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The innovative development of the aphasia speech application for Thai adults with aphasia

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ABSTRACT

Background: The growing trend of internet usage among the Thai population, both in terms of user numbers and time spent online, has led to a growing demand for self-training applications. This trend presents opportunities to enhance access to healthcare services, especially in speech rehabilitation for aphasic patients. However, Thailand faces a shortage of speech-language pathologists (SLPs), making mobile applications a viable solution to expand access to treatment and improve patient outcomes.

Objective: This study aimed to develop a digital tool for speech training in adult aphasic patients under the supervision of SLPs and a multidisciplinary team. It also sought to evaluate the tool's effectiveness in improving speech outcomes for aphasic patients and assess user satisfaction among healthcare professionals, healthy participants, aphasic patients, and their caregivers.

Materials and methods: This developmental research was conducted in four phases, starting with a literature review, developing the speech training application, expert validation of the application's content, and tool implementation. The application was tested with 15 SLPs, six physicians, six nurses, six occupational therapists, six physical therapists, six healthy participants, 15 aphasic patients, and 15 caregivers. Based on the feedback from these diverse groups, the application was further refined to address suggestions and improve its usability. The application's efficiency was measured through satisfaction surveys, while its effectiveness was evaluated using Thai adaptation of the Western Aphasia Battery test (WAB-Thai). Pre- and post-training scores were compared following 12 traditional speech therapy sessions with the Aphasia Speech application, each lasting 60 minutes over three months.

Results: Satisfaction levels among healthcare professionals and healthy participants ranged from 4.0 to 4.2, whereas satisfaction levels among patients and caregivers were 3.9 to 4.6, indicating high satisfaction. The WAB-Thai scores showed statistically significant improvements in all areas, including fluency, comprehension, repetition, naming, reading, and the Aphasia Quotient (AQ) scores, with $p<0.05$.

Conclusion: The developed application significantly enhanced the effectiveness of speech training, as evidenced by improved language and speech outcomes across all metrics. High satisfaction levels from users supported its implementation as a valuable tool for continuing speech therapy at home. Further refinements are necessary to optimize its usability, with plans for broader dissemination among healthcare providers to address the shortage of SLPs in underserved regions.

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Introduction

According to the 2019 Burden of Disease study in Thailand, stroke was the leading cause of disability-adjusted life years (DALYs) lost among individuals aged

60 and older, accounting for 11.8% of DALYs lost in males and 12.9% in females. Overall, stroke ranked as the second most significant cause of DALYs lost, following road traffic accidents for males and diabetes for females.[1]

The prevalence of stroke is 1.88% among adults aged 45 and older, with higher prevalence in men than women, and the mean age of stroke onset is 65 years.[2] Approximately 25–50% of strokes result in aphasia,[3-8] an acquired language disorder resulting from brain injury, typically in the left hemisphere. It affects spoken and written expression, comprehension, and reading.[9] Aphasia significantly diminishes patients' quality of life, with 32% of patients reporting limitations in daily activities, 23% experiencing worsened depression, and 24% facing difficulties communicating with others.[10]

Aphasia rehabilitation includes individual therapy, group therapy, and tele-speech therapy, which utilizes technology such as video conferencing tools to provide remote care. Tele-speech therapy improves accessibility, reduces costs, and addresses the shortage of speech-language pathologists (SLPs) in Thailand.[11-14]

As reported by the Electronic Transactions Development Agency (ETDA) in the Thailand Internet User Behavior 2019 report, internet usage has risen to 70% of the Thai population. Adults aged 55-73 spent 10 hours online daily, while those aged 39-54 spent 9 hours and 49 minutes online daily.[15] This significant engagement with digital platforms among older adults underscores the potential for tele-speech therapy solutions in aphasia rehabilitation. By leveraging the widespread internet access, it is feasible to enhance the reach and effectiveness of rehabilitation services, catering especially to the needs of those with communication disorders.

Thailand had 280 SLPs for a population of 65,951,210, resulting in a ratio of 0.42 SLPs per 100,000 individuals.[16,17] Furthermore, the distribution of SLPs presents an issue, as 70% of them worked in Bangkok and the metropolitan area.[18] In response to the shortage of SLPs in Thailand, this study aimed to develop a digital tool for speech training in stroke-induced aphasia, guided by SLPs and a multidisciplinary team, and to evaluate its effectiveness in improving language and speech outcomes and user satisfaction among healthcare professionals, healthy participants, aphasic patients, and caregivers. The application would be specifically tailored for Thai patients, with the goal of increasing accessibility and motivation for training. By integrating technology, patients can achieve comprehensive rehabilitation, leading to improved language and speech skills and an enhanced quality of life.

Materials and methods

The research comprised four phases aimed at the systematic development and validation of the application, as detailed in the 'Development and Validation Process of the Aphasia Speech Application' flowchart (Figure 1). Each phase of the study involved iterative refinement based on empirical feedback, ensuring the application was rigorously tested and adapted to meet the needs of its diverse user groups. In the first phase, the content was developed using exercises from Supawatjariyakul *et al*.,[19] and Sirindhorn National Medical Rehabilitation Institute,[20] which includes comprehension training, phonation exercises, repetition practice, and naming pictures. These features were then provided to programmers for application development, incorporating a scoring system, adjustable difficulty levels, and auditory and visual cues with images and spoken instructions. The application was designed to be compatible with devices running both Android and iOS operating systems. Please see Figure 1 for a visual overview of the application's design and features. In the second phase, the application was validated by five experts using Item-Objective Congruence (IOC) ratings, with revisions made based on their suggestions. The third phase involved testing with six healthy participants and 39 healthcare providers, including six rehabilitation physicians, six nurses, six physical therapists, six occupational therapists, and 15 SLPs. Participants aged 20-60 were required to be Thai, have no neurological impairments, and be able to use mobile applications. Satisfaction was then assessed, and feedback led to further revisions. In the final phase, the application was tested on 15 aphasic patients and their caregivers. The sample size calculation was based on 4,576 stroke survivors in Nonthaburi province.[21-24] Patients were native Thai speakers without dialects, aged 20 or older, with at least a Year 4 of primary school education, and diagnosed with stroke-induced aphasia. They completed 12 one-hour speech therapy sessions using the application, conducted once per week under the supervision of SLPs. The SLPs guided both patients and their caregivers on how to use the application effectively. They underwent a baseline and post-training assessment using Thai adaptation of the Western Aphasia Battery Test (WAB-Thai).[25] Pre- and post-training scores were compared using a paired t-test, and patient and caregiver satisfaction levels were also evaluated.

The research was conducted from November 2021 to September 2024. The study took place at the Speech Therapy Department of Sirindhorn National Medical Rehabilitation Institute and the Faculty of Information Communication Technology (ICT) at Mahidol University.

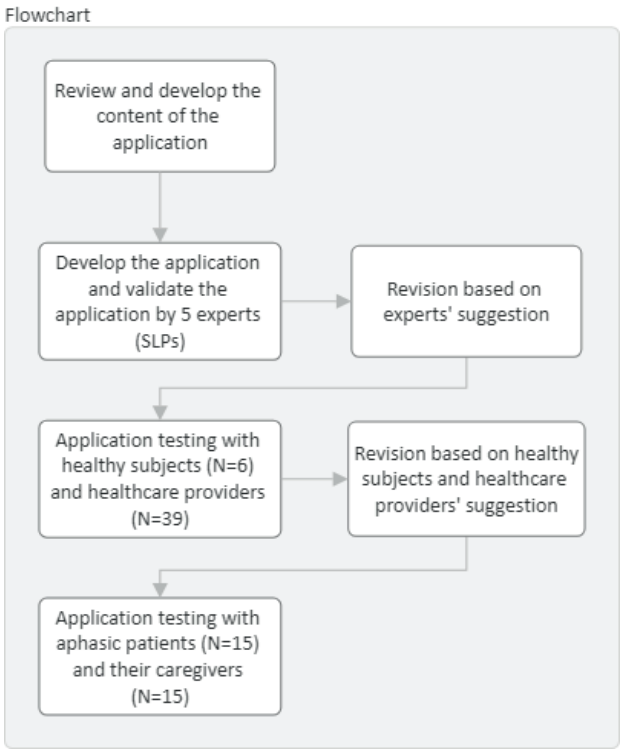

Figure 1. *A Flow chart depicting the development and validation process of the aphasia speech application.*

Results

Results of Phase 1 and 2: Development and validation of the application

Five expert SLPs evaluated the content validity, resulting in IOC scores of 0.6 for listening comprehension, 0.8 for speech production, 0.7 for repetition, 0.7 for naming, and 0.1 for design. Design aspects requiring revision included font clarity (0.4), appropriateness of illustrations (0.0), aesthetic quality and clarity of illustrations (0.2), appropriateness of accompanying sound (0.0), ability for independent use (-0.4), operational smoothness (-0.8), and the ability to record patient data (-0.4). Based on this feedback, revisions were implemented. For example, users reported slow response times, requested a profile deletion feature, and experienced recording issues on some devices. The application had difficulty recognizing soft-spoken words and similar consonants, such as /p/ and /b/ or /t/ and /d/, while certain images were unclear and instructions lacked variety. Additionally, some questions had multiple correct answers, and unfamiliar vocabulary posed challenges. Figure 2 illustrates the final design and features of the application, including the Home Screen and Main Features.

Figure 2. *Application's home screen and main features.*

Results of Phase 3 and 4: Satisfaction levels

The sample group for Phase 3 included 45 individuals: 15 SLPs, six healthy participants, six occupational therapists, six physical therapists, six rehabilitation physicians, and six rehabilitation nurses. The average age was 35.5 years (SD=8.4), ranging from 23 to 52 years, with five males and 40 females. Of these, 33 participants held a bachelor's degree, and 12 had a master's or doctoral degree.

Satisfaction levels were categorized as 0.0-1.4 (very low), 1.5-2.4 (low), 2.5-3.4 (moderate), 3.5-4.4 (high), and 4.5-5.0 (very high). As shown in Table 1, the overall satisfaction score for healthy participants and healthcare providers averaged 4.0, indicating a high level of satisfaction. Perceived ease of use, design, and perceived value were scored 4.1, 4.0, and 4.2, respectively, all indicating high satisfaction. Recommendations included requests for larger buttons, clearer images, automatic progression after correct answers, improvements in voice recognition, and the ability for caregivers or trainers to score speech production exercises based on the patient's ability.

In Phase 4, caregivers reported very high overall satisfaction (4.5). Perceived ease of use was scored 4.6 (very high), with 4.4 (high) and 4.5 (very high) in design and perceived value, respectively. Aphasic patients' overall satisfaction was 4.2, with ease of use at 4.3, design at 3.9, and perceived value at 4.3, all indicating a high level of satisfaction.

Feedback from Phase 4 included suggestions for improving images to be larger and clearer, especially in sections with multiple choices, improving voice output consistency, improving the accuracy of voice recognition, expanding vocabulary in repetition exercises, incorporating images or videos to support pronunciation, and improving button placement, as the repeat button was difficult to press on small devices. Additionally, it was suggested that the level of difficulty in every training session be elevated to increase the challenges for users.

Table 1. User satisfaction with the aphasia speech application among healthy subjects, healthcare providers, caregivers, and aphasic patients.

User satisfaction with the aphasia speech application	Phase 3	Phase 4	
	Healthy subjects & healthcare providers (N=45)	Caregivers (N=15)	Aphasic patients (N=15)
Perceived ease of use			4.3
1. The application menu is easy to use	4.2	4.6	
2. Categories are clearly organized and easily accessible	4.4	4.7	
3. Can be used independently	4.1	4.7	
4. Smooth and continuous operation	3.5	4.5	
Design			3.9
5. The font is clear and easy to read	4.2	4.7	
6. Illustrations are beautiful, clear, and appropriate	3.8	4.4	
7. Buttons are well-arranged and easy to use	3.8	4.6	
8. Accompanying sound is appropriate	3.7	4.2	
9. The language used is clear and easy to understand	4.1	4.4	
10. The level of difficulty is appropriate	4.2	4.2	
Perceived value			4.3
11. Saves on costs for hospital-based speech therapy	4.4	4.5	
12. Enables more frequent practice	4.4	4.7	
13. Overall satisfaction with the application	3.8	4.5	
Overall Average	4.0	4.5	4.2

Results of Phase 4

In Phase 4, aphasic patients and their caregivers tested the application. Patients completed a baseline WAB-Thai assessment, followed by 12 one-hour sessions combining traditional therapy and the application. A post-training WAB-Thai assessment was conducted three months later. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess data normality, with a p-value less than 0.05 indicating a non-normal distribution. The Shapiro-Wilk test was preferred for its higher sensitivity with small sample sizes, while the Kolmogorov-Smirnov test was used for larger datasets.[26] Variables found to deviate from normality included time since stroke onset (p=0.018), caregiver's educational level (p=0.045, 0.015), pre-training naming score (p=0.019), and pre-training reading score (p=0.044). Due to non-normal distributions, non-parametric analyses were applied, with the Wilcoxon Signed Ranks Test used instead of the Paired t-test, although paired t-tests were also conducted for confirmation.

Table 2 presents demographic data for aphasic patients (N=15) and caregivers (N=15). Patients had an average age of 50.5 years (SD=12.2) and an average education of 15.2 years (SD=3.0). The average time since stroke onset was 20.5 months (SD=21.3). Among caregivers, the average age was 46.0 years (SD=14.3), with 15.4 years of education (SD=2.5). Caregivers were predominantly female (73%) and were mainly spouses (47%), followed by children (33%), other relatives (13%), and parents (7%).

Table 2. Demographic information of participants in phase 4.

Characteristics	Aphasic patients (N=15)	Caregivers (N=15)
Gender		
- Males	7 (47%)	4 (27%)
- Females	8 (53%)	11 (73%)
Age (years)	50.5 (12.2)	46.0 (14.3)
Education level (years)	15.2 (3.0)	15.4 (2.5)
Stroke onset (Months)	20.5 (21.3)	-
Relationship with patient	-	
- Parent	-	1 (7%)
- Spouse	-	7 (47%)
- Child	-	5 (33%)
- Relative	-	2 (13%)

***Note**: Values are presented as mean (SD).*

Regarding application usage, 13% of participants used it once a week, 13% used it 2-3 times weekly, 67% used it 4-5 times weekly, and 7% used it more than 5 times weekly. For session duration, 40% used the application for under 15 minutes, 53% for 15-30 minutes, and 7% for 31-45 minutes, with no sessions exceeding 45 minutes. The most practiced activity was naming (67%), followed by repetition (53%), phonation (47%), and comprehension (27%).

Table 3 presents the differences between baseline and week 12 scores across various speech and language measures, which were analyzed using both the Paired t-test and the Wilcoxon Signed Ranks Test. Significant improvements were observed across all measures, with p-values less than 0.05, indicating statistical significance. The results from the Paired t-test closely aligned with those from the non-parametric Wilcoxon Signed Ranks Test, supporting the robustness of the findings. The largest improvement was observed in the Aphasia Quotient (AQ) scores, with a mean increase of 10.2 (SD=8.3) and a p-value of less than 0.001.

Table 3. Difference between baseline and week 12 scores using paired T-test and Wilcoxon Signed Ranks Test.

	Mean (SD) baseline (N=15)	Mean (SD) week 12 (N=15)	Paired t-test			Wilcoxon Signed Ranks Test	
			Mean Diff. (SD)	95 % CI	Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
Fluency	4.3 (2.6)	5.0 (2.9)	0.7 (0.9)	0.2-1.2	0.012*	-2.46[b]	0.014*
Comprehension	4.9 (3.0)	6.2 (2.8)	1.3 (1.5)	0.5-2.1	0.004*	-2.73[b]	0.006*
Repetition	4.6 (3.4)	5.6 (3.7)	1.0 (1.5)	0.2-1.8	0.015*	-2.75[b]	0.006*
Naming	4.0 (3.7)	5.2 (3.6)	1.2 (1.3)	0.5-1.9	0.004*	-2.94[b]	0.003*
Reading	5.7 (3.3)	6.9 (3.1)	1.2 (1.0)	0.6-1.8	0.001*	-3.19[b]	0.001*
AQ	44.3 (28.3)	54.5 (30.6)	10.2 (8.3)	5.7-14.8	<0.001*	-3.29[b]	<0.001*

Table 4 shows the comparison of the distribution of aphasia types among participants at baseline and week 12. Notably, the number of participants with global aphasia decreased from 6 (40%) at baseline to 3 (20%) at week 12, while the number of participants with anomic aphasia increased from 4 (27%) to 6 (40%). Minimal changes were observed in the distribution of other aphasia types.

Table 5 presents the results of the subgroup analysis comparing the mean score differences in each domain between participants aged 50 years or younger and those aged over 50 years. The independent t-test and Mann-Whitney U test results indicated no statistically significant differences in the Pre- and post-training mean scores for fluency, comprehension, repetition, naming, reading, and AQ scores between the two age groups. The p-values ranged from 0.187 to 0.972, all of which exceeded the significance threshold of 0.05.

Table 6 presents the results of the subgroup analysis comparing the mean score differences between participants with post-stroke durations of 1 year or less and those with durations of more than 1 year. The independent t-test and Mann-Whitney U test results indicated no statistically significant differences in the pre- and post-training mean scores for fluency, comprehension, repetition, naming, reading, and AQ scores between the two groups. The *p* values ranged from 0.731 to 0.954, all of which exceeded the significance threshold of 0.05.

Table 4. Comparison of types of aphasia at baseline and week 12.

Types of Aphasia	Baseline (N=15)	Week 12 (N=15)
Global	6 (40%)	3 (20%)
Isolation	1 (7%)	1 (7%)
Wernicke's	2 (13%)	2 (13%)
Broca's	1 (7%)	2 (13%)
Transcortical motor	1 (7%)	1 (7%)
Anomic	4 (27%)	6 (40%)

Table 5. Comparison of mean differences in speech and language scores between participants aged 50 years or younger and those aged over 50 years.

	Mean differences (SD)		*p* value[a]	Asymp. Sig.[b]
	Age ≤50 years (N=7)	Age >50 years (N=8)		
Fluency	0.9 (1.1)	0.5 (0.8)	0.464	0.481
Comprehension	1.5 (1.0)	1.2 (1.8)	0.710	0.728
Repetition	0.5 (0.6)	1.5 (1.8)	0.187	0.522
Naming	1.2 (1.6)	1.2 (1.1)	0.928	0.728
Reading	1.1 (0.5)	1.0 (1.4)	0.972	0.294
AQ	10.1 (5.1)	10.4 (10.7)	0.949	0.728

***Note**: [a]Independent t-test, equal variances assumed, two-sided p value, [b]Mann-Whitney U Test, 2-tailed.*

Table 6. Subgroup analysis of mean score differences in each domain between participants with post-stroke duration of 1 year or less and those with post-stroke duration of more than 1 year.

	Mean differences (SD)		*p* value[a]	Asymp. Sig.[b]
	Post onset 0-12 months (N=8)	Post onset >12 months (N=7)		
Fluency	0.6 (0.7)	0.7 (1.1)	0.856	0.898
Comprehension	1.2 (1.9)	1.4 (0.9)	0.787	0.908
Repetition	1.1 (1.4)	1.0 (1.6)	0.952	0.907
Naming	1.2 (1.3)	1.2 (1.5)	0.952	0.954
AQ	10.4 (10.5)	10.0 (5.6)	0.930	0.728
Reading	1.1 (1.4)	0.9 (0.5)	0.731	0.771

***Note**: [a]Independent t-test, equal variances assumed, two-sided p value, [b]Mann-Whitney U Test, 2-tailed.*

Discussion

This study aimed to develop a digital tool for speech training in adult aphasic patients supervised by SLPs and a multidisciplinary team. Additionally, the study sought to evaluate the effectiveness of the tool in enhancing speech outcomes for aphasic patients and assess user satisfaction.

The application was designed based on a literature review and speech therapy exercises.[19,20] Content validity was assessed by five expert SLPs, yielding an IOC score of 0.6. Design revisions were made according to the experts' recommendations. The application was further evaluated by a multidisciplinary group of 45 individuals, including rehabilitation professionals and healthy participants. Overall satisfaction ranged from 4.0 to 4.2, indicating high satisfaction. Feedback from the group was incorporated into the application, which was then tested on patients and their caregivers. Reported satisfaction ranged from 3.9 to 4.6, indicating strong approval from both patients and caregivers.

When combined with traditional therapy, the Aphasia Speech application was tested on 15 stroke patients with aphasia, who completed 12 one-hour sessions over 3 months. The WAB-Thai test showed significant improvements in fluency, comprehension, repetition, naming, reading, and AQ scores. Both the Paired t-test and Wilcoxon Signed Ranks Test indicated statistically significant improvements between pre- and post-training scores, confirming the effectiveness of the training.

The statistically significant improvement in patients' average language ability scores can be attributed to the frequency of speech training they received. Patients attended speech therapy sessions for one hour per week, and the majority (67%) continued practicing at home 4-5 times per week. Of these, 53% practiced for 15-30 minutes per session, while 40% practiced for less than 15 minutes per session. This consistent practice contributed to the improvement in language and speech abilities across all areas.

These findings aligned with the study by Ngamsuriyaroj et al., which demonstrated that game-based aphasia training applications significantly improved patients' abilities when practiced for 10-15 minutes per day, once per week, over eight consecutive weeks. Pre- and post-treatment comparisons showed improvements in all abilities. Additionally, the use of the application increased the frequency of home practice.[27] Similarly, Garcia found that the use of the 'Theraphasia' application for 10-15 minutes per day, once a week, for eight consecutive weeks resulted in improvements in all subtests of the Quick Aphasia Battery (QAB), including alertness, speech ability, language comprehension, picture naming, repetition, and reading.[28]

Considering the severity levels of aphasia,[25,29] post-training results showed a decrease in the number of patients with the most severe type, global aphasia, from six individuals (40%) to three individuals (20%). Meanwhile, the number of patients with the least severe type, anomic aphasia, increased from four individuals (27%) to six individuals (40%). Survey results indicated that the most frequently practiced activity was word-naming exercises, with 67% of participants engaging in this activity. This is consistent with the types of aphasia present in this study, as all aphasic patients experienced word-finding difficulties, making word-naming exercises essential for their training.[28-30]

The average age of the participants in this study was 50.5 years, with a standard deviation of 12.2 years (95% CI: 43.1, 57.8). A subgroup analysis found no statistically significant differences in the improvement of scores between participants younger than 50 years (N=7) and those older than 50 years (N=8). This finding aligned with the results of a systematic review by Ellis,[31] which analyzed 40 studies with a total sample of 14,795 participants. While stroke is more prevalent in older adults, age appears to influence only the risk of developing aphasia and the type of aphasia. Stroke patients with aphasia tend to be older than those without aphasia, and there is a correlation between age and aphasia type, with younger patients more likely to experience non-fluent aphasia, such as Broca's aphasia. However, age does not show a clear relationship with aphasia recovery or clinical outcomes.[31]

In addition to the age subgroup analysis, the researchers also conducted a subgroup analysis based on post-stroke duration. The average time since stroke onset in this sample was 20.5 months, with a standard deviation of 21.3 months (95% CI: 7.6, 33.3), ranging from 1 to 65 months. When comparing the subgroup with post-stroke duration of 1 year or less (N=8) and the subgroup with a duration of more than 1 year (N=7), no statistically significant differences were found in the improvement of scores between these two groups. These results suggested that the length of time since the stroke may not be a significant factor in the recovery or improvement of language and communication abilities in aphasic patients. This finding is consistent with previous studies, such as Nakagawa et al., which noted that many patients continued to recover even long after the stroke.[32] Similarly, Kertesz and McCabe found that some aphasic patients experienced gradual recovery over several years after their stroke onset.[29] In line with these findings, Naeser et al. observed improvements in naming scores and word length within five years after a stroke[33], while Fitzpatrick et al. reported that aphasic patients continued to show improvement in picture naming between five and fifteen years post-stroke.[34]

Furthermore, the lack of statistically significant differences between groups with varying post-stroke durations may suggest that recovery ability could depend on factors beyond age or time since stroke onset, such as the frequency and quality of speech therapy, family support, or access to continuous care and rehabilitation. This finding was consistent with the study by Harvey *et al*., which found that some aphasic patients continued to make language improvements years after a stroke, indicating that long-term therapy may benefit this population.[35] Therefore, providing appropriate information and therapy for individuals with chronic aphasia could enhance their chances of continued language development.

The use of the application in this study had similar limitations to those identified in the study by Ngamsuriyaroj *et al*., which found several factors that could affect usability. These included the ease of use for both patients and caregivers, the accuracy of visual and audio output, language, user perception, family support, service conditions, and training in the application's use.[27] In this study, patient selection criteria specified that participants must be able to use the application. Patients should be able to look at the interface and understand how to interact with it. While some individuals may access the application independently, others might receive assistance from relatives to launch the application or navigate through its sections. This may have excluded individuals with more severe impairments or less familiar with technology. As a result, the findings may not be fully generalizable to all aphasic patients, particularly those with more significant cognitive or physical impairments. Additionally, the interface design took into account screen and item sizes, resulting in a satisfaction score of 4.7 from participants for the clarity and readability of the font size. However, feedback from caregivers and patients indicated that further improvements were needed, including adjustments to image size and clarity, as well as enhancements to the accompanying audio. There were also suggestions to increase the number of exercises and introduce more difficulty levels.

Limitations

1. The application required further revisions and additional funding before it could be made available for self-download on iOS and Android operating systems.
2. Some patients were unable to use the application independently due to limitations in the accurate verification of speech. Specifically, activities involving speech production, repetition, and naming still necessitated assistance from others, such as SLPs or caregivers, to ensure proper pronunciation.
3. The patients' and caregivers' proficiency with mobile applications may have influenced their satisfaction levels. Those with more experience or confidence in using mobile applications may have found the tool easier to use, which could have positively impacted their overall satisfaction. This factor should be considered when interpreting the results.

Recommendations

1. A randomized controlled trial (RCT) should be conducted to compare the effectiveness of traditional speech therapy alone and traditional therapy combined with the application, using a larger sample size.
2. The application should be enhanced and refined to improve its functionality for future studies.

Conclusion

In summary, the findings of this study indicated that the developed application effectively enhanced the training process, with users reporting high levels of satisfaction. The application significantly improved the effectiveness of speech therapy services, as evidenced by increased language and speech scores across all areas, including fluency, comprehension, repetition, naming, reading, and AQ scores.

The application has the potential to increase the frequency of practice and improve accessibility for patients. Moreover, it could serve as a valuable tool for other healthcare professionals and public health workers in regions where there is a shortage of SLPs. By providing initial support to aphasic patients under the supervision of an SLP, the application could facilitate preliminary care before patients are referred for comprehensive speech therapy with a certified practicing SLP.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics approval

This research was approved by the Human Research Ethics Committee of Sirindhorn National Medical Rehabilitation Institute under approval number 64004 from March 25, 2021, to September 30, 2024.

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