ORIGINAL ARTICLE

Development and Validation of a Web-based Module for Preschool Child-parent Dyads: the Weight-related Behaviour Intervention Programme

Ahmad Faezi Ab Rashid[1,2], Sharifah Wajihah Wafa Syed Saadun Tarek Wafa[1], Ruzita Abd Talib[3], Nor Mazlina Abu Bakar[4]

[1] School of Nutrition and Dietetics, Faculty of Health Sciences, Universiti Sultan Zainal Abidin, 21300 Kuala Nerus, Terengganu, Malaysia.
[2] Wellness Entrepreneurship Programme, Faculty of Hospitality, Tourism, and Wellness, Universiti Malaysia Kelantan, 16100 Kota Bharu, Kelantan, Malaysia.
[3] Nutrition Science Programme, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, 50300 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur, Malaysia.
[4] School of Management Sciences, Faculty of Business and Management, Universiti Sultan Zainal Abidin, 21300 Kuala Nerus, Terengganu, Malaysia.

ABSTRACT

Introduction: Despite a growing number of online health intervention programmes, the development and validation processes of the web-based module for use in the intervention programmes from the perspective of health professionals and parents (end-users) have rarely been reported. This study aims to develop and validate a web-based Interactive Malaysian Childhood Healthy Lifestyle (*i-MaCHeL*) module for preschool child-parent dyads. **Materials and methods:** This study is a cross-sectional study that consists of two stages. The development and validation processes of this study were guided by the five-phase ADDIE model. Stage 1 consists of four phases: analysis, design, development, and implementation of the web-based module. Stage 2 consists of an evaluation phase that involves the content and face validity of the web-based module by health professionals (n=5) and parents (n=42), respectively. The content and face validity of the web-based module were measured based on the value of the content validity index (CVI) and face validity index (FVI). The S-CVI (scale-level content validity index) and S-FVI (scale-level face validity index) were used to analyse the validity of the web-based module. **Results:** The validated web-based module consists of 13 topics related to the weight-related behaviour of preschool children. The calculated S-CVI (range from 0.9 to 1.0) and S-FVI (range from 0.98 to 1.0) were above the acceptable value of 0.80, indicating that the web-based module has excellent and acceptable scores for both content and face validity. **Conclusion:** The web-based module was deemed validated and suitable to be delivered to the preschool child-parent dyads.
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Keywords: Child-parent dyads, Web-based module, Weight-related behaviour, Content validity, Face validity

Corresponding Author:
Sharifah Wajihah Wafa Syed Saadun Tarek Wafa, PhD
Email: sharifahwajihah@unisza.edu.my
Tel : +60126911510

INTRODUCTION

Poor nutritional status in children is a subject matter of priority worldwide. In Malaysia, the National Health and Morbidity Surveys (NHMS) 2019 indicated that the prevalence of thinness, overweight, and obesity among children and adolescents were 10%, 15%, and 14.8%, respectively (1). The data demonstrated that overweight and obesity coexist with thinness in children and adolescents. Early childhood is an opportune time to establish new behaviours that could influence lifetime effects on preventing non-communicable diseases (2). Poor dietary intake and insufficient physical activity increase the risk of undesirable effects and various non-communicable diseases associated with over-nutrition, including obesity (3). Many studies describe the adverse effects of unhealthy eating and sedentary behaviours on poor nutritional status among children (4, 5). Considering the high likelihood of becoming obese in adulthood (3), there is a strong rationale for designing a weight-related behaviour intervention tailored for preschool children and their parents.

The family and home environment are recognised as a strong influence on the weight-related behaviours of children (6). Therefore, partnerships with parents to promote weight-related behaviour changes in children may have a lifelong impact on their weight-related outcomes. Besides that, obesity prevention is likely to

have optimal effects if started in early childhood with parental involvement, as young children are generally guided by parents in their dietary intake and physical activity levels (7). Previous systematic reviews indicated that targeting children and their parents in weight-related behaviour change programmes that combined diet and physical activity were effective in altering unhealthy lifestyle behaviours among preschool-aged children (6, 7). The weight-related behaviour components, particularly dietary intake and physical activity, have a high potential to influence active living, reducing sedentary behaviour, consumption of healthy foods, and weight status of children (4).

It is well established that targeting both children and their parents in weight-related behaviour intervention produces more significant impacts (6). However, to sustain engagement among them is a considerable challenge (8). The Web-based intervention programmes that targeted multifactorial weight-related behaviours (physical activity, sedentary behaviour, and dietary intake) and included both children and their parents might hold promise in reducing childhood obesity risk (6). Previous studies on parent-focused web-based intervention programmes demonstrated improvements in the diet and physical activity of the children (9, 10). In addition, the weight-related behaviour change programme in children that combined healthy lifestyle components (diet and physical activity) and the web-based element had favourable intervention effects (11-13). To date, however, there are limited web-based intervention programmes targeting multifactorial weight-related behaviours (physical activity, sedentary behaviour, and dietary intake) for preschool children that include parents (6, 11, 14). Thus, effective weight-related behaviour change programmes using the web-based approach, corresponding to the evidence-based national guidelines, are urgently needed to reverse the obesity epidemic, particularly in Malaysia.

In recent years, the application of Information and Communication Technologies (ICT) in the development of weight-related behaviour intervention has been rising (12, 14). Many studies demonstrated that the utilisation of online and web-based modules in weight-related behaviour interventions were feasible and effective in improving weight-related outcomes (9, 13, 15, 16). In addition, providing online and web-based educational material in the weight-related intervention programme offered an effective method to improve the intervention process of the programme (10). The online and web-based educational modules provide flexibility of pacing for participants to access and complete the module independently using a variety of electronic devices (smartphones, tablets, and laptops) at their convenience time and anywhere (17). Furthermore, the online and web-based modules provide more advantages than the print modules as they can provide materials and activities in the form of infographics, pictures, videos, electronic texts, and interactive quizzes.

To date, web- and internet-based modalities have been an increasing interest and promising approach in the health-promoting intervention programme involving child-parent dyads (14). The online approach might hold the most promise in enhancing the efficacy of the intervention and participants' adherence to the weight-related intervention programme (17). Despite the rising popularity of employing web-based technology to promote healthy behaviours among child-parent dyads (14), there remains a notable gap in the validation process of the information provided in the web-based intervention programme. In addition, evidence to support the content validity and face validity of the web-based module targeting preschool child-parent dyads is limited, especially in Malaysia. The content and face validation are useful to improve the understandability, legibility, and quality of the information in the intervention module (18). Moreover, undergoing content and face validation processes are essential to ensure the intervention module is reliable, relevant, and acceptable to the target group (19).

Despite a growing number of online and web-based weight-related behaviour interventions, the development and validation processes of the web-based module for use in the intervention programmes from the perspective of health professionals and parents (end-users) have rarely been reported. Therefore, the present study aims to develop and validate a web-based Interactive Malaysian Childhood Healthy Lifestyle (*i-MaCHeL*) module to be used in the *i-MaCHeL* intervention programme. The *i-MaCHeL* is a 3-month web-based programme developed to promote healthy weight-related behaviour in reducing the risk of malnutrition in children. The *i-MaCHeL* also educates parents to shape home lifestyles for optimal child growth and development. Besides that, the *i-MaCHeL* employed multifactorial weight-related behaviours (dietary intake, physical activity, and sedentary behaviour) to improve children's body weight, physical activity, diet, and social home environment. The *i-MaCHeL* comprises of the website, social media, interactive activities, and theory-based behavioural change components. A detailed description of the intervention development and components of the *i-MaCHeL* was described elsewhere (20). In the present study, the content validity index (CVI) and face validity index (FVI) were used to prove that the information in the web-based *i-MaCHeL* module was valid and relevant for preschool child-parent dyads (18). The CVI and FVI were useful in expressing the proposition of agreement on the relevancy of measured indicators among health professionals and parents (end-users) (19, 21). Furthermore, the suggestions and recommendations provided by the health professionals and parents were used to improve the content of the web-based module.

Objectives

In general, this study aims to develop a web-based weight-related behaviour module to be used in the *i-MaCHeL* intervention programme. The specific objectives of this study are (1) to develop the web-based *i-MaCHeL* module in accordance with the ADDIE model, (2) to assess the content validity of the web-based *i-MaCHeL* module among health professionals, and (3) to evaluate the face validity of the web-based *i-MaCHeL* module among parents of preschool children.

MATERIALS AND METHODS

Research design

This research involved a cross-sectional design that consists of two stages. The development and validation processes of the web-based module were guided by the five-phase ADDIE model (Analysis-Design-Development-Implementation-Evaluation). Stage 1 (web-based module development) consists of four phases: analysis, design, development, and implementation of the web-based module (stage 1). Stage 2 (content validity and face validity) consists of an evaluation phase that involves the content validity and face validity of the web-based module by health professionals (n = 5) and parents (n = 42), respectively. In the present study, the five-phase ADDIE model was accordingly represented as follows: 1. The analysis phase refers to the analysis of the learning needs of target learners; 2. The design phase refers to the process of planning and structuring the web-based *i-MaCHeL* module; 3. The development phase refers to the process of producing the web-based *i-MaCHeL* module; 4. The implementation phase refers to the process of delivering the final product of the web-based *i-MaCHeL* module in a small-scale trial, and; 5. The evaluation phase refers to the process of analysing the validity of the web-based *i-MaCHeL* module. The Universiti Sultan Zainal Abidin Human Research Ethics Committee, Malaysia, issued ethical approval prior to this study (Ref. No: UniSZA/UHREC/2020/184).

Stage 1: Web-based module development

Analysis phase

In the analysis phase, document analysis was conducted to determine the needs and suitability of the web-based *i-MaCHeL* module for preschool child-parent dyads. Document analysis was performed on the national nutrition guidelines and health education curricula used in government preschools to identify the key messages and components that should be incorporated into the newly developed web-based *i-MaCHeL* module. The national standards that served as primary references for the implementation of the weight-related programme in Malaysia were analysed to determine the components and content of the web-based intervention module. In this study, the national standards that were referred to are: (1) The Third National Plan of Action for Nutrition of Malaysia, 2016-2025 (NPANM III) (22); (2) Malaysian Dietary Guidelines for Children and Adolescents 2013 (MDGCA 2013) (23), and; (3) National Preschool Curriculum Standard 2017 (NPCS 2017) (24).

The Third National Plan of Action for Nutrition of Malaysia, 2016-2025 (NPANM III) is a 10-year master plan (covering the period of 2016 to 2025) for addressing nutrition challenges in Malaysia. The implementation of healthy eating and active living promotion at the national level have been identified as effective strategies in reducing nutritional deficiencies and diet-related non-communicable diseases in Malaysia. The NPANM III specifically highlighted the role of preschools as a platform to reach both parents and children in promoting healthy lifestyle behaviours. Various activities related to parental involvement in promoting healthy eating, developing teaching materials (e.g., interactive and educational games), and providing a healthy menu in preschool have been suggested as having a direct impact on improving the nutritional status and physical activity of preschool children under the NPANM III (22).

The Malaysian Dietary Guidelines for Children and Adolescents 2013 (MDGCA 2013) is an evidence-based dietary recommendation established for children and adolescents (aged 0 to 18 years) that was critically developed by multidisciplinary health professionals in nutrition, public health, paediatric health, and psychology (23). The development of the MDGCA 2013 was aligned with the recommendation by NPANM III to prevent nutrition-related diseases. The MDGCA 2013 is a compilation of 15 key messages covering the whole range of food and nutrition issues related to children and adolescents. The MDGCA 2013 provided recommendations on consuming a variety of foods in specific food groups, attaining a healthy weight, and achieving active physical activity for children and adolescents in Malaysia. In addition, the guideline highlighted the use of settings such as nurseries, kindergartens, preschools, and schools in planning nutrition-related programmes for children (23). However, the existing educational modules developed by the Ministry of Health Malaysia and local studies mostly focused on changes in dietary intake and habits targeting older children and adolescents (25-27). Thus, there is a need for an educational module that focuses on weight-related behaviour, specifically for preschool-aged children and their parents, in accordance with the evidence-based MDGCA 2013 national guidelines and recommendations for children to overcome poor nutritional status among children.

The National Preschool Curriculum Standard 2017 (NPCS 2017) (24) is an educational programme standard that serves as the primary teaching and learning handbook that guides preschool teachers in delivering curriculum and co-curricular activities for preschool children. The NPCS 2017 emphasised the importance of the child's physical development and body fitness

for personal well-being. The awareness of practising healthy lifestyle behaviours through balanced diets and active physical activities in early childhood education was also incorporated in the NPCS 2017. The analysis of preschool curriculum guidelines was conducted to ensure that the newly developed web-based intervention module followed the current recommendations for the nutrition and physical activity of preschool children in Malaysia.

Design phase

The design phase involved the process of determining, specifying, and structuring the web-based *i-MaCHeL* module. In the design phase, topic themes and sequence, specific learning objectives, exact contents, online activities, flowcharts, and storyboards of the web-based *i-MaCHeL* module were determined and prepared. The topic themes were primarily designed following the key messages in the MDGCA 2013, which focused on healthy foods, fruit and vegetable intakes, healthy drinks, reducing fast food intake, increasing physical activity, and reducing sedentary behaviour. The content of the web-based *i-MaCHeL* module was also aligned with the NPANM III. Besides that, previous randomised controlled trial studies related to the diet and physical activity programmes implemented in the preschool children and parent population were analysed to ensure the themes, course contents, and activities of the web-based *i-MaCHeL* module included the essential components of effective weight-related behaviour intervention (28, 29). The web-based *i-MaCHeL* module consists of the following topics: *"1. Introduction to the i-MaCHeL Programme; 2. Parents as Agents of Change; 3. Healthy Weight; 4. My Healthy Plate; 5. Active Physical Activity; 6. Sedentary Lifestyle; 7. Vegetables and Fruit; 8. Whole Grains; 9. Foods High in Protein; 10. Drinking Milk; 11. Fat, Do Not Eat Too Much; 12. Beware of Sugar and Salt in Foods, and; 13. Refresh Yourself with Plain Water".* Each topic consists of several components arranged in the topic, beginning with the introduction section (preface, objective, instruction, and table of content), followed by the content section, and ending with the activity section.

Development phase

The development phase involved the process of developing and producing the web-based *i-MaCHeL* module. In this phase, educational webpages, infographics, pictures, videos, and interactive activities were created (29). The information provided in the web-based *i-MaCHeL* module was ensured to be engaging, realistic, attractive, concise, and interactive by using stylish infographics and educational videos to entice users to stay focused. In this phase, the learning digital media such as infographics, pictures, videos, and electronic texts were created using various software and Web-based 2.0 platforms. The infographics were created using Piktochart, and the educational videos were created using Powtoon. The texts and figures were created and edited using Adobe Photoshop and Microsoft PowerPoint.

After the web-based *i-MaCHeL* module was produced, five health professionals were appointed to validate the content of the module. For this purpose, a purposive sample of five health professionals was appointed to evaluate the content validity of the web-based intervention module. The purposive sampling technique was used to select the health professionals based on their knowledge and familiarity with a particular field (30). The health professionals were selected based on the following criteria: 1. Had a senior position in theMinistry of Health Malaysia (MOH) and public universities, and; 2. Had at least ten years of experience in the nutrition field. In the present study, three senior lecturers holding doctorate degrees in nutrition from different public universities and two senior nutrition officers from the Nutrition Department of MOH were appointed to validate the content validity of the web-based *i-MaCHeL* module.

The health professionals were given four weeks to review and evaluate the module. In addition, a consensus meeting was conducted with the health professionals to verify that the web-based *i-MaCHeL* module was relevant, easy to understand, helpful, essential, clear, and engaging. Besides that, in the consensus meeting, the health professionals were asked about the latest knowledge, essential topics, techniques, approaches, and best practices that need to be incorporated into the web-based *i-MaCHeL* module. Information about the current nutritional status, questions that parents tend to ask about the nutrition and physical activity of their children, and potential challenges were also acquired from the health professionals (29). Feedback and suggestions for enhancements, deletions, or additions of the modules were also solicited (31). All comments and recommendations for revision were taken into consideration.

Implementation phase

The implementation phase involved the process of delivering the web-based *i-MaCHeL* module into the small-scale trial. For this purpose, a total of 42 preschool child-parent dyads were recruited. Given that this was a small-scale study and not hypothesis testing, no formal sample size calculation was conducted. In this study, parents of preschool children were recruited from government preschools in Terengganu, Malaysia. Six preschools were randomly selected at the preschool level using the cluster random sampling technique. The eligibility criteria of the participants were in accordance with the main cluster-RCT study (20). Informed consent was acquired from parents prior to the commencement of the study. The participants were given the right to refuse or not to participate in the study. The child-parent dyads were asked to complete all 13 topics over three months (one topic per week) from 5 September

to 4 December 2021. Before the start of the 3-month trial, sociodemographic information, such as ethnicity, child's sex, parents' age, education level, working status, marital status, and household income, was obtained from the parents. In the trial, the parents were given face validity questionnaire related to the relevancy, difficulty, helpfulness, and essentiality of every topic in the web-based *i-MaCHeL* module. The questionnaire was administered online through *Google Forms* upon completion of each topic. Participant recruitment and data collection for this trial were conducted between June and December 2021.

Stage 2: Content validity and face validity

Evaluation phase
The evaluation phase involved the process of analysing data on the content validity and face validity of the web-based *i-MaCHeL* module. In the present study, the content validity data obtained from health professionals (n = 5) were analysed using the content validity index (CVI) (30, 32). The face validity data obtained from the parents (n = 42) were analysed by using the face validity index (FVI) (21). The face validity was determined based on the views of the nonprofessional users (general public) who actually use the module, which cannot be replaced by professionals, health professionals, or psychometricians (21). The CVI and FVI were calculated to measure the level of agreement among health professionals and parents, respectively.

In this study, content validity and face validity refer to the degree in which health professionals and parents view the web-based *i-MaCHeL* module based on the following criteria: relevancy, difficulty, helpfulness, and essentiality (30, 32). In this study, similar questionnaire items and responses were administered for both content validity and face validity assessments. The questionnaires consist of the following four inquiries: 1) how relevant is the information; 2) how easy or difficult is the wording; 3) How helpful is the information, and; 4) how necessary is the information. At the end of the validation rating of each topic, the parents were asked to provide general comments and suggestions. Content validity testing and face validity testing were performed using a 4-point Likert scale (32, 33). The response for the relevancy item was: 1 = not relevant, 2 = somewhat relevant, 3=quite relevant, and 4 = very relevant. The response for the difficulty item was: 1 = difficult, 2 = a little easy, 3 = mostly easy, and 4 = very easy. The response for the helpfulness item was: 1 = not helpful, 2 = a little helpful, 3 = mostly helpful, and 4 = very helpful. The response for the essentiality item was: 1 = not essential, 2 = somewhat essential, 3 = quite essential, and 4 = very essential. Ratings of 1 and 2 were considered content invalid, while ratings of 3 and 4 were considered content valid.

Statistical Analysis

The 4-point Likert scale of the CVI and FVI was divided into two groups. Ratings of 1 and 2 were considered the group of "not agreed item", while ratings of 3 and 4 were considered the group of "agreed item" (34, 35). The empirical technique method was used to calculate the values of CVI and FVI. The CVI value was computed using the I-CVI (item-level content validity index) and the S-CVI/Ave (scale-level content validity index based on the average validity index) and the S-CVI/Ave (scale-level content validity index based on the average S-FVI/Ave (scale-level face validity index based on the average method) (21). The values for CVI and FVI range from 0 to 1.0. A higher score for CVI and FVI indicates greater agreement among evaluators or raters. The values of I-CVI and I-FVI were calculated by adding the items rated 3 or 4 (agreed item) and dividing the sum by the total number of responses in the item's evaluation (34). The S-FVI/Ave was calculated by taking the sum of the I-FVI score and dividing it by the total number of items. Similarly, S-CVI/Ave was calculated by dividing the sum of the I-CVI score by the total number of items (33, 35). Polit et al. (2007) (32) proposed that the index must be at least 0.78 to indicate a good validity index when there are three or more panels involved, whereas Davis (1992) (36) and Rubio et al. (2003) (37) recommended the index of 0.80 or above for new measures. Therefore, aligned with other module validation studies (25, 38), the content validity index (CVI) and face validity index (FVI) measures of at least 0.80 and above were considered acceptable for the web-based *i-MaCHeL* module. If the score was less than the acceptable value, the aspect of the particular topic was revised accordingly based on the recommendations given.

RESULTS

Web-based module development
The web-based *i-MaCHeL* module comprises 13 topics related to healthy eating, active physical activity, and sedentary behaviour of preschool-aged children. Various weight-related educational information, infographics, informative videos, relevant pictures, and interactive parent-child activities were included in the web-based *i-MaCHeL* module. The health professionals agreed that the 13 topics of the web-based module were relevant, easy to understand, helpful, and essential to the preschool child-parent dyads. The comments and suggestions for improvement were obtained from the health professionals to supplement the quantitative data. Overall, based on the comments and suggestions of the health professionals, the web-based *i-MaCHeL* module required no major corrections. The proposed improvements submitted by the health professionals were as follows: 1. The Malay translation should be standardised in all topics; 2. The videos shared from the

YouTube channel should be from credible, trusted, and valid sources recognised by the Nutrition Division of MOH; 3. The module should provide more examples of healthy foods commonly available in and taken by the local community, for example, local fruits (papaya and banana) and fishes (*kembung* and *selar*); 4. The Malaysian food pyramid and growth cart of the BMI-for-age should use the updated Malay version provided by MOH; 5. Rearrange the topics sequence according to the updated version of the Malaysia Food Pyramid (2020), and; 6. Online activities in the web-based *i-MaCHeL* module should be developed using established web 2.0 tools such as *Padlet* and *Quizizz*. Further amendments and modifications of the web-based *i-MaCHeL* module based on the comments provided by the health professionals were made accordingly.

Apart from that, positive feedback was acquired from the health professional members. They agreed that the web-based *i-MaCHeL* module was complete and relevant to the preschool child-parent dyads. The development of the module was aligned with the recommendation by the NPANM III to empower parents and caregivers to provide healthier food choices for their children. The newly developed module also aligned with the healthy eating promotion activities targeted at preschools with parent involvement as recommended by the NPANM III. In addition, the health professionals agreed that the content of the web-based *i-MaCHeL* module was in accordance with the essential key messages in the MDGCA 2013. Table I summarises the topic themes, learning objectives, contents, and activities of the web-based *i-MaCHeL* module.

Table I: Topics in the web-based *i-MaCHeL* module.

Topics	Learning objectives	Contents	Activities
Topic 1: Introduction to the *i-MaCHeL* Programme	To introduce the *i-MaCHeL* programme.	1. Overview of the *i-MaCHeL* programme; 2. Programme objectives; 3. Goal setting and contracting, readiness to change, and; 4. Tips for healthy eating.	1. Share barriers/challenges to changing the unhealthy lifestyles of children (online activity); 2. Determine the level of readiness to change unhealthy dietary intakes and sedentary habits of children (online activity).
Topic 2: Parents as Agents of Change	To educate parents to be role models for their children.	1. Effective methods to educate children; 2. Role of parents in planning healthy eating with children; 3. Role of parents in planning physical activities with children, and; 4. Tips for parents to be role models for children related to a healthy lifestyle.	Share a picture of a healthy lifestyle activity parents do with their children (online activity).
Topic 3: Healthy Weight	To explain the need of ensuring normal growth and weight for children's health.	1. The importance of monitoring children's growth and development; 2. Health risks if children's growth and development are affected; 3. How to determine children's weight, height, and BMI status, and; 4. Weight management tips for overweight or obese children.	Calculate BMI of children using an online BMI calculator.
Topic 4: My Healthy Plate	To explain the need of consuming food in a balanced, moderate, and varied for children.	1. Overview of the Malaysian Food Pyramid; 2. How to choose healthy food based on the recommendations of the Malaysian Food Pyramid; 3. How to provide meals based on the Malaysian Healthy Plate, and; 4. How to determine the number of serving and portion size of food for children.	Share a picture of a healthy plate (Malaysian Healthy Plate) that parents served to their children (online activity).
Topic 5: Active Physical Activity	To explain the need of keeping children to be physically active daily.	1. The importance of being physically active for children;2. How to encourage children to be active every day; 3. Types of moderate- and high-intensity activities for children, and; 4. Tips to stay active with children at home.	Complete an online quiz (memory game) to identify active physical activities (child-parent activity)
Topic 6: Sedentary Lifestyle	To explain the need of reducing sedentary activity for children.	1. The importance of limiting sedentary behaviour in children; 2. Adverse effects of prolonged use of screen-based media devices for children, and; 3. How to reduce the use of screen-based media devices in children.	Complete an online quiz (multiple-choice answers) to identify sedentary behaviour (child-parent activity)
Topic 7: Vegetables and Fruits	To explain the need of eating a variety of fruits and vegetables for children's health.	1. The importance of eating vegetables and fruits every day; 2. Daily serving size of vegetables and fruits recommended for children; 3. How to provide a variety of vegetables and fruits for children every day, and; 4. Tips to get children to eat vegetables.	1. Complete an online quiz (matching column game) to identify fruits and vegetables (child-parent activity); 2. Monitor the fruits and vegetables intake of children using healthy eating sticker book.
Topic 8: Whole Grains	To explain the need of eating whole grains for children's health.	1. The importance of whole grains for health and disease prevention; 2. Daily serving size of rice and cereal products recommended for children; 3. How to provide high-fiber wholegrain food for children, and; 4. Tips to provide a simple and nutritious breakfast.	1. Share a picture of healthy breakfast (whole grain-based food) that parents serve to their children; 2. Completes an online quiz (multiple choice answer) to identify cereal-based food (child-parent activity).

CONTINUE

Table I: Topics in the web-based *i-MaCHeL* module. (CONT.)

Topics	Learning objectives	Contents	Activities
Topic 9: Foods High in Protein	To explain the need of eating fish, meat, chicken, eggs, and legumes for children's health.	1. Source of food high in protein; the function of protein for body health; 2. Health risks of protein deficiency for children; 3. Daily serving size of high-protein food recommended for children; 4. How to encourage children to consume moderate amounts of fish and legumes, and; 5. How to provide healthy high-protein food for children.	1. Complete an online quiz (memory game) to identify high-protein food (child-parent activity); 2. Monitor high-protein food intake of children using healthy eating sticker book.
Topic 10: Drinking Milk	To explain the need of consuming adequate milk and dairy products for children's health.	1. Nutrient content in milk and dairy products that are essential for children's health; 2. Health risks of low intake of milk and milk-based products; 3. Daily serving size of milk and dairy products recommended for children, and; 4. How to provide milk creatively for children.	1. Complete an online quiz (matching column game) to identify milk-based food (child-parent activity); 2. Monitor the milk intake of children using healthy eating sticker book.
Topic 11: Fat, Do Not Eat Too Much!	To explain the need of eating low-fat food for children's health.	1. The function of fat for body health; 2. Source of food high in fat; 3. Health risks of high intake of high-fat food for children; 4. How to provide low-fat food for children, and; 5. Tips to reduce oil in cooking.	1. Share a picture of modified dish that parents serve to their children to reduce the fat content (online activity); 2. Complete an online quiz (memory game) to identify food high in fat (child-parent activity).
Topic 12: Beware of Sugar and Salt in Foods!	To explain the need of consuming food low in sugar and salt for children's health.	1. Health risks of high intake of food high in sugar and salt; 2. How to provide low-sugar food and beverages for children; 3. How to provide less-salt food for children, and; 4. Source of food with hidden salt.	Complete an online quiz (multiple-choice answers) to identify food high in sugar and salt (child-parent activity).
Topic 13: Refresh Yourself with Plain Water	To explain the need of drinking plenty of plain water for children's health.	1. The importance of drinking adequate plain water for health; 2. Health risks of water deficiency for children, and; 3. How to encourage the consumption of plain water for children.	1. Complete an online puzzle game (child-parent activity); 2. Monitor the water intake of children using healthy eating sticker book.

Content validity

Table II shows the content validity index (CVI) analysis for the web-based *i-MaCHeL* module. For the relevancy item, all topics achieved the I-CVI of 1.0, indicating an excellent level of agreement among the health professionals. For the difficulty item, all topics received scores of 1.0 for the I-CVI, except for topic 1 (Introduction to the i-MaCHeL Programme) and topic 11 (Fat, Do Not Eat Too Much!), which obtained the I-CVI of 0.80. For the difficulty item, all topics received scores of 1.0 for I-CVI, except for topic 1 (Introduction to the *i-MaCHeL* Programme) and topic 11 (Fat, Do Not Eat Too Much!), which obtained the I-CVI of 0.80. For the helpfulness item, all topics received scores of 1.0 for I-CVI, except for topic 10 (Drinking Milk) and topic 11 (Fat, Do Not Eat Too Much!), which obtained the I-CVI of 0.80. For the essentiality item, all topics received scores of 1.0 for I-CVI, except for topic 8 (Whole Grains), which obtained the I-CVI of 0.8. Overall, the S-CVI (average I-CVI) scores for all topics ranged from 0.9 to 1.0, indicating that the web-based *i-MaCHeL* module had excellent content validity (36).

Table II: Content Validity Index (CVI) of the web-based *i-MaCHeL* module by health professionals (= 5).

No	Topic themes	Relevancy item		Difficulty item		Helpfulness item		Essentiality item		S-CVI/ Ave [b]
		No. agreed item	I-CVI [a]	No. agreed item	I-CVI	No. agreed item	I-CVI	No. agreed item	I-CVI	
1	Introduction to the *i-MaCHeL* Programme	5	1.00	4	0.80	5	1.00	5	1.00	0.95
2	Parents as Agents of Change	5	1.00	5	1.00	5	1.00	5	1.00	1.00
3	Healthy Weight	5	1.00	5	1.00	5	1.00	5	1.00	1.00
4	My Healthy Plate	5	1.00	5	1.00	5	1.00	5	1.00	1.00
5	Active Physical Activity	5	1.00	5	1.00	5	1.00	5	1.00	1.00
6	Sedentary Lifestyle	5	1.00	5	1.00	5	1.00	5	1.00	1.00
7	Vegetables and Fruits	5	1.00	5	1.00	5	1.00	5	1.00	1.00
8	Whole Grains	5	1.00	5	1.00	5	1.00	4	0.80	0.95
9	Foods High in Protein	5	1.00	5	1.00	5	1.0	5	1.00	1.00
10	Drinking Milk	5	1.00	5	1.00	4	0.80	5	1.00	0.95
11	Fat, Do Not Eat Too Much!	5	1.00	4	0.80	4	0.80	5	1.00	0.90
12	Beware of Sugar and Salt in Foods!	5	1.00	5	1.00	5	1.00	5	1.00	1.00
13	Refresh Yourself with Plain Water	5	1.00	5	1.00	5	1.00	5	1.00	1.00

[a] I-CVI (item-level content validity index): the value was calculated by adding the items rated 3 or 4 (agreed item) and divided by the total number of responses in the item's evaluation.
[b] S-CVI/Ave (scale-level content validity index based on the average method): the value was calculated by taking the sum of the I-CVI scores and dividing by the total number of items.

Demographic information

Table III provides details of the demographic characteristics of study participants involved in the small-scale trial. A total of 42 parents were involved in this trial, with the majority of participating parents aged between 30 to 39 years old, females, Malays, married, had less than five children aged under 18 years, had an education level of some college or higher, had a low monthly household income (less than RM 4,850), mothers were housewives, and fathers worked in the private sector.

Table III: Demographic characteristics of participating parents (= 42).

Characteristic	(%)
Participating parent's gender	
Male	4 (9.5)
Female	38 (90.5)
Participating parent's age	
29 years old or younger	4 (9.5)
30 to 39 years old	31 (73.8)
40 to 49 years old	7 (16.7)
Race, n (%)	
Malay	42 (100)
Family marital status	
Married	41 (97.6)
Divorced	1 (2.4)
Mother's highest level of education	
Less than high school	1 (2.4)
High school graduate	18 (42.9)
Some colleges or higher	23 (54.7)
Father's highest level of education	
Less than high school	2 (4.8)
High school graduate	19 (45.2)
Some colleges or higher	21 (50.0)
Mother's occupation	
Self-employed	1 (2.4)
Private sector	4 (9.5)
Government sector	12 (28.6)
Not working	25 (59.5)
Father's occupation	
Self-employed	10 (23.8)
Private sector	20 (47.6)
Government sector	12 (28.6)
Monthly household income (Ringgit Malaysia)	
Low (less than RM 4,850)	26 (61.9)
Middle (RM 4,850 to RM 10,959)	14 (33.3)
High (RM 10,960 or more)	2 (4.8)
Number of children aged under 18 years	
< 5	39 (92.9)
≥ 5	3 (7.1)

Face validity

Table IV indicates the face validity index (FVI) analysis for the web-based *i-MaCHeL* module. The value of I-FVI for all subscale items (relevancy, difficulty, helpfulness, and essentiality) was > 0.95, indicating an excellent level of agreement among the parents. Overall, the S-FVI (average I-FVI) scores for all topics ranged from 0.98 to 1.0, indicating that the web-based *i-MaCHeL* module had excellent face validity. In addition, based on the comments provided, the parents agreed that the content of the web-based *i-MaCHeL* module was easy to understand, well-organised, helpful, and interesting. No major issue was reported. Furthermore, upon completion of the face validity measures, Cronbach's alpha was also performed to test the internal consistency of the items in each topic (30). The overall Cronbach's α value was 0.78, indicating that the items used in the validation instrument had acceptable reliability (α > 0.70) (39).

Table IV: Face Validity Index (FVI) of the web-based *i-MaCHeL* module by parents (*n* = 42).

No	Topic themes	Relevancy item		Difficulty item		Helpfulness item		Essentiality item		S-FVI/ Ave [b]
		No. agreed item	I-FVI [a]	No. agreed item	I-FVI	No. agreed item	I-FVI	No. agreed item	I-FVI	
1	Introduction to the *i-MaCHeL* Programme	42	1.00	42	1.00	42	1.00	42	1.00	1.00
2	Parents as Agents of Change	41	0.98	41	0.98	42	1.00	42	1.00	1.00
3	Healthy Weight	42	1.00	42	1.00	41	0.98	42	1.00	1.00
4	My Healthy Plate	42	1.00	41	0.98	42	1.00	42	1.00	1.00
5	Active Physical Activity	42	1.00	40	0.95	42	1.00	42	1.00	0.99
6	Sedentary Lifestyle	41	0.98	41	0.98	41	0.98	42	1.00	0.99
7	Vegetables and Fruits	42	1.00	42	1.00	42	1.00	42	1.00	1.00
8	Whole Grains	42	1.00	41	0.98	42	1.00	41	0.98	0.99
9	Foods High in Protein	42	1.00	41	0.98	42	1.00	42	1.00	1.00
10	Drinking Milk	41	0.98	40	0.95	42	1.00	42	1.00	0.98
11	Fat, Do Not Eat Too Much!	42	1.00	42	1.00	42	1.00	42	1.00	1.00

CONTINUE

Table IV: Face Validity Index (FVI) of the web-based *i-MaCHeL* module by parents (*n* = 42). (CONT.)

No	Topic themes	Relevancy item		Difficulty item		Helpfulness item		Essentiality item		S-FVI/ Ave [b]
		No. agreed item	I-FVI [a]	No. agreed item	I-FVI	No. agreed item	I-FVI	No. agreed item	I-FVI	
12	Beware of Sugar and Salt in Foods!	42	1.00	41	0.98	41	0.98	42	1.00	0.99
13	Refresh Yourself with Plain Water	42	1.00	42	1.00	42	1.00	42	1.00	1.00

[a] I-FVI (item-level face validity index): the value was calculated by adding the items rated 3 or 4 (agreed item) and divided by the total number of responses in the item's evaluation.
[b] S-FVI/Ave (scale-level face validity index based on the average method): the value was calculated by taking the sum of the I-FVI scores and dividing by the total number of items.

DISCUSSION

The ADDIE is a well-known instructional design model that has been widely used as a framework for developing effective, relatable, and interactive educational programmes. Numerous studies have successfully developed efficient teaching and training courses (40), online modules (30), multimedia products (41), and technology-based programmes (42) based on the ADDIE model. The ADDIE model provides a systematic, iterative process for determining training needs, designing instructional programmes and materials, implementing them, and evaluating their effectiveness (43). In addition, the ADDIE model provides rapid prototyping by receiving continual feedback on each phase. The multi-phase approach of the ADDIE model is interconnecting and interrelating; however, it does not impose a strictly linear progression through the steps. This approach was systematic and thorough, yet relatively simple, with having stages clearly defined to facilitate the development of effective programmes (44). Each phase of the ADDIE model offers dynamic and flexible guidelines that can be adapted to various forms of product development (45). The non-linear design of the ADDIE model allows researchers to make changes to improve the quality of instructional tools built for each phase (46).

In the present study, the five-phase ADDIE model was used as a framework to plan, develop, and evaluate the web-based *i-MaCHeL* module for preschool child-parent dyads. Multiple phases of research activities were employed in the study to ensure the web-based *i-MaCHeL* module was responsive to the wants and needs of the preschool child-parent dyads. The ADDIE model was applied to ensure the newly developed web-based intervention module was comprehensible, engaging, and potentially effective in promoting healthy lifestyle behaviours among preschool child-parent dyads. This study systematically developed the web-based *i-MaCHeL* module following scientific procedures of the five-phase ADDIE model. The web-based intervention module was designed to encourage healthy lifestyle behaviours among preschool child-parent dyads. The information and contents of the module corresponded with the Third National Plan of Action for Nutrition of Malaysia, 2016-2025 (NPANM III) framework and recommendations provided by the Malaysian Dietary Guidelines for Children and Adolescents 2013 (MDGCA 2013) to strengthen the role of parents in improving the dietary intake and physical activity of their children. In addition, the health professionals were consulted extensively throughout the design and development process of the web-based *i-MaCHeL* module. The content and topics of the web-based intervention module were further refined in accordance with the comments and feedback by the health professionals and parents to ensure the best lifestyle practices were targeted in the web-based *i-MaCHeL* module.

Previous studies demonstrated that content validity and face validity had successfully been used to prove the validity and relevancy of the information provided in the intervention modules (18, 19, 47). The present study employed effective development and validation processes of the web-based *i-MaCHeL* module involving both health professionals and parents (end-users). Establishing content validity and face validity are essential steps in producing more scientifically effective and high-quality weight-related intervention modules (25). The content and face validation of the web-based *i-MaCHeL* module involves judgment by health professionals and parents (end-users) as to whether the module includes relevant and appropriate content (48). The web-based *i-MaCHeL* module had gone through an adjustment process based on the suggestions by health professionals and parents until the validated final version was reached. The recommendations provided by the health professionals and parents during content and face validation processes successfully improved the quality of the web-based *i-MaCHeL* module.

The content validity and face validity of the web-based *i-MaCHeL* module were measured based on the content validity index (CVI) and face validity index (FVI) calculations. The CVI and FVI are quantitative approaches commonly used to determine the validity of newly developed intervention modules. The CVI was reported using the item-level content validity index (I-CVI) and scale-level content validity index (S-CVI), while the FVI was calculated using the item-level face validity index (I-FVI) and scale-level face validity index (S-FVI). The I-CVI and I-FVI measure the content validity of individual items, while the S-CVI and S-FVI calculate the overall scale validity (21, 35). A higher score for CVI and FVI indicates greater agreement among evaluators or raters. The web-based *i-MaCHeL* module was reviewed by five health professionals and 42 parents, and the module was then refined based on the comments provided. Based on the findings, the calculated I-CVI and S-CVI were above the acceptable value of 0.80, showing that the web-based *i-MaCHeL* module had good and acceptable content validity among the

health professional group. In addition, the face validity assessment among parents indicated that the I-FVI and S-FVI were over the acceptable value of 0.80, showing that the web-based *i-MaCHeL* module had excellent and acceptable face validity. Thus, CVI and FVI scores confirmed the content validity and face validity of the web-based intervention module. The web-based *i-MaCHeL* module was deemed validated and suitable to be delivered to the target population (preschool child-parent dyads). Therefore, the present study successfully developed a validated web-based module to be used in the *i-MaCHeL* intervention programme. The web-based *i-MaCHeL* module was designed with an innovative approach to deliver a weight-related behaviour change programme for preschool child-parent dyads. The web-based *i-MaCHeL* module focused on the multifactorial weight-related behaviour components by targeting healthy eating, active physical activity, and sedentary behaviour of preschool children. The parents' engagement in the intervention programme was believed to play a significant role in shaping the home environment and influencing the children's dietary behaviours and active physical activity. Moreover, it is well understood that distributing intervention materials online increases the accessibility and availability of the information to be utilised by the participants (9, 17).

This study provided strong content-related validity evidence by verifying each topic based on the relevancy, difficulty, helpfulness, and essentiality criteria. Furthermore, this study considered both the content validity and face validity involving health professionals and parents in the validation process. The study also successfully demonstrated that the CVI and FVI had the potential to be effective methods in calculating the validity of web-based intervention module. Reporting the range of I-CVI and I-FVI values, as well as the methods used to calculate the S-CVI and S-FVI, were the strengths of this study. However, this study also had limitations. This study was developed in Malay language only as the language served as the national language and was used as a medium of instruction in government preschools. Translating the web-based *i-MaCHeL* module into English and other languages commonly used in Malaysia will minimise language barriers for preschools with different mediums of instruction. Even though the web-based *i-MaCHeL* module has undergone proper development and validation processes, it is not being applied in the definitive *i-MaCHeL* intervention programme to statistically evaluate the effectiveness of the web-based intervention module.

CONCLUSION

The development of the web-based *i-MaCHeL* module successfully followed the scientific procedures of the ADDIE model. The development process could provide guidance and opportunities for other researchers to use the ADDIE model as an alternative method in developing web-based intervention modules. The web-based *i-MaCHeL* module had acceptable values of the CVI and FVI. Hence, the web-based module was appropriate to be used in the definitive cluster-RCT *i-MaCHeL* intervention programme to assess the efficacy of the programme in promoting healthy weight-related behaviour among preschool child-parent dyads. In the cluster-RCT study, we hypothesised that improvement trends in children's BMI z-score, health-related quality of life, dietary intake, physical activity, screen time duration, parental role modelling, parental policies, and parental self-efficacy at 3- and 9-month post-baseline would be observed (20). The essential components of the web-based intervention module are believed to be potentially effective in reducing childhood malnutrition risk, especially in Malaysia.

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