health action. iii. *Perceived benefits* - perceptions of an individual concerning the effectiveness of different actions to minimize the threat of disease. iv. *Perceive barriers*- the feelings of a person towards obstacles to perform a suggested health action v. *Perceived severity*- The feelings of an individual on the solemnity of getting a disease vi. *Perceived susceptibility*- the perceptions of an individual regarding the risk of getting a disease.		ii. It fails to consider the account behaviors done for reasons that are non-health.

2.6.2 Educational development model

The development of 'See, Select, Tell' food poisoning prevention educational module requires a systematic development design to ensure the product development meets the quality and the target group. The module developed in this study involves a series of educational and learning activities that enhance the consumer's knowledge, improve the attitude and risk perceptions towards food poisoning by achieving the learning objectives from the designed topics.

Module based activities are designed according to the background, style of learning, value, interest, and motivation of the user (Zulkepli Mohamad, 2010). The activities are strategized according to topics that are intended to be delivered to the target participant to enhance their knowledge about the food safety concept. A module is a complete self – educational package that encompasses components such as objectives, teaching and learning strategies, as well as assessment activities (Meyer ,1988). Activities are conducted according to a set of systematic instructions for the user to be able to follow the steps gradually and master the learning topics. Sharifah Alwiah (1981) on the other hand described module as one small completed section and integrated with other sections. She also concludes that a module is an effective instrument that can be used in teaching and learning activities.

There are two types of modules namely educational module and teaching module. The module development process should be adhered to ensure the content reflects the consumer need and the concept, principle and skill emerged from the module activities align with consumer's ability and learning objectives. Hence, there are a few module

characteristics that shape the module content and determine its effectiveness in achieving the learning objectives. Table 2.2 explains each of the module characteristics.

Table 2.2: Module characteristics

No	Characteristic	Description
1.	Target participant	A module is developed based on specific target participant that possess similar cognitive abilities and other important characteristics.
2.	One or a few concepts	Since module comprises of one complete learning unit, only one or a few concepts can be embedded in the module.
3.	Behavioral objectives	Behavioral objectives can be stated at the beginning of the module content. Objectives should be able to measure and observe.
4.	Module content	The content should be stated at the beginning of the module in order to achieve the learning objectives.
5.	Media	The selection of media used in the module should be based on the need and driven by the learning objectives.
6.	Complete or supplemental teaching	Modules can act as a recovery or supplementary teaching based on the need or can be used as a complete teaching for a whole course.
7.	Self-directed learning	Instructions and learning direction are prepared for trainees to self-progress without any problem.
8.	Multi strategies	A module can comprise of a variety of strategies and activities.
9.	Self – paced	Trainees can learn the module content at their own pace.
10.	Continuous affirmation	These are obtained from the answers given in the module after each unit learning exercise completion.
11.	Sufficient exercise	Trainees are provided with sufficient exercise on concept, skills and other outcomes.

Table 2.1: Module characteristics

No	Characteristic	Description
12.	Evaluation	Trainees are evaluated based on learning objectives, pre and post assessment, as well as other module learning assessments.
13.	External assessment	The complete module should be tested on its usability on the target trainees. Necessary amendments are made in order to ensure its effectiveness in achieving the learning objectives.

Sources: Sharifah Alwiah (1981).

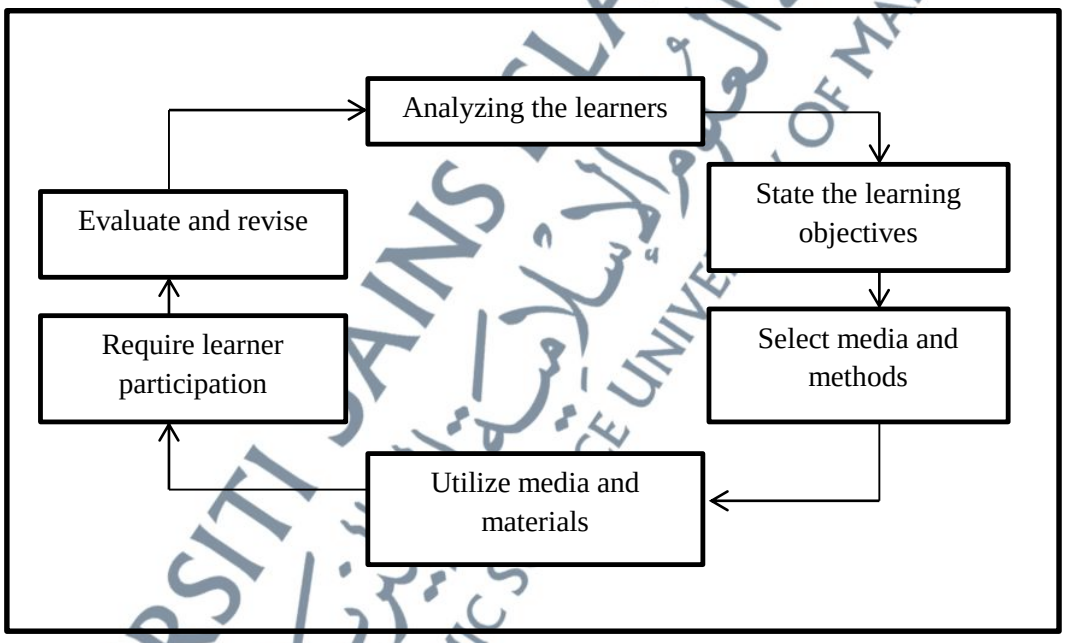
There are a few instructional design models that can be adhered to develop an educational module. These include ASSURE model (Heinich et al., 2002), ADDIE model (Branch, 2009) and Sequential Iterative Model (SIM) (Milano and Ullius, 1998). Although there are some differences in the procedure and approach aspect, the outcome of a module is to develop an educational product to ensure a high quality of education system. This is supported by previous findings that there is a need to develop a focused module to enhance knowledge, attitude, and risk perceptions towards food poisoning prevention (Kwol et al., 2019; Zanin et al., 2027).

The aim of developing an educational module is to ensure the teaching and learning implementation to be conducted structurally, hence, giving an optimum impact to the desired learning outcome to the consumer. Morrison et al. (2011) identified four fundamental components in designing systematic teaching and learning activities they are respondent's characteristics, objective, method and evaluation. Each of these components are developed to be associated to each other. There are a few modules development models

that can be referred to in designing and developing an educational module. These will be discussed in the following subsection.

2.6.2 a Model ASSURE (1996)

ASSURE model was introduced by Heinich et al. in the year of 1996 (Heinich et al., 2002). There are six steps involved in this model: (i) Analyzing the learners; (ii) State the learning objectives; (iii) Select methods, media and materials; (iv) Utilize media and materials; (v) Require learner participation; and (vi) Evaluate and revise (Refer to Figure 2.4).



Source: Heinich et al. (2002)

Figure 2.4: ASSURE model.

Every step in this model receives the input from the previous step and produce output to the following step. Table 2.3 elaborates each of the steps involved in the module development using ASSURE model (Heinich et al., 2002).

Table 2.3: Steps in developing module in ASSURE model

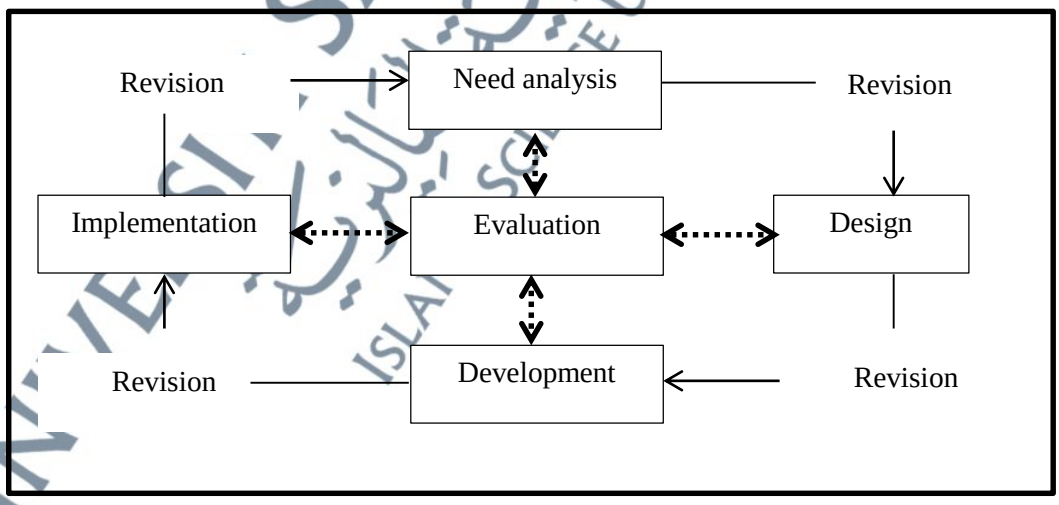
No	Steps	Description
1	Analyzing the learners	Determine the target learner (consumer) who will receive the module content. This is crucial to ensure the content meets the needs of the participant and facilitator. Hence, researcher should familiarize facilitator's teaching experience, teaching skill, attitude and interaction strategies before planning the design of the module content.
2	State the learning objectives	Identify beforehand the required learning objectives. These include behavioral change, knowledge, attitude and risk perceptions towards food poisoning prevention. Objectives should be clear and measureable.
3	Selection of media and materials	Ensure the module content is suitable to be delivered by the facilitator, answers each objective, and suits the curriculum. If the module is for the use of the community, documents such as food safety guidelines and previous literature should be referred to ensure the appropriateness of the content. Researcher should identify appropriate materials and delivery strategies, as well as facilitators' competencies and available resources to implement the module.
4	Utilize media and materials	Researcher should ensure media and teaching materials are appropriate. Quality media and materials will positively impact the learning process. The use of text, video, graphic, animation and audio should be in line with the need of facilitator and module content.
5	Learner participation	Ensure active participation from the consumer along the teaching and learning process. This includes conducive teaching environment that promotes effective information delivery. Researcher should discuss with the facilitator in order to obtain feedback on the module effectiveness in gaining active participation from the consumers.
6	Evaluate and revise	The module content should be evaluated in order to measure its effectiveness and usability. This allows appropriate amendments to be made to improve its usability among the facilitator and consumers.

Source: Heinich, et al. (2002)

2.6.2b ADDIE Model (1987)

Five phases in ADDIE Model which are: (i) analysis; (ii) design; (iii) development; (iv) implementation; and (v) evaluation has diversified and modified from time to time into a different design based on the research conducted. Researcher concludes the five phases from the instructional design of ADDIE model as in Figure 2.5.

In Figure 2.5; the development of the product using ADDIE model involving a dynamic process whereby it allows product improvement through evaluation. Branch (2009) identified this evaluation as revision. There are two evaluations involved that are formative and summative. Formative evaluation is employed in each phase when a product is developed or improvised until its implementation. In contrast, the summative evaluation is the final evaluation of the product during its implementation in the field. Should a formative assessment is conducted in every phase; the summative evaluation may not be applicable or can be conducted at minimum level. Table 2.4 explains these processes in ADDIE model.



Source: Branch (2009)

Figure 2.5: A cyclic process of ADDIE model.

Table 2.4: Phases involved in ADDIE model

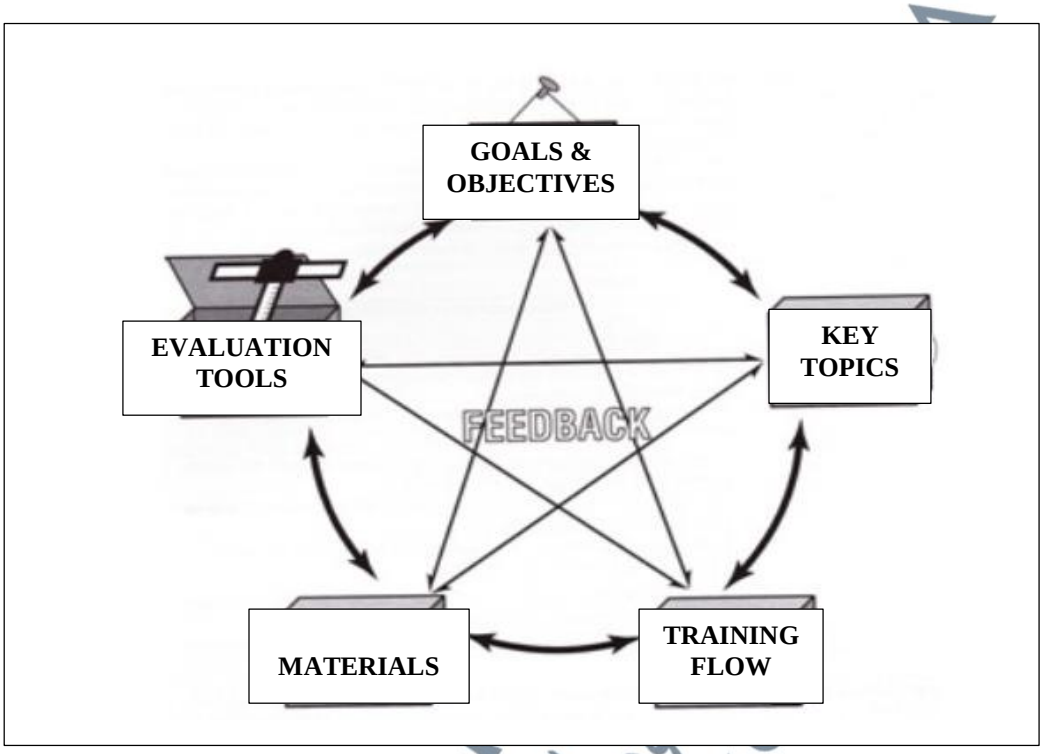
No	Phase	Description
1	Need analysis	Researcher has to conduct analysis on the user and learning environment. In addition, the aim of the learning should also be exercised.
2	Teaching design	Specific teaching should be developed, teaching strategies and assessment items for the learners should be identified. At this stage, researcher should determine the module content specifically, delivery strategies and presentation technique in order to deliver the module content.
3	Development	This is a complex stage. Researcher should be able to plan the whole teaching process. If the teaching process involves the use of paper-and-pencil, development drafts should utilize specific resources for the desired population. On the other hand, if it is a computer-based system, the facilitator should be competent in both information technology and teaching design.
4	Implementation	When the teaching design and development is established, the subsequent step is the module implementation. This is to ensure the module content effectiveness and usability.
5	Evaluation	Evaluation phase is conducted during the development of the module (formative assessment) and after module implementation (summative assessment). Evaluation is necessary to ensure the teaching and learning system is effective and applicable to the target learners.

Sources: Branch (2009)

2.6.2c Sequential Iterative Model (SIM)

The Sequential Iterative Model (SIM) is a model designed for developing a training and education module. It was constructed by Milano and Ullius (1998) of which consists three characteristics in determining the strength of the programme that are: effective, efficient and engaging. Effective refers to the attainment of the specific programme objectives related to participant's behavior, knowledge or attitude. Efficient on the other hand is the objective attainment without any wastage of time or energy whilst engaging refers to the ability of the programme to attract participant's interest, involvement and experience sharing (Milano & Ullius, 1998). The SIM model was constructed based on the main concept that a specific programme development is according to specific sequence and iterated.

The model has gone through a series of testing and improvement processes since its eight years of introduction. There are five aspects that are interrelated to each other: objective, main topic, delivery technique, training flow and evaluation. The development process of the training programme in a sequence that involves analytical steps, planning, developing, implementing and evaluating and this is illustrated in Figure 2.6. Each component in SIM model has its own purposes and is related to one another. Table 2.5 elaborates further on these components.



Source: Milano and Ullius (1998)

Figure 2.6: SIM training model.

Table 2.5: Function of elements in SIM training model

No	SIM model component	Elaboration
1	Aim and objectives	The aim and objective of training or learning involve the following: i. elements that are required to be trained ii. the target consumers iii. the appropriateness of the training iv. consumer's skill level. In addition, the aim and objectives of it should be in line with the training outcomes to be achieved.

Table 2.4: (continued)

No	SIM model component	Elaboration
2	Key topics	It is referred to the training content to be conducted on the consumers. The selection process of the elements to be embedded in the content requires expert view and opinion. Each selected element should be listed and arranged in order to facilitate the training process on the consumers.
3	Training flow	The training flow is related to the key topics that involve listing and arranging processes. Hence, the training flow process requires an expert who is skillful in identifying which element to be emphasized and trained on the consumers. This is very crucial in ensuring the training or learning conducted is effective, efficient and related to each other. It also helps to prevent time and resource wastage of conducting redundant training. Therefore, training flow should be outlined once the aim, objectives and key topics have been determined.
4	Training materials	Training materials are an important component that aids the training process. There are three training aids that should be considered in order to design training. This comprises of training material for the facilitator, learning aid for the training consumers and delivery media (audiovisual, logistic etc.).
5	Training evaluation	Evaluation is necessary in order to determine efficacy and usability of the training to the consumers. An evaluation can be conducted either during the period of training or after the training is completed. Milano and Ullius (1998) suggest that a few criteria can be ascertained during the evaluation process:

Table 2.4: (continued)

No	SIM model component	Elaboration
	Training evaluation	i. What are the reactions of the consumers to the training? ii. What do they learn from the training? iii. Do they apply the elements of the training in their daily life? iv. Is there any difference of the score of the assessment before and after the training?

Each component exhibits its strength and importance in developing effective training. The primary strength that can be seen from the SIM model is that effective training begins with the determination of the aim and objectives that focus on the outcome of the training. Next, it involves the key topics that require selection of the content in the training development. The training flow on the other hand arranges the training content based on the priority that involve expert in the training field. The emphasis of the training material in training is to ensure the training to be conducted efficiently. Finally, the training evaluation component helps to determine the usability of the module on the consumers.

In addition to the components above, Milano and Ullius (1998) have outlined a few other criteria of effective training as follows:

i. Training conducted should be objective – oriented.
ii. The training should be focused on the application of the trained elements.
iii. The training conducted should be well suited to the adult learning style.

iv. The training should be balanced and suit diverse participants.

v. The training should be able to reduce the teacher/ educator –centered.

vi. The training should also have an evaluation process in order to identify the achievement of the training given.

Based on this premise, the current study adheres to SIM model in order to develop the 'See, Select, Tell' food poisoning prevention educational module. The module content was objective oriented and the key topics were determined based on the consumers' need and expert views. In addition, each of the key topics was delivered using appropriate materials, followed by assessment at the end of the topic to ensure the information was delivered effectively.

2.6.2d Design and developmental research (DDR)

On top of the educational module development model presented, the incorporation of Design and Development Research (DDR) has become prominent in product and tool design. DDR focuses on the process of product development and involves the context and situation, as well as the assessment of the product (Saedah et al., 2013). DDR is known as a problem – solving oriented approach that uses interdisciplinary research methodology such as case studies, experiments, action research and evaluation studies (Richey & Klein, 2007). Richey and Klein (2007) identified two types of DDR research namely: Type 1 Product and tool development and Type 2 Model development. Table 2.6 summarized the characteristics of each DDR type.

Table 2.6: DDR types and the characteristics

A. Type 1: Product and Tool Research	B. Type 2: Model Research
Comprehensive Design and Development Projects i. Instructional products and programmes ii. Non-instructional products and programmes	**Model development** i. Comprehensive model development ii. Development of model component process
Specific Project Phases i. Analysis ii. Design iii. Development iv. Evaluation	**Model Validation** i. Internal validation of model components ii. External validation of model impact
Design and Development Tools i. Tool development ii. Tool use	**Model Use** i. Study conditions impacting model use ii. Designer decision-making research iii. Designer expertise and characteristics research
Emphasis Study of specific product or tool design and development process.	**Emphasis** Study of model development, validation or use
Outcome Lessons learned from developing specific products and analyzing conditions that facilitate their use Context-specific conclusions	**Outcome** New design and development procedures of models, and conditions which facilitate their use Generalized conclusions

The tool or product design and development is implemented in phases of need analysis, design, development, implementation and evaluation. The phases were similar to the previous instructional design model such as ADDIE, research development model by Morisson et al. (2011) and model by Ellis and Levy (2010). The DDR process or phases were further elaborated in Table 2.7.

Table 2.7: DDR phases as demonstrated by Richey and Klein (2007)

Phase	Explanation
Phase 1: Need analysis	Identifies development needs of a model or module. Done before design and development is implemented.
Phase 2: Design and development	Decides on design of module using several approaches. Develops model or module using appropriate approaches.
Phase 3: Implementation and assessment	Implements models or module in real situation and their effectiveness is assessed through selected approaches.

2.7 Past literature review: Food poisoning prevention intervention

In this section, previous literatures were discussed and analyzed according to strategies of designing food safety intervention to improve consumers' knowledge, attitude and risk perceptions. Mosler (2012) describes behavior change as the result of psychological factors within the individual. He also emphasized that for the behavior change -oriented programme to be successful, it is crucial to know which of these factors influence individual bad behavior (Mosler, 2012). Mosler identified four behavior factors that should be investigated when designing a behavior-change intervention are: (i) risk factors; (ii) attitudinal factors; (iii) ability factors; and (iv) self-regulation factors (Mosler, 2012). By identifying these factors, specific intervention can be strategized and implemented.

Current study adhered to Health Belief Model (HBM) to pinpoint the possible psychological factors towards food poisoning prevention apart from cognitive factors that contribute to behavioral changes. HBM model did not specifically include normative belief

of which it requires perceptions of approval from the family or community members on a specific behavior performed, since that numerous previous research studies demonstrate that normative belief does not associate with food safety handling intention (Dang and Tran, 2020; Gupta et al., 2018; Nik Rosmawati et al., 2016; Milton and Mullan, 2010).

A systematic review on food safety education intervention conducted by Young et al. (2020) clearly indicated that multifaceted food safety intervention is able to give larger effect size on participant's knowledge, attitude and inspection score. In addition, other studies also supported continuous food safety knowledge empowerment through education and training (Abdul Mutalib et al., 2012; Morse et al., 2020; Young et al., 2020). Hence, by understanding the impact of food poisoning prevention intervention on specific enabling factors of food poisoning preventive behavior, it may assist in designing an effective module intervention. Based on this premise, a review of previous literature on food safety intervention with an interest in knowledge, attitude and risk perception outcome was conducted using available databases such as Sciencedirect, PubMed, EBSCO and CINAHL. The review was summarized in the subsequent subheadings.

2.7.1 Food poisoning prevention intervention and knowledge

One of the aims of food safety intervention is to improve food safety knowledge as it seems to be deficient and can be strengthened with continuous education and training (Young et al., 2020; Sanlier et al., 2020; Gautam et al., 2017; Abdul Mutalib et al., 2012). Al-Sakkaf (2013) identified knowledge as one of the factors that contribute to poor food safety practices among consumers. As such, imparting knowledge in food safety intervention will help to improve consumer behavior.

It is necessary to identify the area of food safety to be focused on during the module intervention. Previous study suggested that cross – contamination, time and temperature control, and foodborne pathogen were the least knowledgeable areas and requires emphasis in food safety intervention (Al-Kandari et al., 2019; Ruby et al., 2019b; Bou-Mitri et al., 2018). Al-Kandari et al. (2019) in their findings demonstrated that most of the food handlers are unaware of activities that may contribute to cross-contamination. Similarly, most food handlers were found to incorrectly report "washing hand using water only reduce risk of contamination" and "wearing glove reduce the risk of transmitting infection to consumers" (Bou-Mitri et al., 2018). Consequently, the lack of knowledge in these areas may impose the risk of foodborne illness.

Food handlers were identified as the main vehicle for foodborne pathogens transmission. As such, good personal hygiene as well as minimizing the risk of cross contamination either from utensils to food or hands to food may reduce the incidence of food poisoning. One study was found to report knowledge on food safety among the consumers in Malaysia. Ruby et al. (2019b) in their research have found that more than half of the consumers did not know the optimum temperature for refrigeration. Refrigeration is one of the storage methods used to inhibit the growth of bacteria as bacteria rapidly grow at room temperature. Thus, the lack of knowledge on the recommended temperature control can lead to food spoilage, especially for high – risk food such as milk and meat that require refrigeration to prevent rapid bacterial growth (Marklinder & Eriksson 2015).

Studies on food safety intervention among consumers were very little since more research was conducted among the food handlers (Viator et al., 2015; Zanin et al., 2017;

Nik Rosmawati et al., 2016; Clark et al., 2019). For instance, Majowicz et al. (2017) using standardized provincial Food Handler Training programme on high school students. The authors employed longitudinal design of which data were measured repeatedly at three *circa* (1 week before, *circa* 2, 12 weeks after intervention) (Majowicz et al., 2017). Knowledge of time and temperature control, and high –risk foods remained higher than the baseline but slightly decreased after 12 weeks intervention. On the other hand, students' knowledge of cross – contamination did not change after intervention (Majowicz et al., 2017). In contrast to the usage of available food handler course as part of consumer education intervention, Feng et al. (2019) employed a positive deviance food safety curriculum for high school students. This approach allows students to discuss their food safety behavior and learn from positive deviants which are their peers that practice the recommended food safety behavior (Feng et al., 2019). Interestingly, a positive deviance approach improved students' food safety knowledge, as well as observed recommended food safety behavior (Feng et al., 2019).

White et al. (2018) adopted experiential learning as part of learning method to educate and train university students in public health field on foodborne outbreaks. This method involved the usage of case study exercises, simulation exercises, and public health case competition (White et al., 2018). The method allowed students to apply knowledge in realistic scenarios within time pressure, limited resources and team dynamics (White et al., 2018). In addition, experiential learners applied their knowledge and personal prior experiences at a macro – level perspective, rather than go into individual pieces (eg: steps in an outbreak investigation). Hence, this method helps to increase self – motivation, analytical thinking and long – term retention (White et al., 2018; Barret et al., 2017).

Moving into the era of borderless learning, the incorporation of multimedia in Moodle Learning Management System (LMS) offers improvement in food safety knowledge in a creative way. Alberts and Stevenson (2017) for instance demonstrated the incorporation of multimedia components such as videos and interactive games in the LMS increased students' knowledge on Hazard Analysis and Critical Control Point (HACCP) and Good Manufacturing Practice (GMP) as well as their behavioral intention. The use of video in this research had aided in students' learning of which it made difficult concepts easier to understand (Albert & Stevenson, 2017; Mehrpour et al., 2013). Nonetheless, the true effectiveness of this study may be questionable since it did not compare to the control group (Spurlock, 2018; Young et al., 2020). The single group, pre-post design has several limitations in imparting definitive evidence, but some research may employ this design for practicality and feasibility purposes (Knapp, 2016; Spurlock, 2018; Young et al., 2020).

Imparting knowledge alone in food safety education will not necessarily lead to food poisoning preventive behavior change as not all knowledge gains will translate into desired behavior (Young et al., 2020; Viator et al., 2015). It is noted that by incorporating consumer's attitude and risk perception element in food safety intervention may offer a greater chance of desired behavioral change (Alberts & Stevenson; 2017; Young et al., 2015). This will be discussed in the following paragraph.

2.7.2 Food poisoning prevention intervention and its impacts on risk perceptions and attitude

Food safety intervention recently have made attempts at changing risk perception of which it is defined as the subjective judgment a person makes about how risky something

is to him or her such as the chance of contracting a food poisoning, through risk communication fundamentals (Bass et al., 2022). This can be a new potential approach not only to change individual behavior and attitudes but also affect social and cultural factors to develop a food safety culture driven by consumer demands (Powell et al., 2011; Bass et al., 2022). Research investigating the risk perception as an important antecedent to perform food safety behavior exhibits significant effects related to changing behavior (Bass et al., 2022). In addition, lay people perceive risk and hazards differently than the experts and it can be enhanced if the person feels that they are lacking control or do not trust those providing risk information (Slovic et al., 2005).

Risk is conceived at an affective level (emotion) and decisions are made heuristically that are influenced by psychological or cultural factors (Kahneman et al., 1982; Siegrist et al., 2006; Siegrist & Sutterlin, 2014). For instance, consumer risk perceptions can be changed by manipulating messaging strategies. Nauta et al. (2008) examined the effect of web – based messages that incorporated cues to improve food safety in Netherlands. There were three groups of interventions that received: (i) basic information on food safety; (ii) basic information on food safety with 'aggressive' language, colors and images that evoke emotional response; (iii) messages meant to elicit disgust along with risk information that was embedded together with behavioral cue to perform food safety protective behavior (Nauta et al., 2008). This study revealed that risk information increased food safety behavior intention, behavior and emotional reactions such as disgust were associated with intended and actual food safety behavior (Nauta et al., 2008).

There are several studies that looked into risk perceptions and risk communication strategies in market settings. For example, Chalak et al. (2019) examined the effect of

messages based on quantitative risk reduction attributes of purchasing streets foods from Lebanese families. The finding demonstrated that disclosing food safety attributes and food safety certification of street vendors affect consumers' willingness and preferences to buy food that they perceived safe (Chalak et al. 2019). Similarly, Lagerkvist et al. (2015) observed that shoppers who were informed about the actions taken by the vendor to minimize food poisoning risk (handwashing, wearing gloves, proper storage etc.) perceived less risk and higher volitional control which led them to choose vendors who had taken measures, as to compare to the non-exposed group (control group). They were also willing to pay more for food handled safely than the consumers in the control group (Lagerkvist, et al., 2015). On the other hand, consumers who work or volunteering in food service premises have slightly stronger belief of personal susceptibility to and personal threat from food poisoning (Majowicz et al., 2017). From the examples discussed, it is clearly indicated that risk assessment is not only based on real risk or quantifiable estimates, but it is how the individual perceives risk and whether it is deemed to be important (Bass et al., 2022).

A few strategies can be adopted in tackling individual's risk perception towards food safety. One important communication intervention strategy is by using social marketing, of which it adapts commercial marketing to change food safety behavior and risk perceptions (Bass et al., 2022; Partnership for Food Safety Education, 2021). 'SuperAmma' was one of the studies that adhered to this approach whereby it instilled the element of 'emotional drivers' that focusing on 'disgust', or desire to avoid and remove food contamination (Biran at al., 2014). Moreover, the author also inserted maternal emotional driver of nurturing to influence the behavior (Biran et al., 2014). Such marketing

concept had significantly affected handwashing behavior among the villagers indicating that this approach may be one of the effective ways to influence community behavior and risk perceptions towards food behavior (Biran et al., 2014).

In – person education is also known to be an effective method in improving individual risk perception and skills on food poisoning prevention. It usually included 'promoters' or community health volunteers to assist in educating and influencing the community on food safety behavior (Chidziwisano et al., 2020). Chidziwisano et al. (2020) depended on the local residents of Chikwawa District in Malawi; especially the mothers and trained them on food safety behaviors such as handwashing with soap, washing kitchen tools and food reheating. The involvement of the women in food safety intervention provides the 'trickle down' effect to overall food safety for the families (Gilmore & McAuliffe, 2013) and helps to improve knowledge, skills, attitudes and observed food safety behaviors (Chidziwisano et al., 2020; Ghaffari et al., 2020; Andrade et al., 2019; Edward et al., 2019). However, this strategy is more efficient and effective in low – and – middle – income countries (LMIC). Involvement of trusted authorities such as general practitioners (GPs) has shown to increase trust among the Italian consumers in seeking food safety information (Tiozzo et al., 2018). It is believed that the role of GPs can influence families, research institutions, local and governmental public authorities with mandates to guarantee food safety (European Commission, 2010; Tiozo et al., 2018). Hence, public authorities can invest in food safety risk communication interventions development and delivery in collaboration with the GPs (Tiozzo et al., 2018).

Like risk perceptions, improving individuals' attitude towards food poisoning prevention may lead to food poisoning preventive behavior as demonstrated in a few

studies (Albert and Stevenson, 2017; Archila – Gordinez et al., 2022; Feng et al.,2019; White et al., 2018). The use of positive deviance among the high school students demonstrates a significant change in attitude of using color as indicator of meat doneness (Feng et al., 2019). White et al. (2018) on the other hand has indicated improvement of confidence level of conducting foodborne outbreak investigation among the students who participate in the 'Foodborne Outbreak Challenge' event. This event was developed by incorporating an experiential learning approach that integrates education curriculum and workforce (White et al., 2018). The implementation of multimedia and virtual learning too illustrates a significant improvement in attitude towards food safety practices (Albert and Stevenson, 2017; Archila – Gordinez et al., 2022). Albert and Stevenson (2017) developed a multimedia case study teaching method and applied it among the undergraduates in their food safety management systems course. The method has significantly improved students' attitude, knowledge and intention to implement food safety management systems (Albert & Stevenson, 2017). Conversely, using virtual platform to educate low-income population in the United States demonstrate improvement in attitude, perceived behavioral control, subjective norms and intentions of food safety practices (Archila – Gordinez et al., 2022).

The review suggests that by empowering consumers through knowledge, food safety risk perception and attitude together with various strategies that influence emotion and community members such as families and peers can be useful in promoting food safety behavior. It is also proposed that a comprehensive food poisoning prevention education should not only focus on knowledge alone, but consolidating other psychosocial elements to ensure its effectiveness in promoting food poisoning preventive behavior.

Nonetheless, previous research on food poisoning prevention interventions were more targeted to food handlers and adolescents. Although both groups play a significant role in ensuring the safety of the food along the food chain, it is advocated that by empowering the consumers on the food safety, may create a positive culture of safe food handling especially among the food vendor or supplier. Furthermore, there is very little evidence from previous literature that indicates the use of a module for food safety intervention. The usage of module is known to assist in behavioral and knowledge changes as it encompasses a complete package of learning objectives, activities and assessment that enable the user to follow the steps gradually and to track the progress of the learning outcome. Numerous studies were found to adopt one – time activity that only targeted specific food safety outcome, rather than a few outcomes that assimilate to each other. Hence, this research aims to develop food poisoning educational module that helps to improve the consumers' knowledge, attitude and risk perceptions.

2.8 Conclusion to literature discussion

The literature review above clearly highlights a few elements that influence consumer food poisoning preventive behavior and how food safety intervention is crucial in promoting the food safety behavioral change. Hence, it summarized from the literature discussion that the development of food poisoning prevention educational module is part of the effort to improve consumers' knowledge, attitude, and risk perception towards food poisoning prevention. To achieve this purpose, a systematic module that encompasses objective – oriented activities enables the consumers to learn effectively and in a fun way. The 'See, Select, Tell' module was developed systematically by adhering to SIM model

and this module can be an alternative to health educators and community leaders to advocate safe food consumption for food away from home.