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Interactive Nutrition Education Courseware for Children's Health Awareness in Malaysia

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ABSTRACT: This study presents the development and evaluation of an interactive courseware designed for children's nutrition education in Malaysia. The courseware aims to enhance the awareness of parents, guardians, and kindergarten teachers regarding the nutritional needs of children under six years old. This research employed the ADDIE model to develop a comprehensive, user-friendly, and engaging courseware as a learning tool. Data were collected through a quantitative method using online questionnaires distributed to 20 respondents consisting of parents, guardians, and kindergarten teachers. The findings indicated positive responses, with 85% of respondents agreeing that the courseware is attractive, easy to use, and informative. These results suggest that such courseware has the potential to effectively facilitate understanding and increase knowledge about children's nutritional needs.

KEYWORDS: Interactive nutrition education; courseware; children's health; technology-enhanced learning

1. Introduction

Nutrition education is an important component in promoting healthy dietary habits and improving overall health outcomes. Over the past five years, extensive research has explored the effectiveness of nutrition education interventions and their impact on different demographic groups, including athletes, children, and healthcare professionals [1–4]. In the context of early childhood, community-based nutrition education has shown promising results [5]. This highlights the potential of targeted nutrition education programs in addressing undernutrition and promoting healthy growth in young children. Nutrition education in schools also plays a significant role in fostering healthy eating habits. Such programs often involve a combination of health awareness, communication, and skill-building strategies that emphasize environmental and behavioral factors [6]. The integration of nutrition education into school curricula can contribute to improved physical and mental development, leading to better academic performance and long-term health outcomes [7, 8].

There is also growing recognition of the need to strengthen nutrition education in the training of healthcare professionals. Many healthcare providers still lack adequate training in nutrition and physical activity counselling. Therefore, establishing standardized competencies is essential to equip future healthcare professionals with the necessary skills to provide effective nutrition care [9]. Nutrition education remains a field where continuous research and innovation are necessary to address the diverse needs of different populations. By leveraging evidence-based strategies, nutrition education can significantly contribute to improving public health outcomes. Therefore, this study investigates and reports the development process of an interactive nutrition education courseware for parents and guardians of children under six years old in Malaysia.

2. Related Work

2.1. Challenges in Malaysia.

Malaysia faces two main challenges related to children's nutrition: stunting and obesity. Stunting is characterized by low height-for-age and affects approximately 20.7% of children under five years old. Additionally, 11.5% of children in the same age group suffer from wasting (low weight-for-height). Among children aged five to nineteen years, about 12.7% are classified as obese [10]. These conditions are influenced by several factors, including changes in the food environment, food advertising, and shifting dietary trends. Poverty also plays a significant role, particularly in urban areas such as Kuala Lumpur.

Technology specifically designed for children's nutrition education in Malaysia remains limited. The World Health Organization reported that 17.7% of Malaysian children and adolescents aged five to nineteen years exhibit stunted growth [11, 12]. The National Health and Morbidity Survey conducted by the Malaysian Paediatric Association revealed an increase in stunting from 17% in 2006 to 20.7% in 2016, while the proportion of underweight children increased from 12.9% to 13.7% during the same period [11, 13]. Moreover, the Malaysian Child Nutrition Study (SEANUTS Malaysia) found that one in three Malaysian families lack essential nutrients such as vitamin C, iron, and calcium. These statistics highlight the serious issue of child malnutrition currently faced in Malaysia [13, 14].

2.2. Nutrition education courseware.

Various forms of online education, such as massive open online courses (MOOCs), web-based instruction, and computer-based tools, have emerged as effective methods for disseminating nutrition knowledge. This section reviews recent studies that evaluate the effectiveness, implementation, and outcomes of digital nutrition education platforms.

2.2.1. Online-based platforms.

A randomized trial compared the effectiveness of online and in-person nutrition education among participants in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) [15]. The study found that both approaches were effective in increasing breakfast-related knowledge and reducing breakfast skipping. Notably, the online group showed greater improvements in breakfast frequency among both parents and children. An online course designed for clinicians provided a strong foundation of clinically relevant

nutrition knowledge and practical strategies for nutritional counseling. The course included more than 100 key references, immersive clinical scenarios, and downloadable summaries, effectively enhancing clinicians' nutrition knowledge and counseling skills [16].

An internet-based resource for individuals with pre-diabetes and type 2 diabetes showed significant improvements in participants' ability to identify foods that affect blood glucose levels. This resource, tested among a multi-ethnic population in New Zealand, demonstrated effectiveness in promoting healthier dietary and lifestyle choices [17]. Similarly, a study involving pre-service physical education students reported high interest and improved learning outcomes in nutrition science through e-learning approaches [18]. Research on synchronous online delivery for graduate clinical nutrition students found significant benefits in terms of interactivity, connectedness, and enhanced learning outcomes compared to asynchronous formats. This mode of delivery also supported the development of professional competency in clinical nutrition [19]. Online courses for healthcare professionals related to nutrition education have also received positive feedback, indicating their potential to improve professionals' ability to integrate nutrition counseling into clinical practice [20]. In addition, an online nutrition course for medical residents demonstrated significant and sustained improvements in nutrition knowledge as well as more positive attitudes toward the role of nutrition in clinical practice [21]. Web-based instruction has also been used as a self-study tool in basic food nutrition courses. One study developed an online lesson titled "Vitamins and Health," incorporating visual and dynamic features to enhance comprehension. Students were required to collaboratively complete web-based assignments and participate in online discussions [22].

Several studies have shown that face-to-face and online nutrition courses produce no significant differences in knowledge gain, suggesting that online nutrition education can be as effective as traditional classroom learning [23]. Supporting this finding, another study evaluating the immediate impact of web-based tailored nutrition education reported significant differences in awareness and intentions to change dietary behaviors between intervention and control groups [24]. MOOCs have become a popular platform for delivering nutrition education to a global audience. One study highlighted how registered dietitians utilize MOOCs to provide nutrition-related educational opportunities [25]. Another study evaluated a nutrition-focused MOOC using Kirkpatrick's model and reported positive participant reactions, increased perceived vegetable intake, and significant peer-to-peer learning among participants [26].

2.2.2. Application-based and computer-based platforms.

Mobile applications have also been developed to support nutrition education. One Android-based application was designed to simplify the process of calculating nutritional needs and arranging appropriate dietary patterns. The application received high usability scores and demonstrated its feasibility as an effective nutrition education tool [27]. A pilot study conducted during the COVID-19 pandemic assessed the feasibility of remote nutrition education for adolescents with Autism Spectrum Disorder. The program reported high attendance rates and positive feedback from participants, parents, and educators [28].

A controlled trial evaluated the impact of a computer-based nutrition course for general practitioner trainees and found significant improvements in both factual knowledge and clinical practice behavior among trainees who received computer-based instruction compared with those following standard vocational training programs [29]. Similarly, a computer-based teaching tool developed for primary school children was found to be as effective as traditional

teaching materials in improving nutrition knowledge. However, the study indicated that younger pupils benefited more from the computer-based tool [30]. A systematic review of postsecondary online nutrition education courses revealed that students can acquire knowledge as effectively through online learning as through face-to-face instruction, although levels of student satisfaction and motivation may vary [31]. Collectively, these studies demonstrate the effectiveness of various digital platforms in delivering nutrition education.

3. Research Methodology

3.1. Research design.

The ADDIE model was adopted as the research design framework because of its suitability for developing educational courseware and achieving the objectives of this study. The ADDIE model consists of five phases: analysis, design, development, implementation, and evaluation. This systematic approach ensures that the courseware is designed based on users' needs and evaluated for its effectiveness.

3.2. Analysis phase.

The analysis phase is essential for identifying existing problems and determining appropriate solutions. In this phase, several techniques were applied, including needs analysis, job analysis, and task analysis. The analysis also considered factors such as the learning environment, possible constraints, delivery options, and the timeline for the courseware development project. The main issues identified were the limited awareness among parents, guardians, and kindergarten teachers regarding children's nutritional needs and the lack of educational tools that address this issue. Therefore, the courseware was designed to target parents, guardians, and kindergarten teachers, with the objective of improving their understanding of children's nutrition. The usability of the courseware was later tested among these groups to ensure its effectiveness and user-friendliness.

3.3. Design phase.

The output of the analysis phase was translated into flowcharts and conceptual structures for the courseware. The design phase focused on constructing the courseware framework based on these outputs. This phase included the preparation of detailed storyboards and prototypes that specify the graphical user interface, navigation structure, and content layout of the courseware.

3.4. Development phase.

During the development phase, the courseware was created based on the previously designed prototype. Various multimedia elements, including text, graphics, audio, video, and animation, were integrated to enhance user engagement and learning effectiveness. The courseware was developed using Adobe Captivate 2019.

3.5. Implementation phase.

The implementation phase involved testing the courseware to ensure that it functioned properly and met the intended objectives. In this phase, the courseware was piloted with a group of target users. Necessary adjustments were made based on their feedback. Continuous testing during

the design and development stages helped identify and resolve potential issues early in the process. The pilot evaluation involved 20 respondents consisting of parents, guardians, and kindergarten teachers. Their feedback was used to assess the effectiveness, usability, and overall acceptance of the courseware.

4. Proposed Courseware

This section presents the proposed design of the courseware, as illustrated in Figure 1. The design emphasizes simplicity and user engagement, ensuring that the courseware is easy to navigate and visually appealing. The screen flow for the Nutrition Education for Children courseware guides users through several sections, including the home screen, category pages, and detailed nutrition information pages. The storyboard provides a visual representation of the courseware structure by outlining the layout and content of each screen (Figure 2). This process ensures that the courseware is well organized and aligned with the intended educational objectives.

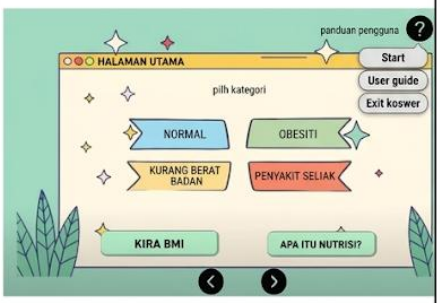
Screen Display	Description
	This main view displays the title This main display has buttons • "Start" to enter the main page • "User guide" for koswer usage guide • "Exit koswer" to exit koswer
	This page is the main page which has a button: • "NORMAL" to go to the NORMAL category page • "OBESITY" to go to the OBESITY category page • "LOSE WEIGHT" to go to the WEIGHT LOSS category page • "CELIAC DISEASE" to go to the CELIAC DISEASE category page • "User guide" for koswer usage guide • "Exit koswer" to exit koswer • "Next" for the next page • "Previous" for the previous page
	This page is a NORMAL category page where it explains the nutritional requirements for normal BMI children. This page has a button: • "WHAT IS NUTRITION" to go to the NUTRITION page • "User guide" for koswer usage guide • "Exit koswer" to exit koswer • "Next" for the next page • "Previous" for the previous page • "Home Page" to go to the home page

Figure 1. Courseware screen display

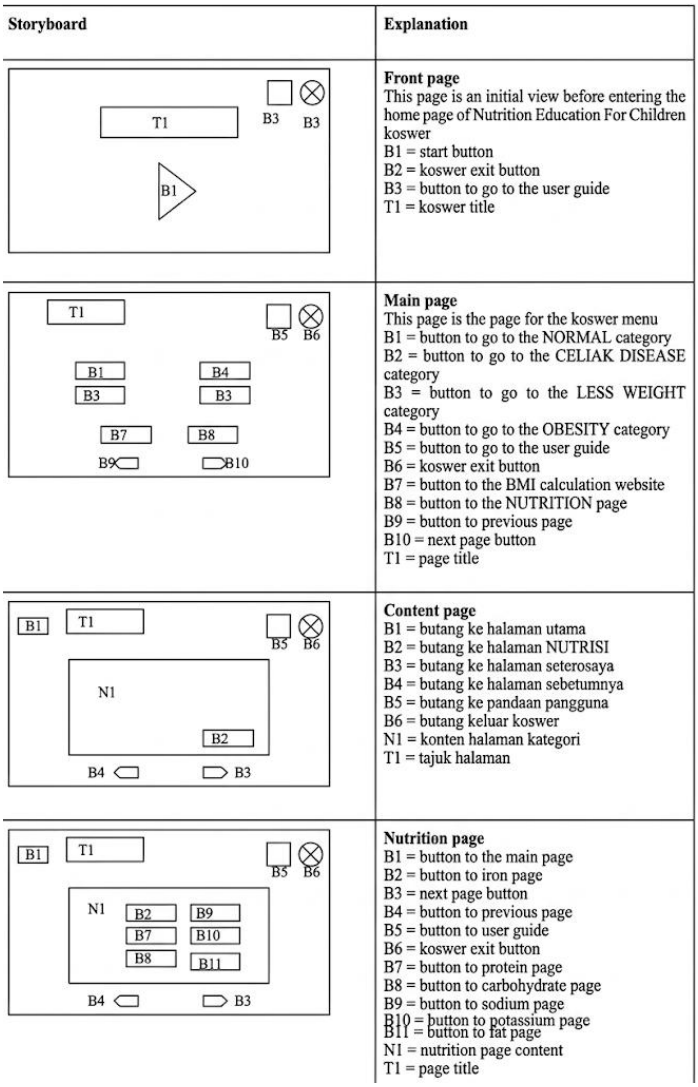


Figure 2. Courseware stroyboard.

5. Results and Analysis

This section presents the analysis of data collected from respondents regarding the effectiveness and usability of the Nutrition Education Courseware for Children. Data were collected using an online questionnaire distributed through Google Forms. The questionnaire was designed to evaluate several aspects of the courseware, including design, usability, and content quality. The responses were analyzed to provide insights into users' perceptions and experiences when interacting with the courseware. The evaluation involved 20 respondents consisting of parents, guardians, and kindergarten teachers. Respondents were asked to rate their level of agreement with several statements using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The following subsections present the demographic characteristics of the respondents and the evaluation results related to courseware usability.

5.1. Data analysis.

The demographic profile of the respondents was first analyzed to understand the background of participants involved in the evaluation process. The gender distribution of respondents is presented in Table 1. Table I shows that the majority of respondents were female. Out of 20 respondents, 17 were female (85%), while only 3 were male (15%). This indicates that female

respondents were more involved in the evaluation of the courseware. The ethnic background of the respondents is presented in Table 2. The data indicate that all respondents participating in this study were of Malay ethnicity.

Table 1. Gender of respondents.

Gender	Frequency (n)	Percentage (%)
Male	3	15%
Female	17	85%
Total	20	100%

Table 2. Ethnicity of respondents.

Ethnicity	Frequency (n)	Percentage (%)
Malay	20	100%
Chinese	0	0%
Indian	0	0%
Total	20	100%

5.2. Evaluation of courseware usability.

The usability and effectiveness of the developed nutrition education courseware were evaluated through a structured user assessment. The evaluation aimed to examine three key aspects of the system: (1) multimedia and design elements, (2) awareness-raising potential and ease of use, and (3) the clarity and organization of the learning content. A total of 20 respondents participated in the evaluation and assessed the system using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This evaluation was conducted to determine whether the courseware provides an engaging learning environment, supports knowledge acquisition related to children's nutrition education, and presents information in a clear and accessible manner for users.

5.2.1. Multimedia and design elements.

The evaluation results related to multimedia and design features are presented in Table 3. Overall, respondents expressed very positive perceptions regarding the visual and technical components of the courseware. Most participants strongly agreed that the courseware presents an attractive interface design and that the text size is appropriate and easy to read, indicating that the system effectively supports readability and visual comfort for users. Similarly, the majority of respondents strongly agreed that the graphics and icons used in the courseware are suitable and easy to understand, suggesting that the visual elements successfully support the learning process by helping users navigate the system and interpret information. Visual clarity and intuitive icon design are particularly important for educational applications targeting children, as they facilitate comprehension and reduce cognitive load during learning. A small proportion of respondents selected a neutral response regarding certain multimedia aspects, particularly the use of colors (10%) and the selection of background music and sound effects (5%). Although these neutral responses do not indicate dissatisfaction, they suggest that user preferences for aesthetic and auditory elements may vary. Nevertheless, no respondents expressed disagreement with any of the statements, highlighting the overall positive reception of the multimedia design.

Table 3. Use of multimedia elements.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The courseware uses an attractive design.	0	0	0	3	17
The text size is appropriate and readable.	0	0	0	3	17
The graphics used in the courseware are suitable and attractive.	0	0	1	2	17
The use of colors in the courseware is suitable and attractive.	0	0	2	2	16
The icons used in the courseware are easy to understand.	0	0	1	2	17
The selection of music and sounds is attractive.	0	0	1	2	17

5.2.2. Raising awareness and ease of use.

The effectiveness of the courseware in improving users' understanding of children's nutrition education and its overall usability is presented in Table 4. The results demonstrate that the system achieved strong educational and usability outcomes. A large majority of respondents (85% strongly agree) reported that the courseware increased their knowledge about children's nutrition education. This finding suggests that the learning materials and instructional design embedded within the courseware successfully convey important nutritional information and enhance user awareness of healthy dietary practices for children. In addition to its educational benefits, the system was also perceived as easy to learn and operate. Most respondents strongly agreed that they required only a short time to master the courseware, indicating that the interface and navigation structure are intuitive. Furthermore, 85% of respondents strongly agreed that the courseware is user-friendly, particularly for children, highlighting its suitability for the intended target audience.

Table 4. Importance of courseware in raising awareness.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The courseware increases my knowledge about children's nutrition education.	0	0	0	3	17
I needed only a short time to master the courseware.	0	0	1	2	17
The courseware is user-friendly, especially for children.	0	0	0	3	17

5.2.3. Content organization and clarity.

The respondents' perceptions regarding the structure, clarity, and usefulness of the educational content are summarized in Table 5. The results indicate a high level of satisfaction with the way information is presented within the courseware. Most participants strongly agreed that the information is well-structured and systematically organized, suggesting that the courseware successfully presents learning materials in a logical sequence that facilitates comprehension. Clear organization is essential in educational software, as it helps learners follow the instructional flow and locate relevant information efficiently. Additionally, respondents strongly agreed that the information is easy to read and understand, indicating that the language used in the courseware is appropriate for the target audience. The clarity of language is particularly important for children's educational applications, where complex terminology can hinder understanding. Importantly, the majority of respondents also strongly agreed that the courseware helps society better understand the importance of children's nutrition education. This finding highlights the broader educational impact of the system, suggesting that the courseware has the potential to contribute not only to individual learning but also to public

awareness regarding child nutrition. Only a small percentage of respondents (5%) selected a neutral response regarding the organization of the content, and no negative responses were recorded. Overall, these findings demonstrate that the courseware provides clear, accessible, and well-structured educational information, supporting its effectiveness as a digital learning tool for nutrition education.

Table 5. Respondent perceptions of courseware content.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The information in the courseware is well-structured and organized.	0	0	1	2	17
The information is easy to read.	0	0	0	3	17
The information helps society understand children's nutrition education.	0	0	0	3	17
The language used in the courseware is clear and easy to understand.	0	0	0	3	17

4. Conclusions

This study successfully developed and evaluated an interactive courseware designed to enhance nutrition education for parents, guardians, and kindergarten teachers responsible for children under six years old. The usability evaluation involving 20 respondents demonstrated overwhelmingly positive perceptions across multiple dimensions, including multimedia design, usability, and content clarity. Most participants strongly agreed that the courseware features an attractive interface, appropriate text readability, and visually appealing graphics and icons. These multimedia elements contributed to creating an engaging and user-friendly learning environment that supports effective knowledge delivery. The findings also indicate that the courseware effectively increases users' understanding of children's nutrition education. A large majority of respondents reported that the system was easy to learn and could be mastered within a short time, confirming its accessibility and suitability for the intended audience. In addition, the educational content was perceived as well-structured, clearly written, and easy to understand. Respondents also recognized the courseware as a useful tool for raising public awareness about the importance of proper nutrition for young children. Overall, the results highlight the strong potential of this courseware as a digital educational resource that can support early childhood nutrition awareness. Future work should focus on expanding the content to include additional nutritional information, such as dietary requirements for children with allergies or specific health conditions. Furthermore, incorporating more interactive elements, including quizzes and educational games, could further enhance user engagement and reinforce learning outcomes. Longitudinal studies are also recommended to evaluate the long-term impact of the courseware on users' knowledge retention and behavioral changes related to children's nutrition practices.

Competing Interest

The authors declare that there are no competing interests regarding the publication of this paper.

Author Contributions

All authors contributed equally to the conceptualization, design, development, data collection, analysis, and writing of this manuscript.

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