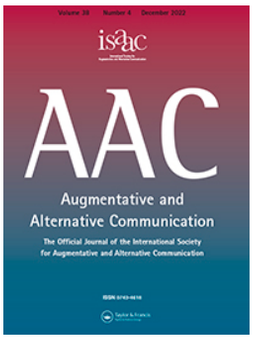

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RESEARCH ARTICLE

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Speech-language pathologists' perceptions of augmentative and alternative communication in Thailand

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ABSTRACT

Augmentative and alternative communication (AAC) systems are not well-known and broadly used in Thailand. To begin introducing AAC systems and interventions to children with complex communication needs in Thailand, understanding speech-language pathologists' (SLPs) perceptions toward various AAC systems is an important first step. This study assessed SLPs' perceptions of three AAC modalities: gestural communication, communication boards, and iPad[1]-based speech-output technologies. A total of 78 SLPs watched three video vignettes of a child using each mode and rated their impressions of intelligibility, ease of learnability and use, effectiveness, and preference. Then they were asked to rate factors on visual analog scales that provided additional insights into their rationales and their preferences for AAC modalities for nonverbal clients and for themselves if they were nonverbal. The results indicated that most of the SLPs rated iPad-based speech-output technologies as being the more intelligible, effective, and preferred mode of communication. Gestural communication was rated as the easiest mode to learn and use for a child with complex communication needs. Despite infrequent use of iPad-based speech-output technologies in Thailand, SLPs' ratings indicated high social acceptance of this modality for promoting communication abilities of children with complex communication needs. Results also revealed some biases and lack of knowledge about AAC systems in Thailand.

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Communication plays a significant role in our daily living. The lack of functional communication skills reduces independence and self-determination (Drager et al., 2010), as well as social participation and overall well-being (Anaby et al., 2011; Hyppa-Martin et al., 2016). Researchers have found that augmentative and alternative communication (AAC) can promote communication competencies and decrease challenging behaviors in children with complex communication needs (Branson & Demchak, 2009; Drager et al., 2010; Ganz et al., 2012; Machalicek et al., 2010; Romski et al., 2015; Schlosser & Wendt, 2008). Communication competencies include the quality of communication functions; an adequate level of communication skills; and sufficient knowledge, judgment, and skill to communicate in daily living (Light, 1989). One significant factor that effects success in AAC implementation is clinicians' perspectives on AAC systems (Alant et al., 2006; Baxter et al., 2012; Marshall & Goldbart, 2008; Murphy et al., 1996; Smith & Connolly, 2008). Because speech-language pathologists (SLPs) are the professionals who play a key role in screening, assessing, diagnosing, and treating persons requiring AAC intervention, their perspectives are especially important to evaluate.

Perceptions about AAC can be a barrier to accessing AAC systems (Clarke & Wilkinson, 2008; Iacono & Cameron, 2009; Johnson et al., 2006; McCarthy & Light, 2005). Schlosser (1999) suggested that social validity, and especially social acceptability, of various AAC interventions be evaluated. Presumably, the AAC modality receiving more favorable social acceptability ratings would be more likely to facilitate effective communication and, importantly, acceptance in society; therefore, understanding SLPs' perceptions may inform what AAC systems will be broadly accepted (ASHA, n.d.; Beck et al., 2010; Triandis et al., 1984).

Schlosser (1999) proposed a social validation framework to gather perceptions of different AAC modalities, including (a) intelligibility of the modality, (b) ease of use/learnability, (c) effectiveness of the modality with a communication partner, and (d) preferred modality. Along these lines, Achmadi et al. (2015) evaluated the perceptions of undergraduate students in New Zealand toward manual signs, picture-exchange communication systems, and a speech-generating device (SGD). The findings indicated that SGDs received the highest mean ratings for intelligibility, effectiveness, and preference whereas picture-exchange communication systems were perceived as the easiest AAC mode to learn and use. Similarly, Schäfer et al. (2016) reported that American undergraduate students and teachers perceived speech-output technology to be the easiest to learn and use and the most intelligible, effective, and preferred AAC mode,

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[1]iPad is a product of Apple Computers Inc., Cupertino, CA, www.apple.com

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compared to manual sign and the picture-exchange communication system.

Although much research on AAC interventions has been conducted in western countries, simply applying these findings to non-western countries may be inappropriate. Differences in culture, language, service delivery patterns, and professionals' AAC knowledge are important considerations (Dada et al., 2017; Muttiah et al., 2022; Tönsing et al., 2018). For example, Tönsing et al. (2018) and Singh et al. (2017) indicated that multilingualism in South Africa and Malaysia, respectively, complicated the implementation of AAC interventions. As such, AAC research exploring challenges affecting use of AAC systems in non-western countries is required to gain an understanding of unique needs and eventually how to address them.

According to Thailand statistics, approximately 27,747, or 36% of children aged birth to 14 years of age were diagnosed with multiple disabilities or autism spectrum disorder (Department of Empowerment of Persons with Disabilities, 2021). This represents a sizable population of children who might benefit from AAC. The few studies about AAC use in Thailand have reported on developing AAC applications for individuals (e.g., Chompoobutr et al., 2009, 2011, 2013). A notable gap in the research is speech-language pathologists' perspectives about AAC. This information would be useful to rehabilitation professionals interested in introducing AAC intervention approaches in Thailand and other countries.

Accordingly, the aim of this study was to investigate Thai SLP perceptions toward three AAC modalities demonstrated in three video vignettes: gestural communication, communication boards, and iPad-based speech-output technologies. Consistent with prior research (Achmadi et al., 2015; Schäfer et al., 2016), data were collected on SLP ratings of intelligibility, ease of learnability and use, effectiveness, and preference. Information also was gathered on a variety of other factors that influenced their ratings (e.g., affordability, intelligibility, motivating to users, promoted communication development, social inclusion, societal attitudes). The research questions were (a) What were Thai SLP's perceptions of the three AAC modalities and how did they weigh factors that affected their judgments? (b) Which modality did the SLPs consider to be the most appropriate to use with nonverbal children? (c) Which modality would the SLPs choose if they themselves were unable to speak?

Method

Participants and settings

All licensed speech-language pathologists in Thailand were eligible to participate in the on-online questionnaire. An invitation to participate was posted for 6 weeks on Thai speech-language pathology group social media sites using Facebook[2] and LINE[3] (i.e., an online communication platform compatible with smartphones, tablets, and computers). Although the first author posted originally, other SLPs reposted to encourage participation. The number of SLPs who read the postings is unknown.

Details about the study, including consent forms and questionnaires and access to the three videos, were delivered using REDCap (Research Electronic Data Capture), a secure web-based data collection system (Harris et al., 2009). Participants provided informed consent by choosing an option showing that they had read and agreed with the details in the consent form. Of the 204 licensed speech-language pathologists in Thailand, 78 (38%) participated.

Participants' work experience ranged from 1 to 30 years ($M = 10.21$, $SD = 7.72$). All participants reported that they knew about AAC. All but four had experience providing interventions for children with nonverbal communication. Table 1 provided the percentages of children using various communication modes and contrasts them with those typically being taught to nonverbal children. The modalities the clients used most frequently included gestural communication (38%), vocalizations (29.4%), and facial expressions (22.2%), often in combination. The participants reported that they most often taught natural gestures (28.9%), speech communication (19.9%), vocalizations (17.5%), facial expressions (13.3%), and photographs (8.1%). Other communication modalities were used and taught infrequently. Although the participants had experience working with children with nonverbal communication, they mainly used unaided AAC to communicate with those children.

Research design

Survey research was conducted to investigate Thai SLPs' impressions of three AAC modalities (i.e., gesture, communication board, and iPad-based speech-output technologies). To provide a consistent context for providing feedback about the three communication modes, video vignettes with a Thai child demonstrating each of the AAC modalities were developed. Parent permission was provided for an 8-year-old male child to serve as a child actor for all three video vignettes. Three questionnaires were utilized, each of which included a number of items that were rated using a visual analog scale from 0–100, as well as open-ended questions to identify other factors the SLPs considered in their ratings.

Materials

Videos

Three video vignettes were created to illustrate the three communication modalities: gesture, communication boards, and iPad-based speech-output technologies. Each video displayed a Thai child communicating five communicative functions – greeting, answering, rejecting, asking, and requesting– using each of the three modalities.

The child performing in the video was an 8-year-old Thai boy with typical speech and language development in Thai and English. Prototype versions of a communication board and an iPad-based speech-output technology were created

[2]Facebook is a social networking platform that facilitates online connections.

[3]LINE is a freeware app for instant communications on electronic devices such as smartphones, tablet computers and personal computers.

Table 1. SLPs' reports of the communication modes used by children contrasted with the modes typically taught.

Modes of Communication	Modes used by children	Modes taught by SLPs
Natural gestures	69 (38.3%)	61 (28.9%)
Speech	NA	42 (19.9%)
Vocalizations	53 (29.4%)	37 (17.5%)
Facial expressions	40 (22.2%)	28 (13.3%)
Photographs	5 (2.8%)	17 (8.1%)
Drawing	4 (2.2%)	17 (8.1%)
Writing	3 (1.7%)	7 (3.3%)
Picture Exchange Communication Systems	2 (1.1%)	6 (2.8%)
Typing	1 (0.6%)	1 (0.5%)
Communication board	1 (0.6%)	2 (0.9%)
Speech-generating device	1 (0.6%)	3 (1.4%)
Sign language	1 (0.6%)	2 (0.9%)

for the child actor to use to communicate with the first author in the video. The prototype for the iPad technology was developed using the SymboTalk[4] AAC-specific application on iPad; recordings of a Thai-adult male with normal voice and speech were used. His speech was recorded word-by-word and uploaded for each word or symbol.

The videos illustrated the child and an adult sitting at a table along with objects (i.e., cookies, car toys, and plush toy) used to elicit the communicative functions. For two of the videos, the iPad-based technologies or a communication board were visible. Each video began with a title labeling which AAC modality participants would be viewing. Each video was approximately 1-min long. The sequencing of communication functions for each modality was greeting, answering, rejecting, responding to a request, asking, and initiating. The order of presenting videos was counterbalanced across participants.

Questionnaire

The questionnaire was written in Thai. It was divided into three sections (a) to identify SLP perceptions pertaining to intelligibility, ease of use/learnability, and effectiveness of the AAC modalities (seven items); (b) to rate factors that influenced SLP perceptions of the modalities (nine items); and (c) to examine SLP modality preferences for nonverbal children (nine items) and themselves, should they ever be unable to communicate (11 items). These items were rated on a visual-analog scale from 0 (*strongly disagree*) to 100 (*strongly agree*). The second and third sections included an optional open-ended question allowing participants to express additional thoughts relating to the use of the three modalities. Except for the optional questions, if any item was left blank, the participant could not continue with the questionnaire.

Validating the video stimuli and questionnaire items

Three Thai SLP graduate students reviewed questions and items and the videos prior to their distribution. To judge the fidelity of video stimuli, the SLPs focused on ensuring they could detect the communication functions illustrated. They rated the functions for each segment using a 5-point scale based on one viewing without access to the written scripts. All three agreed on their recognition of all communication functions illustrated in video stimuli for the three AAC modes. To judge the face validity of the questionnaire, the SLPs reviewed each question and item and rated whether they were easy to understand and conveyed the intention of the dimensions (i.e., intelligibility, learnability, effectiveness, and preference). They edited questions and items until they reached a consensus that each question and item was acceptable.

[4]SymboTalk is an AAC-specific application for Apple's iOS and Google's Android operating systems.

Procedures

Data collection

The questionnaire began with background questions about experience as an SLP (i.e., How long have you been working as an SLP?), AAC knowledge (i.e., Have you heard about AAC before?); and work experience with clients with nonverbal communication (i.e., What communication mode did you teach your client with nonverbal communication to use?).

The first rating section began with a short video providing instructions for viewing examples of different modes of communication, completing the questionnaires, and using the rating system. Then, questions about the SLPs' perceptions of AAC modalities began with the first video vignette and included seven questions. Likewise, the second and then the third video vignettes played next, and questions followed. Each video vignette displayed a specific AAC modality, but the order of presenting the AAC modalities was counterbalanced.

In the next section, the participants answered nine questions about factors that influenced their perceptions of AAC modalities. They viewed a picture and name (i.e., gesture, communication board, and iPad-based generating device) illustrating the AAC mode and responded with their impressions of that mode.

In the final section, the participants were asked to select one preferred modality for children with severe speech impairment and then to rate the importance of the nine factors in deciding on a modality. Then, participants selected an AAC mode that they would prefer to use if they were ever unable to use speech and rated the importance of 11 factors related to this decision.

Data analysis

To analyze participants' impressions of intelligibility, ease of learnability and use, and effectiveness across the three AAC

modalities, a mixed 3 × 6 ANOVA was conducted (i.e., three AAC modes as a within-group factor and the six rating orders as a between-group factor); thus, differences in the mean responses of SLPs for the seven items were evaluated in separate analyses. The interaction effect was reported for the purpose of investigating the order effect that possibly resulted from counterbalancing the order of presenting the videos. If a statistically significant interaction was revealed, indicating that order of viewing effected the main effect of AAC modalities, a repeated measures ANOVA with a covariate (i.e., groups) was conducted to covary out the group effect.

For factors that influenced perceptions of AAC modalities, the ratings were compared for each of the nine factors using one-way repeated measure ANOVAs. For the significant main effects, post-hoc tests using Bonferroni correction were conducted to evaluate the differences among the three communication modalities.

For AAC modality preferences for nonverbal children and themselves, participants' selections of preferred communication modalities were analyzed descriptively to provide summaries of both preferences. The questions that identified the factors that influenced these decisions were summarized, and those with mean scores of 80 or higher (out of 100) were highlighted. To analyze additional comments relating to preferred modalities, the researcher applied conventional content analysis (Hsieh & Shannon, 2005). First, the justifications were sorted into three categories based on the three AAC modalities. Second, the key words and phrases in narrative responses were highlighted and used as preliminary codes for classifying the responses. Finally, the participants' responses were sorted into the existing codes.

Results

SLP perceptions of AAC modalities

This section describes results of analyses of each of the seven topics regarding SLPs' perceptions of each of the three AAC modalities (the full question in the questionnaire is included in parentheses).

Most intelligible: "this mode is easy for SLP to understand a child's communication"

The main effect for the AAC modalities for ratings of intelligibility was significant, $F(2,144) = 14.80$, $p < .001$, partial $\eta^2 = .17$. Post-hoc tests revealed that the SLPs rated iPad-based speech-output technologies ($M = 86.2$) as significantly more intelligible than both gestural communication ($M = 74.0$) and communication boards ($M = 80.2$); the latter conditions did not differ significantly.

SLP learnability and use: "this mode would be easy for SLPs to use or learn to use"

The main effect of AAC perceptions on ease of use and learning was not significant, $F(2,144) = 2.92$, $p = .057$, partial $\eta^2 = .04$. The mean perceptions were all high 82.5–85.6.

Child learnability and use: "this mode would be easy for a child to use or learn to use"

SLPs' mean perceptions on ease of use and learning for children were significantly different among communication modes, $F(2,144) = 22.14$, $p < .001$, partial $\eta^2 = .24$. There was a statistically significant interaction, $F(10, 144) = 2.20$, $p = .021$, partial $\eta^2 = .13$, which indicated that order of viewing affected the main effect of AAC modalities. When the effect of group was covaried out, there was a statistically significant difference in perceptions of ease of use, $F(2,130) = 6.11$, $p = .003$, partial $\eta^2 = .08$. Post-hoc tests using the Bonferroni correction demonstrated that gestural communication ($M = 81.8$) was rated easier for children to use and learn than communication boards ($M = 70.9$), and iPad-based speech-output technologies ($M = 72.8$), $p < .001$; the latter modes did not differ significantly.

Appropriate for child with cognitive delays: "this mode would be appropriate for a child with significant cognitive delays"

There was a statistically significant main effect for SLPs' mean perceptions of communication modes appropriate for children with cognitive delays, $F(2,144) = 15.74$, $p < 0.001$, partial $\eta^2 = .18$. Post-hoc tests reported that gestural communication ($M = 70.5$) was significantly higher than communication boards ($M = 58.7$) and iPad-based speech-output technologies ($M = 58.1$), $p < .001$.

Effective in Thai community: "this mode seems to be effective for a child with nonverbal communication in the community"

The main effect for the AAC modalities for ratings of effectiveness in the community was significant, $F(2,144) = 18.83$, $p < 0.001$, partial $\eta^2 = .21$. Post-hoc tests revealed that iPad-based speech-output technologies ($M = 82.8$) were more effective in the community than gestural communication ($M = 68.5$) and communication boards ($M = 73.5$), $p < 0.001$. The difference between gestural communication and communication board was not significant ($p = .32$).

Less stigma risk: "this mode would not cause a negative image (or stigma) to a child"

The mean perceptions of stigma risk were not significantly different among communication modes, $F(2,144) = 2.88$, $p = .060$, partial $\eta^2 = .04$. There was a statistically significant interaction effect, $F(10, 144) = 2.13$, $p = .025$, partial $\eta^2 = .13$, and when the effect of group was covaried out, there was a statistically significant difference, $F(2,144) = 8.04$, $p < .001$, partial $\eta^2 = .10$. Post-hoc tests using the Bonferroni correction revealed that stigma risk was less with iPad-based speech-output technologies ($M = 59.3$) than with communication boards ($M = 54.4$), $p = .003$, but perceptions did not differ between gestural communication ($M = 56.0$) and communication boards.

Table 2. Means, standard deviations, and main effect of ANOVA of SLPs' perceptions toward nine factors considered for using gestural communication, communication board, and iPad-based speech-output technologies.

	Gesture		CB		iPad		ANOVA	
Factors	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2
1. Affordability	**92.88**	**16.57**	84.16	14.65	52.55	23.48	105.48*	.59
2. Intelligibility	70.23	20.03	79.03	14.45	**85.61**	**12.97**	22.73*	.24
3. Durability	**89.19**	**16.50**	62.20	22.68	73.89	16.82	37.60*	.34
4. Portability	**94.59**	**14.23**	62.84	20.64	72.11	15.92	75.68*	.51
5. Maintenance	**92.77**	**15.87**	59.27	22.86	63.35	19.74	66.70*	.47
6. Motivating to user	81.24	16.30	**63.84**	**20.19**	84.40	12.68	41.60*	.36
7. Promotes speech development	57.56	28.35	64.52	22.26	**73.36**	**19.93**	14.09*	.16
8. Promotes language development	67.56	25.15	72.97	19.16	**80.09**	**17.80**	13.83*	.16
9. Promotes social inclusion	70.45	21.43	71.57	19.15	**77.20**	**15.84**	4.73*	.06

CB: communication board; iPad: iPad-based speech-output technologies; ANOVA: analysis of variance. Bolded numbers indicate significantly higher or lower values among the three communication modalities for each factor.
*$p < .05$

Table 3. Modalities, themes, and illustrative comments regarding SLPs' responses

Modalities	Themes	# of responses	Illustrative comments
Gestures	Cognitive or intellectual level	3	Most children can use gestures if their cognitive development is not severely delayed
	Physical or motor competence	2	Gestures benefit children with few physical problems
	Easy to use	5	Gestural communication is the easiest communication mode
	Intelligibility	4	Parent may misunderstand that the child wanted her to open the door, but he wants her to lock the door.
	Communication partner not familiar with gestures	2	There are significant limitations resulting from using gestures to communicate with unfamiliar communication partners.
	No universal rules for gestures	2	Interpretating gestures depends on the individual.
Communication boards	Cognitive or intellectual level	2	A child with cognitive delays may have limitations in learning to use a communication board.
	Physical or motor competence	1	A child's readiness to learn to use (e.g., physical ability).
	Communication limitation	3	Limitations pertaining variety of sentence formats.
	Communication partner unfamiliar with CB	1	Guessing the meaning of message by unfamiliar communication partner is needed.
	Learn to use	3	Learning about word-symbol correlation is needed
	Number of symbols per page	2	Should not have too many symbols on the communication board.
	Communication speed	1	CB requires time for turning pages to find target words.
iPad-based speech-output technologies	Cognitive or intellectual level	3	Child with cognitive delays may have difficulty learning new material.
	Physical or motor competence	1	Physical ability of users may interfere with using speech output technologies.
	Device competence	1	Effectiveness of iPad-based speech-output technologies depends on competence with the device.
	Communication speed	1	Lower communication rate than with gesture.
	iPad-based functions	2	Typing mode supports users' expression of feelings and emotions.
	Precluding speech development	1	iPad-based speech-output technologies would preclude speech development in children.

Long-Term social benefit: "this mode would be beneficial to the long-term social well-being of a child"

There was a significant main effect for perceptions about social benefits of the three AAC modes, $F(2,144) = 16.47$, $p < 0.001$, partial $\eta^2 = .19$. Post-hoc tests revealed that the SLPs thought that iPad-based speech-output technologies ($M = 71.3$) had significantly ($p = .001$) more social benefit than gestural communication ($M = 55.4$) and communication boards ($M = 63.8$). The latter conditions did not differ significantly ($p = .033$).

Factors that influenced perceptions of AAC modalities

Table 2 shows how SLPs weighted factors influencing their perceptions of AAC modalities. As can be seen in the table, four of the nine factors were weighted significantly higher for gestural communication: portability, affordability, maintenance, and durability. Communication boards were rated as significantly less motivating to users. Four factors were weighted significantly higher for iPad-based speech-output technologies: intelligibility, promotes language development, promotes social inclusion, and promotes speech development.

Table 3 summarizes the themes that were derived from comments about other factors that might be considered when deciding among the three communication modalities. The common themes mentioned included cognitive and physical competence. SLPs were concerned that the breadth of communication that could be conveyed was most limited when using gestural communication. Similar concerns were expressed about a communication board, as well as difficulties in learning its use. Finally, the need for higher cognitive competence was often mentioned when considering use of iPad-based speech-output technologies.

AAC modality preferences for nonverbal children and for SLPs

SLPs' preferred AAC mode for children

Participants selected one AAC mode they believed to be most appropriate for use by children unable to use natural

Table 4. Means and standard deviations of slps' perceptions of gestural communication, communication boards, and iPad-based speech-output technologies as a preferred AAC.

	Gesture			Communication board			iPad		
Factors	*M*	*SD*	*R*	*M*	*SD*	*R*	*M*	*SD*	*R*
Intelligibility	**82.00**	19.14	50–100	**85.94**	14.31	60–100	**91.11**	9.17	70–100
Usefulness in school environments in Thailand	74.38	18.68	50–100	**86.72**	14.31	60–100	**86.30**	10.50	65–100
Attitudes of Thai people toward individuals with nonverbal communication	67.46	22.26	30–100	63.56	26.63	0–100	66.20	21.23	0–100
Familiarity with individuals with nonverbal communication in Thailand	70.69	24.51	30–100	61.78	27.55	20–100	58.20	24.21	0–100
Thai Socio-Economic Status	69.15	25.56	20–100	72.61	28.73	0–100	63.68	24.57	10–100
Thai tradition	60.15	33.59	0–100	64.56	29.41	0–100	58.34	24.61	0–100
Thai people's lifestyle	73.46	23.67	30–100	61.72	27.49	0–100	62.14	22.36	0–100
Cost	**86.38**	18.60	50–100	**83.61**	15.22	50–100	69.84	24.12	10–100
Promotes social inclusion	75.23	17.36	50–100	**80.17**	16.66	50–100	79.25	13.44	50–100

Bolded numbers indicate the means that are higher than 80 among the three communication modalities in each factor

Table 5. Modalities, themes, and illustrative comments on preferred communication modes for nonverbal children.

Modalities	Themes	# of responses	Illustrative comments
Gestures	Being less well-known	1	AAC is not well-known in Thailand.
Communication boards	Socioeconomic status	2	Communication board is suitable for various SES levels
iPad-based speech output technologies	Maintenance	1	Maintenance is easier these days.
	Reduce stress	1	Reduce stress while a child with nonverbal communication is communicating.
	Using multiple communication modes to communicate at once	1	Combining gestures and iPad-based speech-output technology would boost effectiveness of communication.
	Support language development	1	Promote a child's language development.
	Effectiveness	2	The most effective modality among the three AAC modes because it provides voice output.
	Learnability	1	Some children and parent may have problems with learning to communicate by using this modality.

speech and then weighed the importance of nine factors in making their decision. Results revealed that 17.3% chose gestural communication, 24% chose communication boards, and 58.7% chose iPad-based speech-output technologies. Table 4 presents descriptive data on the factors that most influenced decisions.

Gestural communication. The 13 SLPs who believed that gestural communication would be the most appropriate AAC modality for use in Thailand rated cost ($M = 86.4$) and intelligibility ($M = 82.0$) as important factors that influenced their decision.

Communication boards. The 18 SLPs who believed that communication boards would be the most appropriate communication mode considered usefulness in school ($M = 86.7$), intelligibility ($M = 85.9$), followed by cost ($M = 83.6$) and social inclusion ($M = 80.2$) as the factors that influenced their decision the most.

iPad-based speech-output technologies. The 44 SLPs who chose iPad-based speech-output technologies as the most appropriate mode, rated intelligibility ($M = 91.1$), followed by use in school ($M = 86.3$) and promotes social inclusion ($M = 79.3$) as the factors that most affected their decision. The mean rating for cost dropped ($M = 69.8$), followed by attitude toward individuals with nonverbal communication ($M = 66.2$), Thai socio-economic status ($M = 63.7$), Thai people's lifestyle ($M = 62.1$), familiarity with nonverbal communication ($M = 58.2$), and Thai traditions ($M = 58.3$).

Table 5 summarizes themes derived from SLP comments on other factors that influenced their perceptions of the most appropriate communication modality for a child with nonverbal communication. There was one comment about the fact that AAC is not well-known in Thailand and one comment about socioeconomic status as a consideration for selecting communication boards. There were more varied comments for iPad-based speech-output technologies, as the SLPs tended to pay more attention to the factors of maintenance and effectiveness.

SLPs' preferred AAC mode for themselves

Participants selected one AAC mode they would prefer to use if they were unable to speak themselves and then rated the importance of 11 factors in making their decision (Table 6). Of the 74 participants, four (5.4%) selected gestural communication, 14 (18.9%) selected communication boards, and 56 (75.7%) selected iPad-based speech-output technologies. The rank ordering of factors considered most important varied depending on the mode selected. The following were weighted 80 or above:

Gestural communication. The four SLPs who preferred to use gestural communication rated portability ($M = 86.3$), durability ($M = 85.0$), and maintenance ($M = 85.0$) as the most important factors influencing their decision, followed by affordability ($M = 80.3$). There were no comments pertaining to gestural communication.

Table 6. Means and standard deviations of SLPs' perceptions of gestural communication, communication boards, and iPad-based speech-output technologies as a preferred AAC modality for themselves.

	Gestures ($n = 4$)			Communication Boards ($n = 14$)			iPads ($n = 56$)		
Factors	*M*	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*
1. Affordability	**80.25**	20.66	50–96	70.07	22.54	17–100	78.41	(16.71)	40–100
2. Intelligibility	68.75	21.75	50–90	**83.21**	17.81	50–100	**91.86**	(10.07)	50–100
3. Effectiveness	68.50	21.50	50–90	**84.36**	15.40	50–100	**89.25**	(11.01)	50–100
4. Easy to use	72.50	26.30	50–100	**81.00**	18.86	50–100	**85.27**	(11.85)	50–100
5. Durability	**85.00**	23.81	50–100	76.29	17.95	50–100	75.61	(17.53)	10–100
6. Portability	**86.25**	24.28	50–100	76.71	17.13	50–100	**80.73**	(16.23)	10–100
7. Maintenance	**85.00**	23.81	50–100	70.50	13.74	50–93	75.57	(17.04)	30–100
8. Motivating to user	72.50	26.30	50–100	**80.71**	17.03	50–100	**85.02**	(13.67)	50–100
9. Promotes speech development	70.00	24.50	50–100	71.43	26.24	13–100	78.46	(18.82)	10–100
10. Promotes language development	75.00	23.81	50–100	**86.21**	15.44	50–100	**82.00**	(15.80)	30–100
11. Promotes social inclusion	72.50	26.30	50–100	78.93	19.61	41–100	**82.29**	(15.85)	45–100

iPad: iPad-based speech-output technologies. Bold indicates values that are higher than 80 among the three communication modalities in each factor.

Communication board. The 14 SLPs who preferred to use a communication board rated promotes language development ($M = 86.2$) as the most important factor influencing their decision, followed by effectiveness ($M = 84.4$), intelligibility ($M = 83.2$), easy to use ($M = 81.0$), and "motivating to user" ($M = 80.7$). There was one comment about AAC knowledge and readiness of the Thai population regarding communication boards.

iPad-based speech-output technologies. The 56 SLPs who preferred to use an iPad-based speech-output technology rated intelligibility ($M = 91.9$) as an important factor affecting their decision, followed by effectiveness ($M = 89.3$), easy to use ($M = 85.3$), and motivating to user ($M = 85.0$), promotes language development ($M = 82.3$), promotes social inclusion ($M = 82.3$), and portability ($M = 80.7$). There was one comment about less stress associated with iPad-based speech-output technologies.

Discussion

The purpose of this study was to questionnaire Thai SLPs to understand their perceptions of three AAC communication modalities: gestural communication, communication boards, and iPad-based speech-output technologies. Several studies have pointed out that communication partners' perceptions play a key role in their reactions toward individuals who rely on AAC (e.g., Baxter et al., 2012; Iacono & Cameron, 2009); however, because AAC systems have not been broadly used in Thailand it was unknown whether the perceptions of Thai SLPs would be different from those of SLPs in countries where AAC systems have been used for many years. This was confirmed by the participants, most of whom taught children with nonverbal communication to use unaided AAC systems (80.6%), the majority of which were low-tech. This result is similar to low-resource countries that mainly use unaided, low-tech AAC systems (e.g., Gormley, 2017; Singh et al., 2017).

SLP perceptions of AAC modalities

Overall, SLPs' mean perceptions regarding intelligibility, ease of learnability and use, and effectiveness toward communication boards were lower than those of iPad-based speech-output technologies but higher than those regarding gestural communication. The results indicated that most SLPs considered iPad-based speech-output technologies as being the most intelligible and effective. In contrast, their perceptions regarding ease of learning for the three AAC modes were similar. Gestural communication was considered the easiest mode for a nonverbal child to learn and use.

The SLPs expressed concerns that iPad-based speech-output technologies might not be appropriate for children with significant cognitive delays. Norburn et al. (2016) reported similar findings among school personnel in the United States: Teachers tended to believe that aided AAC systems and especially high-tech systems were harder for children with special needs to learn and use than natural gestures. The main justification underlying the teachers' perceptions included lack of access to resources (i.e., AAC equipment) as well as lack of knowledge about AAC. Robillard et al. (2013) reported positive correlations between cognitive skills (i.e., sustained attention, categorization, and fluid reasoning) and effectiveness in using iPad-based speech-output technologies. However, this does not rule out the potential for teaching children with significant cognitive delays to use iPad-based speech-output technologies. Overall, SLPs have a significant role in selecting appropriate speech-output technologies and teaching children the skills most helpful for using these technologies to communicate (ASHA, n.d.).

Results of this study were largely consistent with Achmadi et al. (2015), who also found that speech-output technologies were rated higher than other modalities for intelligibility and effectiveness but not for ease of acquisition. Achmadi et al. reported that picture exchange was perceived to be easier to learn and use than manual signing; however, the mean ratings for learning and use of picture exchange and speech-generating device were not significantly different.

Factors that influenced perceptions of AAC modalities

The SLPs in the current study saw an advantage in using gestural communication based on affordability, durability, portability, and ease of maintenance. Moreover, gestural communication can be incorporated into SLP intervention without external equipment. Even so, many also perceived communication limitations for children with motor control

difficulties. They also noted that because there are no universal rules for natural gestures, this mode of communication may not be readily understood by unfamiliar communication partners.

In contrast, SLPs saw advantages in the use of speech-output technologies based on intelligibility, motivating to user, promoting user's speech-language development, and social inclusion. Because of the quality of voice output, iPad-based speech-output technologies would alleviate concerns about intelligible communication. They also highly rated the factors related to gaining the attention of children with communication disorders and motivating them to use iPad-based speech-output technologies to communicate. Lorah et al. (2021) investigated the perceptions of typical preschoolers toward preschoolers with autism spectrum disorder across three AAC modalities (speech-output technologies, communication books, and prelinguistic behaviors). Typical preschoolers perceived speech-output technologies as most intelligible and motivating to use because of their responsiveness, universally interpretable, which would allow children who rely on speech-output technologies to be able to communicate with a wider range of people in the community. These findings were consistent with those from Achmadi et al. (2015) and Schäfer et al. (2016), who reported that speech-output technologies were perceived as being the most intelligible AAC mode and the most beneficial in terms of promoting social inclusion. The disadvantages expressed by SLPs in the current study related to fragile device operation and maintenance, which are legitimate barriers to speech-output technology use (Cooper et al., 2009; Dattilo et al., 2008). Additional limitations include only female-synthetic-voice output being available in the Thai language, and challenges around pronouncing different tones of Thai (the Thai language has five tones that reflect different meanings).

The participants perceived that communication boards were least durable, portable, maintainable, and motivating to use. Many expressed concerns about issues of maintenance, durability, and portability. Because communication boards do not include voice output, they noted that intelligibility could be a problem. They also rated communication boards as less motivating than gestural communication and iPad-based speech-output technologies. Johnson et al. (2006) reported that low motivation of both the AAC user and communication partners in using AAC systems may result in abandonment of AAC systems; it is important for SLPs in Thailand to realize this issue and try to prevent abandonment of communication boards.

The participants believed that children who have cognitive delays or visual-spatial problems would not be candidates for using iPad-based speech-output technologies. This understanding is inconsistent with the findings of Robillard et al. (2013), who noted that visual-spatial performance is not considered the most practical predictor of competency for individuals using speech-output technologies. Another misconception among the participants was that speech-output technologies were appropriate only to a child who is unable to speak and would impede speech development of a child who is able to speak. Teachers in Malaysia also expressed this same misconception (Singh et al., 2020). ASHA (n.d.) indicated that all AAC systems, including those using speech-output technologies, need to be considered for those who are unable to rely solely on verbal speech (i.e., clients with nonverbal and unintelligible communication). Similarly, Norburn et al. (2016) reported that some teachers believed that AAC was not appropriate to use with children with autism spectrum disorders and noted that they had not received appropriate training in AAC. Romski and Sevcik (2005) reported that, thanks to advances in technology, there is a broad range of AAC-device options that are available for children with physical limitations, cognitive impairments, and other challenges. Unfortunately, misunderstandings on the part of teachers, SLPs, and other service providers could greatly impede the communication development of children with severe communication disorders who might benefit from AAC systems. Thus, it is important to raise awareness among SLPs about the need for greater knowledge and training to facilitate the appropriate use of AAC systems in Thailand.

AAC modality preferences for nonverbal children

The participants were asked to select one AAC mode that they believed would be the most appropriate for use by children who are unable to rely on natural speech. The majority of preferred iPad-based speech-output technologies (59%) over gestural communication (17%) and communication boards (24%). The SLPs who selected gestural communication considered cost to be an advantage over iPad-based technologies. Although Thailand is an upper-middle-income country (The World Bank, 2022), economic status must be considered when prescribing high-tech AAC, especially because in Thailand, Malaysia, and other low-and middle-income countries there is typically a lack of or no government funding available to assist families (Balandin & Iacono, 1999; Singh et al., 2020; Soto & Yu, 2014). Therefore, it is recommended that SLPs discuss the pros and cons of AAC systems with parents of clients and consider their ability to follow through with purchases, training, and use of recommended AAC systems.

Although the cost of AAC systems is an important consideration, most SLPs who responded to the questionnaire rated iPad-based speech-output technologies as more appropriate to use with children with nonverbal communication. The factor that most influenced this preference was the intelligibility of iPad-based speech-output technologies over natural gestures and communication boards. In addition, the SLPs saw more limitations in using gestural communication (e.g., less intelligible) and communication boards (e.g., less durable, harder to maintain, less portable) compared to the iPad-based speech-output technologies.

These findings are largely consistent with research from countries where there is more widespread use of AAC systems by individuals with complex communication needs. Achmadi et al. (2015) and Schäfer et al. (2016) investigated perceptions among undergraduate and teacher populations

in the New Zealand and the US. They found that speech-output technologies were preferred over manual signing and picture exchange. Hyppa-Martin et al. (2016) and Lorah et al. (2021) reported similar results when investigating young students' preferences of AAC modes. These studies indicate that students preferred SGDs over non-electronic AAC modalities.

SLPs' AAC preferences for themselves

The participants were asked to select one AAC mode that they would prefer to use if they were unable to speak. They overwhelmingly preferred the iPad-based technologies. In fact, more SLPs selected iPad-based speech-output technologies as a preferred modality for themselves (76%) than for children with complex communication needs (59%). These findings are consistent with McLay et al. (2017) and Schäfer et al. (2016) who reported that SLPs own preferences were for speech-output technologies due to intelligibility and ease of use.

Thai SLPs saw advantages in iPad-based speech-output technologies for many reasons, especially intelligibility. The differences in the percentage of SLPs choosing this modality for themselves versus for children with complex communication needs were mainly influenced by the factors of affordability and capabilities (e.g., cognitive development). This may be because the client population in Thailand varies more in socioeconomic status and clients are likely to be less resourced than the SLP population. Therefore, affordability would limit AAC selection options for parents with low incomes. In addition, because many SLPs believed that cognitive impairment would negatively affect the use of SGDs, more preferred gestural communication and communication boards for children with severe speech disorders.

Clinical implications

The current study revealed SLPs' perspectives that may provide some guidance for Thai SLPs seeking to introduce AAC systems to children with nonverbal communication. The results indicate that most SLPs who participated in this study considered iPad-based speech-output technologies as the AAC mode with the most promise for improving communication success for children with severe speech impairments; however, the study also revealed that there are some misconceptions about AAC systems that need to be addressed (e.g., the misconception that SGDs might hinder speech development and so impede children with complex communication needs from attaining benefits from AAC). Reviews of literature have dispelled this assumption and found that AAC systems can be used to support the communication of children with unintelligible speech (ASHA, n.d.).

In general, there is a need to improve training regarding AAC because the population in Thailand relies on SLPs as the experts on communication. With greater knowledge about AAC systems, SLPs also would have more confidence in using AAC systems with their clients (Johnson et al., 2006; Norburn et al., 2016). Finally, the finding that SLPs had concerns regarding affordability has two implications: First, discussions with client' parents about pros and cons of each AAC mode is necessary before selecting the specific communication modality to the client. Second, there is a need for parents and professionals to advocate for communication as a fundamental right and that funding is required to provide equitable access to appropriate services for all children to reach their potential.

Limitations and Future directions

The limited examples of a single child using the three modes of communication provided only a partial depiction of AAC use. The boy actor who played the role of a child with nonverbal communication in the video was a typically developing child, well behaved, and rather efficient in using all three modalities. He used all three modalities fluently and confidently. Even when he was pretending that he was unable to speak and used gestural communication, his gestures were easy to comprehend, which may not accurately reflect the communication capacity of many children with complex communication needs in real life. In addition, the video stimuli viewed before each segment of the questionnaire to help expose SLPs to the three AAC modalities were brief samples and included only five basic communication functions. Findings might have been different if SLPs had watched videos with more complicated communication functions and actual children with complex communication needs. Future research should include more varied and complicated communication functions and real-life settings in the video vignettes. Likewise, it may be possible to gather video illustrations of actual children with complex communication needs who rely on AAC systems.

Another limitation is that four SLPs failed to complete the whole questionnaire, perhaps due to its length. Although a relatively large proportion (38%) of SLPs in Thailand completed the questionnaire, the total number of responses was relatively small. It may be possible to streamline the questions to shorten the questionnaire and capture important information more efficiently in future research.

Investigations of other stakeholders' perceptions toward the modalities used in the current study and other AAC modalities are needed. Other stakeholders would include parents from different socioeconomic status, social circumstances, and areas in Thailand; teachers at special education schools (e.g., teachers from private school and public school in different areas in Thailand); and caregivers in orphanages where many children with complex communication needs in Thailand reside. Longitudinal studies also would allow researchers to track changes in the perceptions and confidence of SLPs after using AAC systems with children with nonverbal communication. Finally, the study of perceptions toward AAC systems should be replicated in other countries to better understand the influence of cultural, language differences, and socioeconomic differences on perceptions.

Conclusion

This study offers useful information to better prepare Thai SLPs to provide access to appropriate AAC modalities for

their clients. Furthermore, study outcomes may help SLPs and others advocate for greater use of AAC systems in Thailand. Even though the vast majority of SLPs who responded to the questionnaire reported being familiar with various AAC approaches, there were some surprising perceptions and potential misunderstandings about AAC systems. Such perceptions possibly preclude services from children who may obtain benefits from AAC systems. The results indicate that speech-output technologies were considered the mode most preferred and rated highest for intelligibility, effectiveness, and ease to learn and use. However, the affordability of attaining and maintaining speech-output technologies need to be considered. Future research should include video illustrations of actual children with nonverbal communication displaying their varied communication capabilities to illustrate the real circumstances that may affect stakeholders' perceptions of ACC modalities more accurately.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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