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Evaluation of the Mandarin Fricative-Affricate (MFA) Nonsense Word Test Training Module among Audiologists and Audiology Students

(Penilaian Modul Latihan bagi Ujian Perkataan Tanpa Makna Frikatif-Afrikat Bahasa Mandarin dalam Kalangan Audiologis dan Pelajar Audiologi)

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Abstract

The Mandarin Fricative-Affricate (MFA) Nonsense Word Test was developed to assess the speech perception of Malaysian Mandarin-speaking adult clients. However, the language barrier makes it difficult for the audiologists and the audiology students who do not speak Mandarin to administer the test. Therefore, this study aimed to develop and evaluate a training module for the MFA Nonsense Word Test and measure the changes in confidence and perception of audiology students towards administering the MFA Nonsense Word Test. The training module consisted of (1) self-learning using a user manual and seven training videos and (2) practical sessions. This study consisted of two phases: (1) content validation of the user manual, and (2) workshop training. Six audiologists were involved in Phase I. The adapted Suitability Assessment of Materials (SAM) was used to measure the content validation of the user manual. The user manual was proven valid with an excellent content validity index (CVI) of 0.83. Thirty four audiology students participated in Phase II. The questionnaire for assessing the confidence and perception of the participants toward administering the MFA Nonsense Word Test was distributed at three time points: pre-workshop, pre-practical, and post-workshop. The participants were also required to evaluate the face validity of the training videos using the Patient's Education Materials Assessment Tool (PEMAT). The training videos obtained a high face validity score of 98.7%. Friedman's Test showed that there were significant changes in confidence [$\chi^2(2)=51.74$, $p<0.05$] and perception [$\chi^2(2)=48.59$, $p<0.05$] over the three time points. The finding indicated that the training module has effectively improved the audiology students' confidence and perception in administering the MFA Nonsense Word Test.

Keywords: Mandarin; speech perception test; user manual; training videos; evaluation

Abstrak

Ujian Perkataan Tanpa Makna Frikatif-Afrikat Bahasa Mandarin (MFA) telah dibina untuk menguji persepsi pertuturan klien dewasa yang menutur bahasa Mandarin di Malaysia. Namun, kekangan bahasa menyebabkan ujian ini sukar dilaksanakan oleh audiologis dan pelajar audiologi yang bukan penutur bahasa Mandarin. Oleh itu, kajian ini bertujuan untuk membina dan menilai satu modul latihan bagi Ujian Perkataan Tanpa Makna MFA, serta mengukur perubahan tahap keyakinan dan persepsi pelajar audiologi dalam melaksanakan Ujian Perkataan Tanpa Makna MFA. Modul latihan tersebut terdiri daripada (1) pembelajaran kendiri menggunakan satu manual pengguna dan tujuh video latihan dan (2) sesi praktikal. Kajian ini merangkumi dua fasa: (1) kesahan kandungan manual pengguna dan (2) bengkel latihan. Seramai enam audiologis telah menyertai Fasa I. Borang Suitability Assessment of Materials (SAM) digunakan untuk mengukur kesahan kandungan manual pengguna tersebut. Manual pengguna telah disahkan dengan index kesahan kandungan (CVI) yang tinggi, iaitu 0.83. Seramai 34 pelajar audiologi telah menyertai Fasa II. Borang yang digunakan untuk menguji tahap keyakinan dan persepsi para peserta untuk melakukan Ujian Perkataan Tanpa Makna MFA telah diberikan pada tiga titik masa: pra-bengkel, pra-praktikal dan pasca-bengkel. Peserta juga dikehendaki untuk menilai kesahan muka video demonstrasi dengan menggunakan Patient's Education Materials Assessment Tool (PEMAT). Video demonstrasi tersebut telah memperoleh markah kesahihan muka setinggi 98.7%. Ujian Friedman menunjukkan perubahan signifikan dari segi tahap keyakinan [$\chi^2(2)=51.74$, $p<0.05$] dan persepsi [$\chi^2(2)=48.59$, $p<0.05$] para peserta sepanjang tiga titik masa. Hasil kajian ini menunjukkan bahawa modul latihan tersebut telah meningkatkan tahap keyakinan dan persepsi para pelajar audiologi terhadap pelaksanaan Ujian Perkataan Tanpa Makna MFA secara efektif.

Kata kunci: Mandarin; ujian persepsi pertuturan; manual pengguna; vídeo latihan; penilaian

INTRODUCTION

Speech perception tests are behavioural tests that assess hearing performance using speech stimuli. It is widely used in audiology clinics to measure outcomes with amplification devices such as cochlear implants and hearing aids and to cross-check pure-tone audiometry (Fu et al. 2011; Lesimple et al. 2018). It is important to assess clients using their native language because their ability to perceive speech would be compromised when assessed with a non-native language (Shi 2010). The Chinese population accounts for 22.8% of the overall population in Malaysia, making them the second largest ethnic group (Department of Statistics Malaysia 2022). Consequently, it is important to have speech materials in Mandarin to evaluate a Mandarin-speaking client's ability to perceive speech using their native language. Therefore, the Mandarin Fricative-affricate (MFA) Nonsense Word Test was developed to cope with the demand for Mandarin speech perception tests in Malaysia (Chong et al. 2018; Chong et al. 2020; Chong et al. 2021).

The MFA Nonsense Word Test (Chong et al. 2018; Chong et al. 2020; Chong et al. 2021) is a digitally recorded Mandarin speech perception test that emphasises high-frequency Mandarin alveolar and retroflex fricatives (/s/, /ʂ/) and affricates (/ts/, /tsh/, /tʂ/, /tʂh/). The MFA Nonsense Word Test consists of seven male lists and seven female lists, with 18 nonsense words in each list. The development of the MFA Nonsense Word Test can be classified into three phases. Phase I involved the selection of the best exemplars as the test materials (Chong et al. 2018). There were 180 nonsense words recorded from a female and a male Mandarin speaker in the stimulus development stage. The recorded samples consisted of six target Mandarin alveolar and retroflex fricatives (/s/, /ʂ/) and affricates (/ts/, /tsʰ/, /tʂ/, /tʂʰ/) consonants, and three vowels (/a/, /i/ and /u/), in vowel-consonant-vowel (VCV) format (eg., /aca/, /ici/, /ucu/). All VCV samples were examined in terms of acoustic properties and quality judgement by two native Mandarin-speaking listeners, one of whom had undergone phonetic training. This is to ensure that the sample has good (score of 4) or excellent (score of 5) sound quality and is free from idiosyncratic elements. The VCV samples with the highest scores were chosen as the test items for the MFA Nonsense Word test (Chong et al. 2018). In the second phase, the researchers aimed to establish normative data by obtaining the baseline performance-intensity (PI) function of the MFA Nonsense Word Test (Chong et al. 2020). There were 65 native Mandarin-speaking adults with normal hearing who participated in this study. The findings showed (1) the nonsense word identification scores increased as the intensity level increased, reaching a plateau at 20 dB HL; and (2) there was no significant effect of talker gender on the identification mean scores, except at 5 dB HL. The third phase of the study involved determination of the identification scores at higher stimulus presentation levels and examination of test-retest reliability (Chong et al. 2021). There were 43 Mandarin-speaking young adults with normal hearing who involved in the study. Chong et al. (2021) reported that (1) at presentation levels of 35, 60, and 65 dB HL, the identification scores obtained using female-talker lists were significantly higher than those obtained using male-talker lists; and (2) the identification test has excellent test-retest reliability, with an Intraclass Correlation Coefficient (ICC) value of 0.93.

Despite having the MFA Nonsense Word Test ready to be implemented in the Audiology and Speech Science Clinic (KASP), National University of Malaysia (UKM), the language barrier may make administering the MFA Nonsense Word Test difficult for the audiologists and the audiology students who do not speak Mandarin. This may restrict the usage of the MFA Nonsense Word Test in KASP, as more than half of the audiologists and the audiology students in KASP are not Mandarin speakers. To make the test more accessible to non-Mandarin-speaking clinicians, a user manual for the MFA Nonsense Word Test should be developed. A user manual is a technical document that provides information and instructions about using a product. A good user manual should contain procedural, conceptual, and visual information (Vermeulen 2023). Procedural information refers to step-by-step instructions that the user can follow. In contrast, conceptual information is the information that is required for the user to be able to understand procedural information. Visual information such as tables, illustrations, and screenshots should also be included to aid the user in completing a specific task. In addition, the instructions in the manual should be specific. Specific instructions provide straightforward guidelines for administering the test in an audiology clinic, which might be easier for the audiologists in that particular clinic to follow through the test procedures.

On the other hand, several studies have demonstrated the use of video as a highly effective educational tool (Hsin & Cigas 2013; Stockwell et al. 2015). Multimedia tools such as video can provide real-world examples to clarify theoretical concepts from textbook readings adequately (Rackaway 2012). Therefore, the use of training videos might also be useful in helping audiology students to better understand the procedures of the MFA Nonsense Word Test. An evaluation of the user manual and training videos is necessary to ensure

high quality and excellent validity of the materials. A non-validated tool or one with poor validity will lead to suspicion and may not be suitable for use (Yusoff 2019).

Training is also necessary to teach the audiology students who are under training to become audiologists on how to administer the test. Riyad et al. (2020) reported that practical learning is associated with a deeper impact on the mind and improved skills. Therefore, the main aim of this study is to develop and evaluate a training module for the MFA Nonsense Word Test. This study utilised a training module that consisted of (1) self-learning through the user manual and training videos and (2) practical sessions, as a combination of both theoretical and practical learnings is believed to be more effective than any single of these approaches (Riyad et al. 2020). Each component of the training module was evaluated separately.

MATERIALS AND METHODS

This study was approved by The National University of Malaysia's Research Ethics Committee (Reference number: UKM PPI/111/8/JEP-2023-097) on 16th March 2023. The data of this cross-sectional study was collected from 28th March 2023 to 2nd June 2023.

Specifically, this study was divided into two phases. In Phase I, we aimed to (1) develop a user manual and training videos for the MFA Nonsense Word Test and (2) determine the content validity index (CVI) of the user manual. In Phase II, we aimed to (1) determine the face validity of the MFA Nonsense Word Test training videos and (2) examine changes in confidence and perception in administering the MFA Nonsense Word Test of the participants over the three time points: pre-workshop, pre-practical and post-workshop. The definitions for pre-workshop, pre-practical and post-workshop are as stated:

1. Pre-workshop – Before the workshop, when the participants have no or limited knowledge regarding the MFA Nonsense Word Test,
2. Pre-practical – After the participants did self-learning (with user manual & training videos), but before the practical starts,
3. Post-workshop - After the practical.

We hypothesised that (1) the content validity index of the MFA Nonsense Word Test user manual should be equal or more than 0.83 (Lynn 1986; Polit & Beck 2006); (2) the face validity score of the MFA Nonsense Word Test training videos should be at least 80% (Schorr et al. 2018); and (3) there will be significant changes in confidence and perception scores of the participants over the three time points: pre-workshop, pre-practical and post-workshop.

PARTICIPANTS

Phase I

The development of the MFA Nonsense Word Test user manual involved all authors of the current study whereas the development of the training videos involved the corresponding author and the first author of the current study. Six audiologists were involved in the content validation of the MFA Nonsense Word Test user manual. The sample size was determined based on the recommendation from Lynn (1986), who suggested a minimum of six experts for content validation. The participants were recruited by using purposive sampling. The inclusion criteria were (1) audiologists in Malaysia, (2) minimum working experience of one year, and (3) have adult caseload at least monthly. The exclusion criteria were the audiologists who do not see adult clients in the past three months. The MFA Nonsense Word Test user manual is written in English to enable the non-Mandarin speaking students/clinicians to perform the test. Therefore, the ability to comprehend Mandarin was not being considered as one of the criteria for the experts.

Phase II

Audiology students from UKM were involved in the workshop training related to the MFA Nonsense Word Test and the evaluation of the MFA Nonsense Word Test training videos. The sample size for Phase II was calculated by using the G*Power 3.1.9.4 software (Effect size f=0.25, Alpha value=0.05, Power=0.80). A total of 28 participants were needed. To avoid missing data or potential dropouts, 10% of the sample size were added by using the formula from Gupta et al. (2016):

$$N1 = \frac{n}{(1-d)}$$

$$N1 = \frac{28}{(1-0.1)}$$

$$\approx 31$$

N1 = Adjusted sample size,
n = Sample size computed by G*Power software,
d = Dropout rate

Hence, a total of 31 students were needed. The inclusion criteria for the participants were the audiology students at UKM with at least one semester of clinical experience (third- and fourth-year students). Those without clinical experience (first- and second-year students) were excluded from this study.

MATERIALS AND INSTRUMENTATIONS

Phase I

The content validation form used by Chong et al. (2022) to validate the user manual of a Mandarin paediatric speech perception test were adapted and used in this study for the content validation of the MFA Nonsense Word Test user manual. The content validation form used by Chong et al. (2022) was originally adapted from the Suitability Assessment of Materials (SAM; Doak et al. 1996) and another source (Taylor-Clarke et al. 2012). The form used in this study consisted of 20 items under four domains: content, visuals, typography and layout, and literacy demands. A four-point Likert scale, from "strongly disagree" (1) to "strongly agree" (4) was utilised. To allow the experts to provide feedback related to the item being reviewed, a comment space was included for each item.

Phase II

The Patient Education Materials Assessment Tool for Audiovisual (AV) Materials (PEMAT A/V) (Shoemaker et al. 2014) was used to evaluate the face validity of the training videos. Only items from the understandability domain were utilised in this study. After excluding the items that do not apply to the training videos, such as "Medical terms are used only to familiarize the audience with the terms; when used, medical terms are defined", nine items from five topics (i.e., content, word choice and style, organisation, layout and design, and use of visual aids) were chosen for the evaluation. All items had the answer options "Disagree=0" and "Agree=1". The "not applicable" option in the original PEMAT was excluded as there might be a tendency for the participants to be unsure of which option to choose to best respond to the items. Taking the item "The material's sections have informative headers" as an example, if the material does not have an informative header, the participants might wonder if they should choose "disagree" or "not applicable". It might be confusing, especially for someone new to evaluating material, and thus, affecting the results.

An online demographic questionnaire in Google Form that consisted of multiple-choice questions and open-ended questions was utilised in this phase. This online questionnaire was divided into three sections: (1) Section I: Personal Information, (2) Section II: Experience as Student Clinicians, and (3) Section III: Language Proficiency Level in Mandarin. There were 18 items in total. In Section I, the participants were asked about their native language and the language most often used at home and at university. The questions related to the participants' clinical experiences in Section II included the frequency of seeing Mandarin-speaking adult clients and conducting any speech tests on the adult population, as well as the reasons for being unable to perform speech tests on the adult population in the clinic. Some questions required them to rate their experience based on the frequency of conducting certain tasks (Never=0%; Rarely= 1-20%; Sometimes=21-40%; Often=41-60%; Very frequently=61-80%; Almost Always=81–100%). In Section III, the participants were required to rate their language proficiency level in Mandarin, based on the following scale: 0=no proficiency, 1=elementary proficiency, 2=limited working proficiency, 3=professional working proficiency, 4=full professional proficiency, and 5=native proficiency.

The online confidence and perception questionnaire in Google Form (Appendix) were adapted from Amri et al. (2019), Chong et al. (2022) and Johnston et al. (2020). The same questionnaire was used to evaluate the participants' confidence and perception towards conducting the MFA Nonsense Word Test at three time points. The questionnaire consisted of two domains: confidence with three items and perception with four items (Table 8). The rating was based on a five-point Likert scale, from strongly disagree (1) to strongly agree (5).

The validated user manual and training videos from Phase I was utilised as the self-learning materials. The user manual and training videos were described in "Procedures" section.

PROCEDURES

Phase I

A user manual for the MFA Nonsense Word Test in English was written by the corresponding and first authors. Then, it was reviewed by the other two co-authors of the current study. The user manual includes seven chapters: (1) Chapter 1 Introduction, (2) Chapter 2 Test Materials, (3) Chapter 3 Test Preparation and Equipment Set-up, (4) Chapter 4 Test Procedure, (5) Chapter 5 Scoring, (6) Chapter 6 Normative Data, and (7) Chapter 7 Specific Instructions for Conducting The UKM MFA Nonsense Word Test: Example in Audiology and Speech Sciences Clinic (KASP), UKM. Chapter 1 contains conceptual information, while procedural information can be found in other chapters of the user manual. The user manual also includes tables, illustrations, screenshots, and graphs. In addition, chapter 7 provides step-by-step explanation for conducting the MFA Nonsense Word Test in KASP.

Filming for the MFA Nonsense Word Test training videos was done at KASP using the Canon EOS RP Mirrorless Camera. A total of four persons

were involved in the filming: the corresponding author, the first author, and two research assistants. The corresponding author was the video director, the first author and one research assistant were the actors, and another research assistant was the videographer. During the video filming, the actors demonstrated step-by-step procedures for conducting the MFA Nonsense Word Test, from preparation and equipment set-up to scoring a patient's responses. All the procedures were in accordance with those stated in the user manual. The recorded videos were edited using the Adobe Premier Pro video editing software. There are altogether seven short video clips with different topics: (1) Preparation and Equipment Set-up, (2) VU Meter Calibration, (3) Sound Field Calibration, (4) Calculation for Test Presentation Level, (5) Procedure for Online Scoring Method using an Online Response Sheet, (6) Procedure for Manual Scoring using a Patient's Written Response Sheet, and (7) Procedure for Manual Scoring using a Patient's Verbal Response Sheet. Each training video comprises the actions of the test procedures with captions and voiceovers. Each video lasts one to four minutes. The duration of each of the seven short videos was controlled so that it did not exceed six minutes. The training videos were reviewed by the corresponding author, who is also the lead investigator for the MFA nonsense word test, to make sure all information, including the visuals, voiceovers, and captions, is correct. The finalised training videos were uploaded to Google Drive. The links and the QR codes of the Google Drive for each video were added in Chapter 7 of the user manual.

The invitation for the content validation of the MFA Nonsense Word Test user manual was sent via email to the experts. A content validation form, the informed consent form and the MFA Nonsense Word Test user manual were attached to the email. The experts were required to determine the content validity of the user manual based on a four-point Likert scale after they had read the user manual. The user manual was examined in terms of its content, visuals, typography and layout, and literacy demands. Two weeks were given to the participants to complete the form.

Phase II

An internal training workshop in the Audiology Programme, Faculty of Health sciences, UKM was conducted in Phase II. The training workshop consisted of three components: (1) briefing, (2) self-learning, and (3) practical sessions. These sessions were carried out on different days due to time constraints.

All third- and fourth-year UKM Audiology students who have started their clinical training were invited to attend the briefing session. The students were briefed about what would be involved in this study before the session started. Those who are interested in participating in this study (for self-learning and practical sessions) need to fill in the demographic questionnaire and the confidence and perception questionnaire. At this time-point, the participants' confidence and perception towards using the MFA Nonsense Word Test when they have zero or limited knowledge regarding the test (i.e., pre-workshop) were assessed. Then, the briefing session was delivered by the first and the corresponding authors for approximately one hour. The participants were introduced to the background of the MFA Nonsense Word Test.

After the briefing session, the participants were grouped into four to six persons according to their availability for the practical sessions between 5th May 2023 and 2nd June 2023. Then, the self-learning materials (i.e., the validated MFA Nonsense Word Test user manual and the training videos) were shared with the participants via Google Drive link three days prior to the selected dates for the practical sessions. The confidence and perception questionnaire were sent to the participants a day before the practical session to assess their confidence and perception after self-learning (i.e., pre-practical). In addition, the participants were also given the PEMAT A/V questionnaire to evaluate the face validity of the training videos after they had watched them.

During the practical session, the first author demonstrated how to conduct the test to the participants. After that, the participants conducted the test on their own. The confidence and perception questionnaire were given to the participants after the practical session to assess their confidence and perception once they had completed the full training (i.e., post-workshop). The effects of the user manual, training videos, and practical on the training outcomes could be identified by measuring the changes in participants' confidence and perception at three time points mentioned.

DATA ANALYSIS

Phase I

The content validity of the MFA Nonsense Word Test user manual was measured in terms of the item-level content validity index (I-CVI) and the overall scale (S-CVI). The S-CVI included S-CVI/Ave (based on the average) and S-CVI-UA (based on the universal agreement). S-CVI/Ave is defined as the average of the I-CVI for all items examined. S-CVI/UA is the proportion of items with a rating of 3 (Agree) or 4 (Strongly agree) by all experts involved (Polit et al. 2006). According to Lynn (1986), Polit and

Beck (2006) also Polit et al. (2007), for a content validation that involved six raters, the cut-off scores of the I-CVI, S-CVI/Ave and S-CVI/UA should be 0.83, 0.90, and 0.80, respectively. The following formulae from Lynn (1986) and Polit et al. (1986) were utilised:

1. Formula for I-CVI

$$I-CVI = \frac{Experts\ in\ agreement}{Total\ number\ of\ experts}$$

2. Formula for S-CVI/Ave

$$S-CVI/Ave = \frac{Sum\ of\ I-CVI}{Total\ number\ of\ items}$$

3. Formula for S-CVI/UA

$$S-CVI/UA = \frac{Sum\ of\ universal\ agreement\ score}{Total\ number\ of\ items}$$

PHASE II

The face validity of the MFA Nonsense Word Test training videos was calculated in terms of the percentage of items that fulfilled the agreement (Items rated "Agree=1"). The face validity score of the MFA Nonsense Word Test training videos should be at least 80% to be considered as highly comprehensible (Schorr et al. 2018). The formulae for the face validity used in this study (Shoemaker et al. 2014) is as follow:

$$Face\ validity\ (per\ rater) = \frac{No.of\ items\ with\ agreement}{Total\ no.of\ items}\ x\ 100\%$$

The participants' demographic background, including personal information, experience as student clinicians, and language proficiency level in Mandarin, was analysed using descriptive analysis. Changes in confidence and perception were measured by using a five-point Likert scale at 3 time points: pre-workshop, pre-practical and post-workshop. There are two domains in the questionnaire: (1) confidence (3 items), and (2) perception (4 items). The scores for each domain were averaged. Since the data were not normally distributed, therefore, Friedman's Test was used in statistical analysis. When there was a significant difference over the three time points, the Wilcoxon signed-rank test was used as the pairwise analysis. The IBM Statistical Package for the Social Science (SPSS) version 26.0 software was used for the analyses.

RESULTS AND DISCUSSION

Phase I

Six audiologists with working experience ranging from one year to more than 20 years participated in this study. All audiologists are currently working in Malaysia. Five experts work in the private sector, while one is in a public setting. All experts have adult caseload at least monthly.

The MFA Nonsense Word Test user manual obtained I-CVI scores that ranged from 0.83 (four items) to 1 (16 items), a S-CVI/Ave of 0.97 and a S-CVI/UA of 0.80 (Table 1). The user manual was then improvised based on feedback from the experts (Table 2).

The findings from this study demonstrated that the MFA Nonsense Word Test user manual is valid and appropriate for audiologists and audiology students. Before the use of the MFA Nonsense Word Test by audiologists and audiology students, it is important to ensure that the content of user manual for the MFA Nonsense Word Test is valid. Polit et al. (2007) suggested minimum I-CVI, S-CVI/Ave, and S-CVI/UA values of 0.78, 0.90, and 0.80, respectively, for a material to be considered valid and superior.

Table 1 Content validity index (CVI) of the MFA Nonsense Word Test user manual.

Domains	Items	Expert in agreement	I-CVI
Content	The manual explains the purpose and benefits of the MFA Nonsense Word Test.	5	0.83
	The manual emphasizes knowledge/skills aimed at helping readers in conducting the MFA Nonsense Word Test.	6	1
	The scope of the manual covers essential information directly related to the MFA Nonsense Word Test.	6	1

continue...

...cont.

Visual	The visuals are culturally relevant and sensitive.	6	1
	The visuals are easy for readers to follow and understand.	6	1
	The visuals appear professional and appropriate for an adult audience.	6	1
	The visuals are free of distracting details that take away from the main idea.	6	1
	All graphics complement the text.	6	1
	There are step-by-step directions, with examples provided that will build comprehension and self-efficacy to conduct the MFA Nonsense Word Test.	6	1
Typography and layout	The font size is at least 12 pt.	6	1
	The font is easy-to-read font (no fancy script or lettering).	6	1
	Bold and underline are used instead of all caps and italics to emphasize important items.	5	0.83
	Colours are used to promote easy reading (Dark fonts on light backgrounds are best.).	6	1
	Layout and sequence of information are consistent, making it easy to predict the flow of information.	6	1
	Use of colour supports and is not distracting to the information.	6	1
	There is a lot of white space (no dense text).	5	0.83
	The organization of the paragraphs and sentences is conducive to easy reading.	5	0.83
	Instructions are broken into easy-to-read parts.	6	1
Literacy demand	Common words are used all the time.	6	1
	Short sentences not exceeding 20 words per sentence are used.	6	1
		S-CVI/Ave	0.97
		S-CVI/UA	0.80

Table 2 Feedback by experts and action taken to improvise the MFA Nonsense Word Test user manual.

Feedback from audiologists	Actions taken
The manual only explains on how the test is developed and performed. Reader should know what the score represents, how can it help in terms of counselling or hearing aid fine tuning	Added further explanation on what does the score represent and how can it help in terms of counselling or hearing aid fine tuning in section 6.0 “Interpretations of Results”
Recommend when and why to carry out the test	Added the function of the test in introduction section
White space is needed to ease readability	Added space in some pages in between sentences
Layout of table of contents can be improved. Suggest to use different colour for heading and point	Use bold font for the main topics
There’s a typo at page 7, item no. 3 under the “IMPORTANT” subheading. The word “safe” should be saved”	Changed the word “safe” to “saved”
The symbols used to remark the scoring sheet “#This patient’s…”, would be better if change to an asterisk	Changed the symbol # to an asterisk

Several steps were taken during the development of the MFA Nonsense Word Test user manual to ensure the user manual produced was excellent and suitable to be used as training kit. During the development of the user manual, an expert review was carried out by the panels from the research team to examine the suitability of the contents and identify issues in the manual that needed to be overcome. The user manual was copyrighted afterwards (UKM.IKB.800-4/1/4271).

Furthermore, six experts in the Audiology field reviewed the user manual and rated it based on its content, visuals, typography and layout, and literacy demand. Some experts have provided suggestions to improve the quality of its content. For instance, there was a suggestion to include explanations regarding what a particular word identification score represents so that the user can interpret the result better. All the comments and suggestions were considered, and actions were taken to improve the user manual. The revised user manual is believed to be more comprehensive as the aspects the experts thought were lacking have been addressed.

Phase II

Participants' Demographic

A total of 34 audiology students aged 21 to 25 (*Mean*=22.82 years; *SD*=0.14 year) participated in this phase. Table 3 shows the demographic background of the participants. Most of the participants were females (85.3%). Most of the participants chose "Malay" as their native language (73.5%), the language most often used at home (76.5%) and the language most often used at university (67.6%). Most participants reported "No proficiency" in Mandarin (64.7%); only 3 and 4 of them reported "Professional proficiency" and "Native proficiency", respectively

Table 3 Summary of the demographic background of the participants (n=34).

Description	Percentage, % (n)
Gender	
• Female	85.3 (n=29)
• Male	14.7 (n=5)
Race	
• Malay	73.5 (n=25)
• Chinese	20.6 (n=7)
• Indian	2.9 (n=1)
• Kadazan	2.9 (n=1)
Year of Study	
• Year 3	58.8 (n=20)
• Year 4	41.2 (n=14)
Native Language	
• Malay	73.5 (n=25)
• Mandarin	17.6 (n=6)
• English	2.9 (n=1)
• Tamil	2.9 (n=1)
• Kadazan	2.9 (n=1)
Language Most Often Used at Home	
• Malay	76.5 (n=26)
• Mandarin	20.6 (n=7)
• Tamil	2.9 (n=1)
Language Most Often Used in University*	
• Malay	70.6 (n=24)
• English	38.2 (n=13)
• Mandarin	2.9 (n=1)
Mandarin proficiency Level	
• No proficiency	64.7 (n=22)
• Elementary proficiency	11.8 (n=4)
• Limited working proficiency	2.9 (n=1)
• Professional working proficiency	0.0 (n=0)
• Full professional proficiency	8.8 (n=3)
• Native proficiency	11.8 (n=4)

Note: *Some participants chose more than one language, therefore, the total no. of responses = 38.

Figure 1 shows that 38.2% of the participants see Mandarin-speaking adult clients "sometimes" and 55.9% "never" conducted any speech tests on the adult population before. Table 4 shows the reason(s) for not being able to perform a speech test on the adult population in the clinic. More than half of the participants stated that it is not crucial to perform speech test because they can use other measures such as the aided sound-field measurement to assess a patient's performance. Half of the participants acknowledged that lack of skills in conducting speech tests was the reason for not conducting speech test in the clinic.

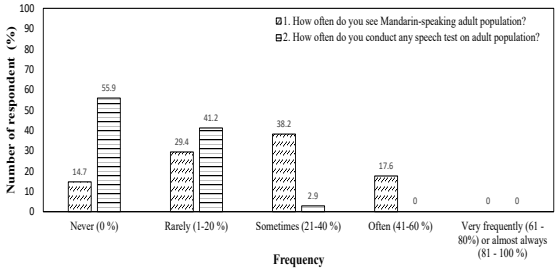

Figure 1 Participants' clinical experience.

Table 4 Reason(s) for not being able to perform speech tests on the adult population in the clinic.

Reason(s) for not being able to perform speech tests on the adult population in the clinic	**No. of responses**	**% of responses per 34 participants**
It is not crucial as I can use other measures to assess the patient's performance or verify hearing aid (e.g. Aided PTA)	18	53%
Lack of skills in conducting speech test	17	50%
Lack of speech test materials that are suitable	13	38%
I am not familiar with the procedures in conducting a speech test	12	35%
Time constraint	12	35%
It is not a standard practice done to assess functional hearing performance or verify hearing aids in my clinic	6	18%
Speech test for the adult population is not available in my clinic	2	6%
Total	80	

Note: The participants were allowed to choose more than one option. Therefore, the total number of responses = 80.

Face Validity of the Training Videos

Table 5 shows the face validity score per rater and average score of the MFA Nonsense Word Test training videos. Findings revealed that the training videos achieved a high mean of face validity score across all domains measured (98.7%). The score suggested that the audiologists and students would be able to comprehend the training videos easily. Therefore, no modification was done on these videos.

Table 5 Summary of face validity score for the training videos.

Domain and Items	**Percentage of agreement (%)**
Topic: Content	
The MFA Nonsense Word Test training videos make their purposes completely evident.	100
Topic: Word choice and style	
The MFA Nonsense Word Test training videos use common, everyday language.	100
The MFA Nonsense Word Test Training Videos use the active voice.	97.1
Topic: Organization	
The MFA Nonsense Word Test Demonstration Videos break or "chunk" information into short sections.	100
The MFA Nonsense Word Test Demonstration Videos' sections have informative headers.	100
The MFA Nonsense Word Test Demonstration Videos present information in a logical sequence.	97.1
Topic: Layout and design	
Text on the screen is easy to read.	100
The MFA Nonsense Word Test Demonstration Videos allow the user to hear the words clearly (e.g., not too fast, not garbled).	97.1
Topic: Use of visual aids	
The MFA Nonsense Word Test Demonstration Videos use illustrations and photographs that are clear and uncluttered.	97.1
Mean face validity score (SD)	98.7 (4.5)

Table 6 Participants' confidence and perception ratings towards using the MFA Nonsense Word Test.

Domains	Median ± IQR		
Confidence	**Pre-workshop**	**Pre-practical**	**Post-workshop**
I am able to conduct the MFA Nonsense Word Test with confidence.	2.00 ± 2.00	3.00 ± 1.00	5.00 ± 1.00
I am able to explain and demonstrate the procedures to conduct the MFA Nonsense Word Test to someone who has no experience with the test.	2.00 ± 2.00	3.00 ± 2.00	5.00 ± 1.00
I am confident to score a patient's responses.	2.00 ± 2.00	3.00 ± 1.00	5.00 ± 0.00
Perception			
The MFA Nonsense Word Test is an effective tool in accessing the speech perception ability in Mandarin-speaking adult patient.	3.50 ± 1.00	4.00 ± 2.00	5.00 ± 1.00
If the test is available at my workplace, I will conduct the MFA nonsense word test to Mandarin-speaking adult patients.	3.00 ± 2.00	4.00 ± 1.00	5.00 ± 0.00
I will recommend this MFA nonsense word test to be implemented in my clinic/workplace.	3.00 ± 2.00	4.00 ± 2.00	5.00 ± 0.00
I will recommend this MFA nonsense word test with user manual and videos to other colleagues.	3.00 ± 2.00	4.00 ± 2.00	5.00 ± 0.00

Note: IQR = interquartile range

Several recommendations to maximise student learning from educational videos proposed by Brame (2016) were considered when developing the MFA Nonsense Word Test training videos to make sure the videos are suitable and appropriate for training purposes. Firstly, the information required for the audiology students to learn the MFA Nonsense Word Test, such as equipment set-up and test procedures, has been segmented into seven short videos. Each video is brief, with a duration of not more than six minutes, as suggested by Guo et al. (2014), to keep the audiology students engaged during self-learning. Despite the short duration, the contents of the training videos are targeted at learning goals. In addition, the training videos also use audio and visual channels to convey information, which has been shown to improve information retention (Mayer & Moreno 2003) and student engagement in learning (Thomson et al. 2014). The steps mentioned above would help maximise the benefit of training videos and assist the audiology students in confidently administering the test.

Confidence and Perception Ratings

Table 6 shows the participants' confidence and perception ratings towards using the MFA Nonsense Word Test at three time points: pre-workshop, pre-practical, and post-workshop. The higher the mean score, the more positive the participants' confidence and perception were. The Friedman's test results show a statistically significant differences in overall confidence and perception over three time points [Confidence: $\chi^2(2)=51.74$, $p<0.001$; Perception: $\chi^2(2)=48.59$, $p<0.001$]. Wilcoxon Signed Ranks Test was computed as post hoc analysis. The findings showed there was a statistically significant difference in confidence and perception between each of these pairs: (1) pre-workshop and pre-practical ($p<.001$), (2) pre-workshop and post-workshop ($p<.001$), and (3) pre-practical and post-workshop ($p<.001$), as shown in Figure 2 and Figure 3.

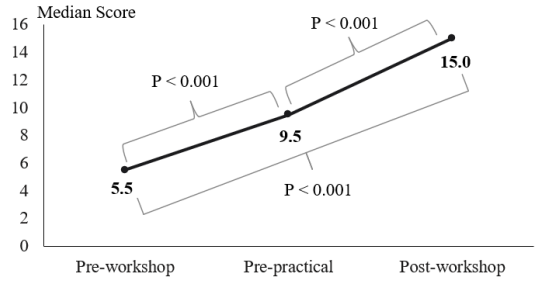

Figure 2 Changes in perception of the participants over three time points (pre-workshop, pre-practical and post-workshop).

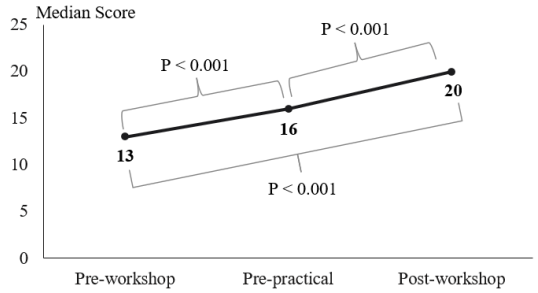

Figure 3 Changes in perception of the participants over three time points (pre-workshop, pre-practical and post-workshop).

The changes in confidence and perception towards using the MFA Nonsense Word Test of the participants over pre-workshop, pre-practical

and post-workshop were measured to investigate the effectiveness of the MFA Nonsense Word Test user manual, training videos and practical session. The findings from this study showed that both the confidence and perception of the participants significantly improved over the three time points, which is consistent with the hypothesis stated earlier. The use of the user manual and training videos has significantly improved the participants' confidence and perception as compared to pre-workshop, where the participants had no prior knowledge regarding the MFA Nonsense Word Test. This significant improvement is expected as the user manual and training videos provide detailed information that can enhance the students' knowledge and understanding regarding the MFA Nonsense Word Test. As a result, the students' confidence and perception of administering the test increased with knowledge. Although it is unsure which materials contribute more to the improvement of participants' confidence and perception from pre-workshop to pre-practical, both materials are appropriate to be used when the audiologists and audiology students wish to administer the test. The level of confidence and perception has further improved after the practical sessions, where they had a chance to conduct the test by themselves. The results were consistent with the study from Riyad et al. (2023) that reported skill improvement with practical learning. Application of the theory or concepts the student clinicians learned from the self-learning materials enables them to put the idea to use, which may promote a better understanding of the information and, thus, enhanced information retention.

The MFA Nonsense Word Test, along with the user manual and training videos, has the potential to be commercialised. Although the training videos developed are based on the settings in KASP, UKM, the MFA Nonsense Word Test user manual and training videos can be generalised for use in other settings. It is recommended for those who wish to conduct the MFA Nonsense Word Test to go through both the user manual and training videos for maximum effect on learning.

Nevertheless, limitations do exist in this study. Firstly, any audiologist or audiology student who wishes to conduct the MFA Nonsense word test must refer to the user manual because some items were not included in the training videos, such as the normative data and the random list. Next, previous studies had established the normative data for online scoring methods with different talker genders and intensity levels. However, no normative data is available for manual scoring using the Patient's Written Response Sheet and Patient's Verbal Response Sheets. The online scoring method requires clients to type their answers in an google form and autoscoring will be done for the clinicians. The manual scoring methods require clients to either (1) handwrite their answers on the Patient's Written Response Sheet and the clinicians will calculate the scores manually or (2) repeat their answers verbally and the clinicians will score on the Patient's Verbal Response Sheets manually. Typing may associate with more cognitive load than handwriting (Shibata & Omura 2018). Therefore, an investigation regarding whether the difference in method of scoring would contribute to different recognition scores should be done to ensure the accuracy of the interpretation of the client's performance.

It is unknown whether different response task will affect the test results. Hence, establishing normative data for different scoring methods is important, as it is uncertain if using different methods yields significantly different results. Normative data is warranted to interpret the patient's speech perception performance accurately. Future studies related to the MFA Nonsense Word Test should focus on establishing performance-intensity function using manual scoring methods, including the Patient's Written Response Sheet and Patient's Verbal Response Sheets. In addition, it is necessary to update the user manual and training videos from time to time when there are new findings to ensure that the materials are up-to-date.

CONCLUSION

The MFA Nonsense Word Test user manual and the training videos have been developed and validated in this study. The user manual and training videos are valid and suitable to be used by non-Mandarin-speaking audiology students. The training module utilised in this study, which consists of self-learning and practical sessions, effectively improves the students' self-perceived ability and confidence in conducting the test. The user manual and training videos are appropriate to be used as guidelines in helping the future audiologists and audiology students who wish to administer the test. Towards completing this study, the MFA Nonsense Word Test can be fully implemented in audiology clinics, with KASP, UKM as the model.

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APPENDIX: THE PRE-WORKSHOP, PRE-PRACTICAL AND POST-WORKSHOP QUESTIONNAIRES

Perception Towards The Use Of The Mandarin Fricative-Affricate (MFA) Nonsense Word Test With Manual And Training Workshop

Dear Participants,

You are invited to complete this online questionnaire to determine the perception towards the use of the MFA Nonsense Word Test with manual and training workshop. This inventory consists of 7 items each. You are required to fill out this questionnaire at **three** time points: pre-workshop, pre-practical and post-workshop.

Pre-workshop – has not yet read the manual and conduct the practical

Pre-practical – has read the manual but not yet conduct the practical

Post-workshop – has read the manual and conducted the practical

Your expert judgement is needed to help us improve the content of the workshop.

Please select one of the four scores (1, 2, 3, 4 or 5) when you are evaluating each of the items:

= Very Poor / Strongly Disagree

= Poor / Disagree

= Neutral

= Good / Agree

= Very Good / Strongly Agree

In addition, kindly provide any additional comments or suggestions to help us to improve the content of the workshop. Thank you.

	Statements	Totally Disagree 1	Disagree 2	Neutral 3	Agree 4	Totally Agree 5	Source of reference
1	I am able to conduct the MFA Nonsense Word Test with confidence.						(Amri et al., 2019; (Chong et al., 2022)
2	I am able to explain and demonstrate the procedures to conduct the MFA Nonsense Word Test to someone who has no experience with the test.						(Chong et al., 2022)
3	I am confident to score a patient's responses.						(Amri et al., 2019)
4	The MFA Nonsense Word Test is an effective tool in accessing the speech perception ability in Mandarin-speaking adult patient.						(Johnston et al., 2020)principles of transformative learning, and included sessions co-designed with people living with breathlessness. Registrants were invited to complete pre and post-workshop surveys. Pre and 1-week post-workshop online questionnaires assessed familiarity and confidence about workshop objectives (0[lowest]-10[highest] visual analogue scale
5	If the test is available at my workplace, I will conduct the MFA nonsense word test to the patient.						(Chong et al., 2022)
6	I will recommend this MFA nonsense word test to my superior to be implemented at my workplace.						(Chong et al., 2022)
7	I will recommend this MFA nonsense word test manual to other colleagues.						(Chong et al., 2022)

Feedback (Optional):