Consonant Screening Application

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Abstract

The objectives of this study were to determine the content validity of the tool, 'Application for Consonant Screening' for normal children aged 2-3 ½ years old with and without cleft lip and palate (CLP). The procedures used in this study included 1) review of literature; 2) establishment of words, composition of initial consonants that were common defects in compensatory articulation disorders (CAD) for children with cleft lip and palate (CLP); 3) design the application; 4) develop the first version of Application for Consonant Screening; 5) Assess Index of Item Objective Congruence (IOC); 6) Tried out to find face validity in 7 children (5 normal and 2 children with CLP). The results showed that the Application for Consonant Screening had IOCs of technical and content agreements of 0.93 and 0.92, respectively. The study concluded that the Application for Consonant Screening could be used as an appropriate tool for articulation screening for children aged 2 - 3 ½ years old.

Introduction

Speech is a process related to the coordination of respiration, phonation, resonation, and articulation. Respiration generates airflow to vibrate vocal cords for phonation or acoustic energy in voice sounds or pass through vocal tract (e.g., pharynx, nasal, oral cavities). Without vocal cord vibration in voiceless sounds, then resonation and articulation (movement of speech organ) modify acoustic energy into different words and meaning. For resonation, the soft palate separates the oral and nasal cavities. If the soft palate closes or contacts the posterior pharyngeal wall, it will produce oral sounds such as fricative sounds (/s, f/), plosive sounds (/p, b, k/), affricate sounds (/t/, th/). On the other hand, if the soft palate opens or contacts the posterior pharyngeal wall, it will produce nasal sounds (/m, n, ng/). (Prathanee, 2014)

Table 1: Development of Thai consonant pronunciation (Prathanee, 2014)

Age (years)	Sounds that normal children can speak clearly.
2.1 - 2.6	/m/ /n/ /h/ /j/ /kʰ/ /ʔ/
2.7 - 3.0	Add sound /w/ /b/ /k/ /p/
3.1 - 3.6	Add sound /tʰ/ /t/ /l/ / tɕ/ /pʰ/ and all tonal and vowels
3.7- 4.0	Add sound /ŋ/ /d/
4.1 - 4.6	Add sound /f/
4.7 - 5.0	Add sound / tɕʰ /
5.1 - 5.6	Add sound /s/
Ages 7 and up	Add sound /r/

The children with cleft lip and palate have high risk for speech and language disorders. The overall rates of delayed language development, articulation disorders, resonance disorders, voice disorders, and hearing disorders were 16.33% (95% CI = 12.65-20.69), 88.56% (84.47-92.65), 43.26% (95% CI = 36.58-49.93), 19.13% (95% CI = 14.26-24.82), and 79.49% (95% CI = 74.28-84.70), respectively (Thanawirattananit & Thanaviratananich, 2013). Most children with CLP had CAD. Currently, advanced communication technology has become essential tools for communication. Different forms of social media platforms such as Facebook, Facetime, Twitter, Line, or What applications accessible either mobile phone or ipad, are commonly used in daily life. These social media might negatively or positively affect children's learning process. Spending too much time on phone or computer screens affects a child's brain development resulting to lack of social interpersonal skill, and to deprivation of stimuli from the environment. In addition, social media is useful for children's development if they use it within caregivers' monitoring and if they set limits on social media usage (Margalit, 2016; Goold, Herring, & Auckland, 2019; Radesky et al., 2016) Recommended that parents and caregivers need to develop a family media plan that takes into account the health, education and entertainment needs unique to each child and as well to the whole family The AAP's recommendation follow to age group as follows: (Council on Communications and Media, 2011)

For children younger than 18 months: Avoid using screen media other than video call. Parents of children aged 18 to 24 months who want to introduce digital media should choose high-quality program and accompany their children to help them understand what they are watching.

For children ages 2 to 5 years: Limit screen use to 1 hour per day of high-quality programs. Parents should co-view media with children to help them understand what they are watching and apply it to their life and surrounding.

For children ages 6 and older: Place consistent limits on the time spent using media, and the types of media, and make sure that the media does not take the time away from having adequate sleeping time, physical activities and other behaviors that are essential to health.

Therefore, it is better to use the phone or social media as an educational tool rather than prohibit the children from using it. Toddlers can learn from online video chats. The findings demonstrated that children aged 12–25 months exhibit social and cognitive learning from video chat because it retains social contingency (Myers, LeWitt, Gallo, & Maselli, 2017) Communication technology and social media use by toddlers supports motivation and attention in learning. However, it can negatively affect a child's brain development, eyesight, social interaction with others and other areas of learning. For another advantage, mobile phone become an essential tool of communication in daily life. Application for Consonant Screening via mobile phone might be beneficial for testing consonant errors.

The researchers, therefore, developed the Application for Consonant Screening to screen children who at risk for articulation errors, particularly for children with CLP. It would be early screening and early intervention in articulation errors.

Objectives

To develop an Application for Consonant Screening for normal and children with CLP aged 2-3 1⁄2 years.

Methods

This research was accredited by the Human Research Ethics Committee, University-Khon Kaen University (Certificate Number: HE631116, date of approval 26 May 2020).

Study Design Development the Application for Consonant Screening as follows: Reviewed literature; Established; Designed the application; Developed the first version of Application for Consonant Screening; Assessed Index of Item Objective Congruence (IOC); Tried out to find face validity

1. Reviewed literature

The researchers reviewed literatures related to articulation development and common CAD in children with CLP age of 2-3 1⁄2 years (Prathanee, 2014; Peterson-Falzone, Trost-Cardamone, Karnell, & Hardin-Jones, 2016) Common risks of CAD in children with CLP were:

- Velar sounds
 k/ /kʰ/ - Plosive bilabilal sounds
 /b/ /p/ /pʰ/
- Tongue-tip sounds
 /tʰ/ /t/ /d/
- Mid-dorsal sounds
 /tc/

2. Established words

Established words, composed of initial consonants that were common defects in compensatory articulation disorders (CAD) for children with cleft lip and palate (CLP) based on development theory of Thai consonants (Prathanee, 2014) by age and common CAD. Established words that normal children are familiar and common in daily life such as nouns, names, animals, objects or verbs and could be drawn pictures. These words were 9 groups

followed to:

    Consonants /k/ : /ka/, /kai/, /kop/
    Consonants /kʰ/ : /kʰai/, /kʰa:u/, /kʰeau/
    Consonants /b/: /ban/, /bua/, /ball/
    Consonants /p/: /pu/, /pla/, /pet/
    Consonants /ph/: /pʰom/, /pʰa/, /pʰea/
    Cononents /th/: /tʰua/, /tʰa:uw/, /tʰung/
    Consonants /t/: /Tao/, /Ta/, /Tu/
    Consonant /d/: /da:w/, /dap/, /dek/
    Consonants /t©/: /t©et/, /t©an/, /t©ut/

3. Design an application

Designed and established Application for Consonant Screening by via Adobe Photoshop program.

4. Developed the first version of Application for Consonant Screening

Application for Consonant Screening for Children Ages 2- 3 ½ Years were developed by using Android operating system, Android Studio program and Java, xml for development (So-in, & Chanyoi, 2011; So-in, Chanyoi, & Veeramongkollert, 2012) Application for Consonant Screening composed of 27 pictures in 9 groups of consonants Researchers tried out application functions and revised to be the first version of Application for Consonant Screening.

5. Assessed Index of Item Objective Congruence (IOC);

The first version of Application for Consonant Screening were evaluated by 3 experts as follows:

    Special educator
    Speech and language pathologist
    Technology expert
      IOC: criteria were
        Consistent = +1
        Not sure, = 0
        Inconsistent = -1

After revision followed to experts' comment and suggestion, pictures and application were modified Conformity assessment was displayed in Table 2 and Table 3.

6. Tried out to find face validity

Face validity was explored by trying out Application for Consonant Screening among 7 children (5 normal and 2 children with CLP) ages 2 - 3 ½ years. Testing face validity for normal children was performed by teacher and for children with CLP, testing was

performed by caregivers with researchers' supervision. Testing steps:

Asked child to naming pictures on screen with question "What is this picture?" Put a checkmark (✔) in the box corresponding to the "correct" text of the "spontaneous naming" box. In case the child has a articulation error, put a sign (X) in the box corresponding to the "wrong" text of the "spontaneous naming " box

If child could not answer or name, wait 5 seconds and give a cue (see the accompanying instructions), wait for the child to answer 5 seconds. Put a tick (✔) in the box corresponding to the "correct" text of the " spontaneous naming " box."

If child still could not 't answer, press the speaker button to demonstrate answer or naming. Put a sign (X) in the box corresponding to the "correct" text of the " repetition" box."

Data analysis

The researchers analyzed the data obtained from experts' scores as IOC. with the formula as: (Sinjaru, 2017; Chanaboon, 2007)

$$IOC = \frac{\Sigma R}{N}$$

ΣR = the total of score

N = the number of the experts

Conformity assessment results as shown in table 2 and table 3.

Table 2: Experts' Item Objective Congruence scores (IOC) for content validity

List	Specialist who			IOC value	Interpret results
	1	2	3		
Content and processing					
The correctness of the content	+1	+1	+1	1.0	Congruent
Consistency between content and purpose	+1	+1	+1	1.0	Congruent
Amount of content in each subject	+1	+1	0	0.6	Congruent
Sequence of steps for content presentation	+1	+1	+1	1.0	Congruent
Clarity in explaining the content	+1	+1	+1	1.0	Congruent
Interesting story action	+1	+1	0	0.6	Congruent
Suitability of Content to the Level of Media Users	+1	+1	+1	1.0	Congruent
Image and language					
Correspondence of the content of the images presented	+1	+1	+1	1.0	Consistent
Consistency between the volume of the image and the amount of the content	+1	+1	+1	1.0	Consistent
Size of the image used for the exercise	+1	+1	+1	1.0	Consistent
Loudness	+1	+1	+1	1.0	Consistent
Clear Listening	+1	+1	+1	1.0	Consistent
Correctness of language used	+1	+1	+1	1.0	Consistent
Letters and colors					
Formats of characters used in the presentation	+1	+1	+1	1.0	Congruent
The size of the characters used for presentation	+1	+1	+1	1.0	Congruent
Overall background color	+1	+1	+1	1.0	Congruent
Total				0.92	Congruent

Results

The Application for Consonant Screening for normal and children with CLP aged 2 - 3 ½ years was established. Conformity of IOC in content validity and technical function were 0.93 and 0.93, respectively. Children's correction scores from tried out was displayed in table 4

Table 3: Results of expert application quality assessment (technical)

List	Specialist who			IOC value	Interpret results
	1	**2**	**3**		
Content and story					
Consistency between content and objectives	+1	+1	+1	1.0	Congruent
Content of each subject	+1	+1	+1	1.0	Congruent
Content motivates learning	+1	+1	0	0.6	Congruent
Image and language					
Correspondence of the content of the images presented	+1	+1	+1	1.0	Congruent
Size and clarity of the images used.	+1	+1	+1	1.0	Congruent
Pictures used for illustration	+1	+1	+1	1.0	
Correctness of language used	+1	+1	+1	1.0	Congruent
Letters and colors					
Formats of characters used in the presentation	+1	+1	+1	1.0	Consistent
The size of the characters used for presentation	+1	+1	+1	1.0	Consistent
Overall background color	+1	+1	+1	1.0	Consistent
Color of pictures and overall graphics	+1	+1	+1	1.0	Consistent
Keypad (Icon) or usage menu There is clearly a suitable size position.	+1	+1	+1	1.0	Consistent
Subject matter management					
Presentation of the main media title	+1	+1	+1	1.0	Congruent
Overall screen design	+1	+1	+1	1.0	Congruent
Interesting to follow	+1	+1	0	0.6	Congruent
Use of learning materials on mobile					
Ease and ease of use of media	+1	+1	+1	1.0	Congruent
The media is appropriate. Beautiful	+1	+1	+1	1.0	Congruent
Media can encourage learners to learn	+1	+1	+1	1.0	Congruent
Total				0.93	Congruent

Table 4: Children's correction scores

The person who	Child	Age	gender	Assessment results		
				Spontaneous Naming scores	Repetition scores	Total scores
1	Normal	3 year 5 month	male	25	2	27
2	Normal	2 year 6 month	female	21	6	27
3	Normal	2 year 3 month	female	16	11	27
4	Normal	3 year 3 month	male	24	3	27
5	Normal	3 year 0 month	male	22	5	27
6	Cleft lip and cleft palate	2 year 11 month	female	20	7	27
7	Cleft lip and cleft palate	2 year 8 month	female	16	11	27

Face validity from trying out 7 children, table 4 presented children's correction scores. Table 5 revealed the words that most children could not naming were "/bu:a/ and /t©ut/". For the 2nd version, these 2 words were replaced with picture of /bin/ (fly) and /t©ap/ (catch) and changed the cueing questions to be "What does a bird do? and "What does this child do?". Caregivers informed that the picture of "/dek/" (child) was not clear which was revised as caregivers' suggestion.

Table 5: Percentage of correction scores from face validity

Words	No. 1 3Y/ 4 M	No.2 3Y/ 5 M	No. 3 3Y/ 6 M	No. 4 2Y/ 0 M	No. 5 2Y/ 6 M	No. 6 (Cleft lip and cleft palate) 2Y/ 11M	No. 7 (Cleft lip and cleft palate) 2Y/ 8 M	Percentage children can tell for themselves	Percentage of children answered after referring	Total	Percentage of correct answer after repeating
Ka	✓	✓	X	✓	✓	✓	X	52	20	72	100
keiw	✓	✓	X	✓	✓	✓	X	52	20	72	100
bua	X	X	X	X	X	X	X	0	0	0	100
pha	✓	✓	X	✓	X	X	X	29	14	43	100
phea	✓	X	X	✓	✓	X	X	29	14	43	100
thue	✓	✓	X	✓	✓	✓	X	52	20	72	100
tu	✓	X	X	✓	✓	X	X	29	14	43	100
dab	✓	X	X	✓	✓	X	X	29	14	43	100
dek	X	X	X	✓	X	X	X	14	0	14	100
thet	✓	X	X	✓	✓	✓	X	43	14	57	100
thud	✓	X	X	X	X	X	\X	14	0	14	100

***(CLP = Cleft lip/palate)

Table 5: Children's correction scores of the 2nd version of application of consonant screening

Words	No. 1 3Y/ 4 M	No.2 3Y/ 5 M	No. 3 3Y/ 6 M	No. 4 2Y/ 0 M	No. 5 2Y/ 6 M	No. 6 (Cleft lip and cleft palate) 2Y/ 11M	No. 7 (Cleft lip and cleft palate) 2Y/ 8 M	Percentage children can tell for themselves	Percentage of children answered after referring
/Bin/	✓	✓	X	✓	✓	✓	X	72 %	100
/Dek/	✓	X	X	✓	✓	X	X	42 %	100
/tⓒap	✓	X	X	✓	✓	X	X	42 %	100

***(CLP = Cleft lip/palate)
Regend: Y= Year, M= Month

Discussion

The Application for Consonant Screening for normal and children with CLP aged 2 - 3 ½ years was established. Validities for content and technical function were excellent (IOC = 0.92 and 0.93). These revealed that the Application for Consonant Screening was a valid tool for consonant testing in children aged 2-3 years old and IOCs were higher than the previous tool on title "Teaching materials for communication skills of children with autism" (Jitrungwitthaya, 2014) that found IOCs in content and technical function were excellent (IOC = 0.83 and 0.82, respectively.) The face validity found three words (/bu:a, tⓒap, dek/) that were too difficult and most children could not name after cuing. The 2nd version was revised and replaced with new words and they could significantly name both by themself and after cuing. In conclusion, the Application for Consonant Screening for normal and children with CLP aged 2-3 years old was appropriate in testing for early diagnosis and early plan for intervention.

limitations

This Application for Consonant Screening was a tool for screening the common consonant errors in children which need formal assessment from professional or speech and language pathologist in case of children have articulation defects.

Suggestion for the further research

The Application for Consonant Screening should be applied for consonant screening in children aged 2-3 ½ years old, particularly in children with CLP to early detection and early articulation correction

The Application for Consonant Screening should be applied for referential population in the future.

If the screening presents articulation errors, children should be referred to a specialist or speech and language pathologist for formal or standard evaluation and intervention.

Acknowledgment

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