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Developing and pre-testing of nutrition cartoon video to promote healthy eating among hearing and deaf and mute children

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ABSTRACT

Introduction: A six-minute nutrition cartoon video "The Magical *Pinggang Pinoy* in *Nutrilandia*" was developed and pre-tested to encourage hearing and deaf and mute children to eat a variety of foods by following the *Pinggang Pinoy*® (Healthy Plate). This study described the development process of the nutrition cartoon video and explored the participants' acceptance towards it. **Methods:** The video underwent two levels of pre-testing to ensure comprehensibility, attractiveness, acceptability, and self-involvement. The first level was conducted among three DOST-FNRI experts, while the second level was among six deaf-mute school teachers and 30 mothers/ caregivers of 6-9 years old hearing children. Data were collected through an online self-administered questionnaire. Open-ended questions allowed participants to express themselves freely on the given subjects. Data analysis used thematic analysis. **Results:** The video conveyed clear information on the *Pinggang Pinoy*®, and the inclusion of animation, subtitles, visuals, and voice-over made the video easier to understand. Participants stated that the message of the video was directed to children, teens, adults, malnourished people, and everyone in general. Pre-testing the nutrition cartoon video before final production identified terminologies and concepts that participants found unfamiliar, confusing and unacceptable; offered suggestions for improvement and made pre-tested video appropriate for hearing and deaf-mute children. **Conclusion**: Overall, the participants had positive perceptions on the nutrition cartoon video. The video can be used in nutrition education classes among hearing and deaf and mute children, and serves as a tool to measure children's nutrition knowledge on healthy eating.

Keywords: cartoon video, healthy eating, hearing and deaf and mute children, nutrition education, pre-testing

INTRODUCTION

Nutrition education is any combination of educational strategies, accompanied by environmental support, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviours conducive to health and well-being (Contento, 2007). Thus, nutrition education programme can be developed for early childhood education

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centres (Kim & Kim, 2014). Young children face rapid development like cognitive and physical developments. Therefore, good nutrition at this stage is essential for good health, growth and development.

Nutrition education uses various strategies and approaches. One such approach uses information, education, and communication (IEC) as a tool to empower people to make decisions, modify behaviours, and change social conditions. The IEC channels include interpersonal communication, such as individual or group discussions, and community meetings and events, or mass media communication like radio, television and other forms of one-way communication, such as brochures, leaflets and posters, visual and audio-visual presentations, and some forms of electronic communication.

The Department of Science and Technology-Food and Nutrition Research Institute (DOST-FNRI) develops IEC materials as educational intervention to help change or reinforce nutrition-related behaviours among specific target audiences. This is because eating abilities and needs of children are dependent on their cognitive and social development in the first few years of life (Tremblay *et al.*, 2013). These IEC materials serve as strategic tools in helping to achieve one of DOST-FNRI's mandates, which is to diffuse knowledge and technologies in food and nutrition, and provide science and technology services to stakeholders.

A new food and nutrition IEC initiative of the Institute is the nutrition cartoon "*Ang Mahiwagang Pinggang Pinoy ng Nutrilandia*" that encourages hearing and deaf and mute children to eat a variety of foods by following the *Pinggang Pinoy*® (Healthy Plate). Cartoon shows for children are generally recommended by psychology experts. Martzoukou (2020) suggests exposing children to interactive cartoon-based activities to help them further explore and understand their perspectives about certain subjects.

Deaf and mute children are visual learners (Rosal & Echaure, 2021). The inclusion of sign-language interpretation in a cartoon video will help deaf and mute children to understand the lesson it conveys. Communication technologies, such as cartoon videos, can aid and accelerate the adoption of health education initiatives that are long-lasting, accessible, and effective to deaf and mute children (Abbasi *et al.*, 2017). Thus, both hearing and deaf and mute children can benefit from an educational cartoon video. Likewise, addressing nutritional problems among deaf and mute children early on with the aid of correct nutrition IEC strategies is encouraged.

The digital age has enabled easier access to cartoons using social media platforms. In an exploratory study by Khalid, Meerah & Halim in 2010, more than 70% of respondents had positive views on the use of cartoons in teaching and learning. Cartoons can be used as a low-cost and feasible educational tool to overcome the barriers of communication efforts among teachers and parents of deaf children (Doichinova & Peneva, 2013).

The COVID-19 pandemic has escalated the practice of blended learning or use of information and communication (ICT) in education worldwide (Bordoloi, Das & Das, 2021). ICT is a vital facet in promoting progress in the language experience of students with hearing impairments "without being dependent on the spoken words and by adopting specialised tools used either in the classroom or at a distance" (Bouzid & Jemni, 2017), such as digital video. Puspaningtyas & Ulfa (2021) mentioned that students' motivation and creative thinking abilities are enhanced through animated video in blended learning.

Health education videos with local languages were found effective in improving knowledge, attitudes, and practice of health among areas least attended by health services (Mutanda, Waiswa & Namutamba, 2016). Thus, the use of video as a learning instrument may facilitate the development of new behaviours (Tuong *et al.*, 2014). Cartoons packaged in video format with health and nutrition messages may provide an option for blended learning. Therefore, the appropriateness of cartoons as an IEC material should be established first by determining its acceptance, perception, attitude, intention, and behaviour among educators (Ibili & Sahin, 2016).

Pre-testing measures the effectiveness of common media and an important step in materials development. It allows the evaluation of messages and materials as to acceptability and potential impact before large amounts of resources are used in production and distribution. It also ensures that materials are effective, comprehensible, and persuasive (Francisco, Manlulu & Vargas, 2021).

The present study was undertaken to describe the development process of the nutrition cartoon video, explore the participants' acceptance of the nutrition cartoon video, and identify recommendations of study participants for the nutrition cartoon video through pre-testing to be more effective to its target audience.

MATERIALS AND METHODS

This was a descriptive study that discussed the development and pre-testing of a nutrition cartoon video to promote healthy eating among hearing and deaf and mute children.

Development process of the nutrition cartoon video

Nutrition educators developed the storyboard of the video in Filipino. The storyboard was based on the concept of healthy plate for Filipinos or *Pinggang Pinoy*®. *Pinggang Pinoy*® is an easy-to-understand food guide using a familiar food plate model to convey the right food group proportions on a per-meal basis to meet the body's energy and nutrient needs of adults. The storyboard of the video was reviewed by experts in the field of nutrition education and communication for accuracy of technical content. Upon approval of the storyboard, the team met with the contracted video developer to discuss the storyboard. The nutrition cartoon video underwent two levels of pre-testing to ensure that the video had good comprehensibility, attractiveness, acceptability, and self-involvement. The first level of pre-testing was done among three DOST-FNRI experts for review of technical content, while the second level was among six teachers from a deaf-mute school and 30 mothers and caregivers of 6-9 years old hearing children. Revisions were made to the video before it was pre-tested for the second level.

The nutrition cartoon video *Ang Mahiwagang Pinggang Pinoy ng Nutrilandia* encourages children to eat a variety of foods by following the *Pinggang Pinoy*® (Healthy Plate). It is six minutes in length featuring the fictional story of siblings, Akiles and Arya and their journey to *Nutrilandia*. The unique thing about the video is that it is intended for hearing and non-hearing children. The video includes an inset showing a deaf and mute translator who acted as the sign language interpreter.

Pre-testing of nutrition cartoon

The video was pre-tested among intended audience to determine whether they understood the content of the video and accepted the video before its final production.

In this study, participants were selected through purposive, snowball

sampling technique, utilising an existing list of mothers and caregivers who attended the DOST-FNRI food and nutrition training. The pre-testing was conducted among mothers of normal, hearing children aged 6-9 years old. The experts involved in the pre-testing were teachers from a deaf-mute school in the Philippines.

Pre-testing participants were recruited by sending letter of invitation via email. Interested participants were assessed based on the inclusion criteria, namely mother or caregiver and teacher with a child aged 6 to 12 years old, can read and write, can answer Google form, and with internet access. A total of 30 mothers and caregivers and six (6) experts from one of the deaf-mute institutions in the Philippines joined the study.

The instrument used in this study was a pre-tested self-administered questionnaire on attractiveness, comprehensibility, acceptability, and self-involvement that was administered online. The online questionnaire was derived from a previously developed questionnaire for pre-testing IEC materials and converted into online format in Google form. Prior to the use of the online self-administered questionnaire, a trial was conducted among selected DOST-FNRI staffs to check the comprehensibility and layout of the questionnaire in Google form. The self-administered questionnaire included instructions to first watch the nutrition cartoon video before accomplishing the online questionnaire, and informed consent and confidentially. The questionnaire included the following items: three (3) for comprehensibility; six (6) for attractiveness; four (4) for acceptability; three (3) for self-involvement, and one (1) for overall impression of the video. The open-ended questions allowed study participants to express themselves freely on the given subject.

The researcher checked thoroughly the accomplished Google form to ensure completeness of responses of the study participants. After accomplishing the online questionnaire, the study participants received PHP 300.00 (6 USD) as a token of appreciation for joining the study.

Responses from the open-ended questions were automatically recorded through Google form, and the matrices of data were prepared. Thematic analysis (TA) was used to present the results. TA (Braun & Clarke, 2006) is an accessible, flexible, and increasingly popular method of qualitative data analysis. Six steps of TA, as suggested by Braun and Clarke (2006) were adopted as follows: (1) familiarisation with the data; (2) generating initial codes; (3) searching for themes; (4) reviewing the themes; (5) defining and naming the themes; and (6) producing the report.

Ethical consideration

Prior to pre-testing of the nutrition cartoon, the questionnaire and informed consent form used for IEC materials were approved by the FNRI Institutional Ethics Review Committee. Information regarding the pre-testing's objectives, type of research intervention, participant selection, voluntary participation, procedure, duration, risks and benefits, reimbursements, confidentiality, sharing of results, right to refuse or withdraw, and contact details were included in the Informed Consent Form. Participants signed the consent forms and were assured of the confidentiality of information collected in the study.

RESULTS

The DOST-FNRI's six-minute nutrition cartoon "*Ang Mahiwagang Pinggang*

Pinoy ng Nutrilandia" centred on the characters of Akiles and Arya – siblings who went on a dream adventure to the *Nutrilandia* kingdom where the magical *Pinggang Pinoy* originated. However, upon their arrival, the siblings found that the people under the cruel rule of *Haring Amon* became malnourished due to inadequate food intake. The magical *Pinggang Pinoy* used to be the kingdom's food guide until *Haring Amon* destroyed it and hid the pieces in several places in the kingdom. Their mission was to find the missing pieces of *Pinggang Pinoy* in *Nutrilandia*.

The video is intended for children aged 6-9 years old, but the pre-testing was done among mothers or caregivers of 6-9 years old hearing children. The respondents in this study composed of six (6) female sign language experts from the Philippine School for the Deaf (PSD). Their ages ranged between 26-56 years old. A total of 30 mothers and caregivers from a mix of rural and urban areas were also involved in this study. Their ages ranged between 22-61 years old, consisting of two males and 28 females.

The comprehensibility, attractiveness, acceptability, and self-involvement of the IEC material were evaluated, and statements provided from the online self-administered questionnaire on each aspect can be found in Tables 1-5.

A. Perceived comprehensibility of the video

The video is comprehensible when the message is clearly understood.

A total of four (4) sign language experts and ten (10) mothers and caregivers said that the nutrition cartoon was about *Pinggang Pinoy*®. Participants also stated that the video was about Go, Grow and Glow foods, nutrition awareness, importance of eating nutritious foods to achieve a healthy body and mind, and nutrition messages and moral lessons for kids.

On the other hand, three (3) of the sign language experts said that they did not find words or sentences difficult to understand. Three (3) experts found that the sign language interpreter's emotion was sometimes not synchronised with the animation of the video, that was why they found it hard to understand the dialogues. About twenty-seven (27) mothers and caregivers said that they did not find words or sentences difficult

Table 1. Perceptions of sign language experts, mothers and caregivers on the comprehensibility of the nutrition cartoon video

Pre-testing aspect	*Theme*	*Sub theme*
Comprehensibility	What is the video all about?	The story is about *Pinggang Pinoy*
		The story is about Go, Grow, Glow
		The story serves as a guide in eating nutritious foods to achieve healthy body and mind
		The story is about the food pyramid
		Nutrition messages and or moral lesson
	Words or sentences difficult to understand in the video	Sign language sentence construction
		The words and sentences should depend upon the age of the targeted population
	Unfamiliar words or sentences in the video	The term *Pinggang Pinoy*®
		The word *magpahilan,* which means not to sleep with a full stomach so he or she will not get indigestion

Table 2. Perceptions of sign language experts, mothers and caregivers on the attractiveness of the nutrition cartoon video

Pre-testing aspect	*Theme*	*Sub theme*
Attractiveness	Things that caught your attention in this video	Beautiful illustrations and animation
		Attractive colours of the characters
		Beautiful sign language interpretation
		Lesson of the story
		Sounds and voice over
		Title of the video
		The term *Pinggang Pinoy*®
		Characters in the story
		The use of Filipino language
		Its educational value
	Reason/s for liking the appearance of the video	Attractive visuals and illustrations
		Catchy colours of the settings and characters
		Lesson of the story
		Sign language interpreter
		Awesome animation and voice over
	Reason/s for disliking the appearance of the video	Unnatural movements of the characters
		Not enough space allotted for the sign language interpreter
		The sign language interpreter covered an image in the video
		The sign language interpreter lacks emotion
		The lack of background music

to understand. Only two (2) mothers/caregivers mentioned that *Pinggang Pinoy*® was difficult to understand. One (1) respondent commented that words and sentences should depend on the age of the targeted population.

A total of five (5) sign language experts did not find unfamiliar words or sentences. Only one expert said that he was not familiar with the Filipino word *magpahilan,* which means not to sleep with a full stomach so he or she will not get indigestion. One respondent from mothers and caregivers stated that she was not familiar with *Pinggang Pinoy*® and *magpahilan.*

B. Perceived attractiveness of the video

The video is attractive when the message is interesting enough to attract and hold the attention of the target audience.

Among the sign language experts, two (2) stated that the first thing that caught their attention was the illustration, one (1) stated colours, and two (2) stated sign language interpreter. However, one (1) specified that the sign language interpreter who was positioned on the lower right corner was not lively.

Among mothers and caregivers, seven (7) stated that the first thing that caught their attention was the story or the lesson, then six (6) stated colours,

Table 3. Perceptions of sign language experts, mothers and caregivers on the acceptability of the nutrition cartoon video

Pre-testing aspect	*Theme*	*Sub-theme*
Acceptability	Offensive feature(s) in the video	Not properly interpreted words by the sign language interpreter
		Some disagreeable actions like throwing of plates and allowing the son to sleep with a full stomach
		Some parts might be too deep for kids
	Confusing section(s) in the video	Some sign language used are incorrect
		The transition of the video from one story to another
		The implication of breaking the *Pinggang Pinoy*® into four parts
		The connection between nightmares and eating with a full stomach
	Unbelievable section(s) in the video	The sign language interpreter's expression for "angry"
		The nightmare and being in a fictional world
	Suggestions to make the video more acceptable to watch	To review the sign languages used
		Adjustment on the size of the sign language interpreter
		Needs improvement on the transition of the story and emotions of the sign language interpreter
		Needs improvement on some colours and the voice of the boy
		Some concept in the story may not be suitable for younger children
		Add subtitles

five (5) specified illustration, and three (3) for animation. Some mentioned that the sounds and voice-over, title, the word *Pinggang Pinoy*®, characters, the use of the Filipino language, and its educational value also caught their attention.

The sign language experts said that they liked the illustration, colours, sign language interpreter, lesson of the story, voice-over, and animation. The mothers and caregivers also liked the illustration, colours, story and lesson, sounds and voice-over, characters, attractiveness, and that it suited all ages.

The four (4) experts mentioned that they disliked the sign language interpreter. The sign language interpreter did not express the emotions appropriately, signs were incomplete, and that some parts of the image in the video were covered. Additionally, the characters should have natural movements.

A total of twenty-five (25) mothers and teachers said that there was nothing in the video that they disliked. Three (3) participants said that they disliked the video because it lacked background music, some colours of the background were not suitable, and the voices of some characters were muffled.

A total of five (5) sign language experts stated that the sound level was

Table 4. Perceptions of sign language experts, mothers and caregivers on self-involvement of the nutrition cartoon video

Pre-testing aspect	*Theme*	*Sub theme*
Self-involvement	Reason/s that encourage you to follow the message in the video	The nutrition messages
		The moral lesson of the story
		Corrected sign language
		Looking forward for the sequel
		Having their own *Pinggang Pinoy*® materials
		The idea of being healthy and the importance of a proper nutrition by eating well-balanced meal
	To whom is the video message directed to?	Children
		Everyone
	Reason/s of willingness to follow the message/advice given in the video	Because it is educational and right for the kids
		Looking forward for the next episode
		Because it is for the good of their health
		Because of the moral lessons in the story
		Because of the benefits of knowing the right food proportion and well-balanced diet
		Because not only it will give them benefits as an individual, but the whole society as well

just right and only one (1) found it very soft. Among the mothers and caregivers, twenty-seven (27) found the sound level just right, and only three (3) found the sound level very loud.

A total of three (3) sign language experts considered the sign language interpreter in the video as excellent, two (2) experts said that the interpreter was good, and only one (1) said that the sign language interpreter needed improvement.

A total of twenty-two (22) mothers and caregivers stated that the video was excellent, seven (7) mothers and caregivers said that it was good, while only one (1) mentioned that it needed improvement.

All the sign language experts and eight (8) of the mothers and caregivers said that the duration of the video was just right. Only three (3) respondents stated that it was too long, while another three (3) respondents said that it was too short.

C. Perceived acceptability of the video

The video is acceptable when the message does not contain anything that is offensive or distasteful by local standards; anything that people perceive to be false; and any annoying elements that will become irritating after repeated exposure to the message.

A total of 33 of the study participants mentioned that they found the video acceptable and there was nothing in the video that they found offensive, annoying, confusing, and unbelievable. Some comments gathered from four (4) study participants included:

1. The video was offensive because of the language used, some parts of the story may be too complex for younger kids to understand, and the mother character just allowed her son to consume too much food and let him go to sleep immediately.

Table 5. Perceptions of sign language experts, mothers and caregivers on the overall impression of the nutrition cartoon video

Pre-testing aspect	*Theme*	*Sub theme*
Overall impression	Overall rating of the video	Excellent, timely, and relevant video
		Very interesting, engaging, and informative
		Suited for young viewers
		Messages that need to be conveyed are clear
		It is an educational and comprehensive video made by Filipinos
		Visuals are clear and attractive
		Needs some improvement on the sign language and sign language interpreter's facial expression
		Sound level is just right
		Needs to add background music
		Duration of the video is appropriate
		Duration of the video is ideal
		Requests to create more nutrition cartoon episodes

2. The video was annoying because there was no background music, there was too much talking without action, and the part where the prince was shouting too loud at the servants and farmers.
3. Two experts stated that they found it confusing because the words were not interpreted properly by the sign language interpreter; *Nutrilandia* was not mentioned earlier and yet the kids knew about it by the end of the video; the *Pinggang Pinoy*® was used in the video with only 1-2 pictures of representations for the Go, Grow and Glow foods; one usually get indigestion and not nightmares after eating and sleeping with a full stomach; transition of the story; and reason why the *Pinggang Pinoy*® was broken into four pieces and why the pieces were hidden in different places.
4. The video was unbelievable because the facial expression of the sign language interpreter did not change according to what was happening in the story and they found that the nightmare with the protagonist's sister and getting into another world as unbelievable.

Other comments to improve the video included: elements that needed to be changed like hand gestures of the sign language interpreter, background colours and road must be changed, some of the words being used can be changed, the garbled voice-over of the boy character, subtitles should be added, and the concept of "*nilason* or poisoning" and "*namatay* or death" may not be suitable for the character of the younger sister.

D. Perceived self-involvement of the video

Self-involvement of the video means that the message is perceived to be directed to the individuals of the targeted audience. Individuals perceive that the message is for them.

Four (4) sign language experts said that the lesson of the story and the sign language interpreter made them follow the messages that the video wanted to

convey. The mothers and caregivers stated that they will follow the messages of the video if there will be a sequel, or nutrition facts and benefits of *Pinggang Pinoy*® will be discussed. Others added that having their own *Pinggang Pinoy*® guide and the idea of being healthy will make them follow the messages in the video.

All sign language experts believed that the messages of the video were directed to children; while according to the mothers and caregivers, the video messages were directed to children, adults, teens, malnourished people, and everyone in general. All sign language experts were willing to follow the messages in the video because they reinforced the importance of eating a balanced and nutritious diet.

E. Perceived overall impression of the video

The overall impression of the sign language experts was that the messages and visuals were clear, volume was just right, the duration of the video was appropriate, and they rated the nutrition cartoon video from very good to excellent.

The mothers and caregivers mentioned that the nutrition cartoon video was excellent, very relevant, timely, and informative, but adding a lively and upbeat music could make it more interesting. They also mentioned that this was a good educational video for kids. Moreover, the video had good animation and sound effects, and the storyline would capture the interest of children.

DISCUSSION

In this study, the researchers determined the study participants' perceptions on attractiveness, comprehensibility, acceptability, and self-involvement (ACAS) of a nutrition cartoon video on healthy eating for hearing and deaf-mute children. The popularity and use of videos for classroom instruction has increased over the years. These are due to its affordability and user-friendliness of today's digital video cameras.

The study of Ramsay *et al.* (2012) suggested six primary characteristics of nutrition education video vignettes that can be used by nutrition educators in selecting and developing videos in nutrition education. These include (1) use real scenarios; (2) provide short segments; (3) present simple, single messages; (4) convey a skill-in-action; (5) develop the videos so participants can relate to the settings; and (6) support participants' ability to conceptualise the information. In the present study, four identified characteristics of nutrition education video were present in the cartoon video. The video provided short segments because it was a 6-minute video; presented simple and single message on a guide for healthy eating or *Pinggang Pinoy*® or the Go, Grow and Glow foods; conveyed a skill-in-action whereby study participants were willing to follow the messages of the video and to teach children the importance of a healthy and balanced diet at a young age. The video also supported participants' ability to conceptualise the information because as viewers, they could process the information conveyed by the video.

In this study, there were elements in the video that were found in both groups of participants like healthy eating messages, moral lessons, illustrations, and colours. Sign language construction and synchronisation of emotion while signing were elements in the comprehensibility part of the video that teachers picked up. Mothers and caregivers mentioned that some of the first things that caught their attention in the video included illustration or graphics, colours, animation, story or lesson, sounds and voice-over, title,

Pinggang Pinoy®, characters, and language used.

The findings of this study are validated by previous literature on instructional video and animation. There are some tips that should be considered in creating an instructional video as suggested by Beheshti (2018), such as clear aims of the video, simple and short, text, graphic, caption, screen recording, and animated characters. Voice is a significant factor that should be taken into account when making an instructional video as it improves engagement by guiding the viewers or learners via voice scripts (Beheshti, 2018). Another factor to be considered is animation. Animation constitutes a powerful education tool by combining audio messages with tailored visual cues and graphics. This serves the dual functions of explaining complex concepts and engaging students' interest in the learning process (Liu & Elms, 2019). A study by Kapoor (2015) mentioned that the advantage of animated character is instant engagement of learners with the learning content alongside having fun while learning. Several studies revealed that animation videos are effective in improving learning outcomes among elementary students. Animation can make students understand the topic presented more easily (Hapsari & Hanif, 2019). A video if enhanced with multimedia like pictures, animation, music and sound can motivate, attract and gather the student's attention (Yakovleva & Goltsova, 2016). This is also in line with the study of Khalid *et al.* (2010), wherein learning science was made more interesting and fun through the use of animation and cartoon.

The developed nutrition cartoon video is for introducing the concept of healthy eating through *Pinggang Pinoy*® to hearing and deaf and mute children. One of the suggestions from study participants was to include captions in the video. Caption should be considered in creating an instructional video, particularly when learners have hearing issue and are unable to watch the video with ease (Beheshti, 2018). Closed captioning is used to represent spoken and audio information as written language in real-time. It is primarily used by deaf and hard-of-hearing people (Waller & Kushalnagar, 2016). A study by Brann & Works (2011) showed that caption can enhance the video completion rate twice (40-80%). It is also useful for learners who do not have English as their first language and have issue in comprehending what is being spoken.

For the video's overall impression, sign language experts mentioned that the messages and visuals of the video were clear, volume was just right, and the duration of the video was appropriate. The length of the video is also an important factor to be considered to keep the learners or kids engaged. The 6-minute video length was in agreement with the study of Guo, Kim & Rubin (2014) that the maximum median engagement time for a video of any length is 6 minutes; thus, making videos longer than 6-9 minutes is likely to be a wasted effort. In this study, the authors observed that the median engagement time for videos less than six minutes was close to 100% for student engagement, which meant that students tended to watch the whole video.

In this study, participants also suggested to add lively music to the video to make it more interesting. This suggestion was also reported in the study of Liu & Chen (2018) that embedding appropriate background music into the video is a common way to enrich user experience, but it is a time-consuming and labour-intensive task to find music that fits the video. This was also

validated in the study by Wilver & Scalia (2017) among 215 individuals on the deaf perspective towards music. Results of this study cited the importance of music among deaf and hard-of-hearing individuals and music experience through visual or vibratory methods.

After gathering the participants' responses on the developed cartoon, their suggestions and comments were incorporated in finalising the cartoon for public consumption and roll-out to public or private schools and deaf-mute institutions in the Philippines. Results of this study will be considered in the development of other nutrition cartoon videos.

The study coverage included mothers or caregivers of hearing children for pre-testing of the nutrition video. However, the video was not pre-tested among mothers or caregivers of deaf-mute children. Children (including deaf and mute) were also not asked to evaluate the cartoon. Mothers, teachers, and children were not interviewed prior to the development of the cartoons (opinions, preference, and perspective not gathered); only a post-development assessment was made. These are the limitations of the study.

CONCLUSION

Overall, the participants held a generally positive acceptance of the video. Pre-testing the nutrition cartoon video before final production identified terminologies and concepts that the participants found unfamiliar, confusing, and unacceptable; offered suggestions for improvement that would make the pre-tested video more likely to be appropriate for hearing and deaf-mute children. Some key improvements in the video were as follows: synchronisation of the emotional expressions of the sign language interpreter like facial movements and hand gestures with the animation of video; addition of lively music or background music to make it more interesting; and inclusion of subtitles or captions in the video. Other positive findings included: the nutrition cartoon video conveyed clear information on *Pinggang Pinoy*® or healthy eating; and the messages of the video were directed to children and even for teens, adults, malnourished people, and everyone in general. It is recommended that the pre-tested nutrition cartoon video be used in nutrition education classes among hearing and deaf and mute children, and to study children's nutrition knowledge on healthy eating after watching the video. Moreover, other future studies may explore to pre-test the video among mothers or caregivers of deaf-mute children.

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Authors' contributions

IGG, principal investigator, conceptualised and designed the study, prepared the online pre-testing questionnaire, reviewed the results of pre-test, prepared the drafts and final manuscript before submission; SFQA, co-investigator, assisted in conceptualising and designing the study, prepared the online questionnaire in Google form, prepared the results of pre-test, assisted in the preparation of draft and final manuscript, assisted in reviewing the final manuscript before submission; MBSD, co-investigator, assisted in conceptualising and designing the study, assisted in the preparation of draft manuscript; TKBJ, co-investigator, assisted in conceptualising and designing the study, assisted in the preparation of results of pre-test; assisted in the preparation of draft and final manuscript; MSG, reviewed the draft manuscript, edited the draft and final manuscript.

Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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