

Development of Multimedia to Enhance Thai Communication Skills for Visually Impaired Students

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ABSTRACT

This study aimed to develop multimedia learning materials to enhance the communication skills of Thai university students who had visual impairments at the ST2RU (Special Education Center, Nakhon Ratchasima Rajabhat University). The study aimed to analyze the instructional problems of visually impaired students, create the multimedia Learning Materials to encourage the four skills of communication in Thai language namely listening, speaking, reading and writing, and assess the effectiveness of the created multimedia Learning Materials. The subjects were 11 undergraduate visual impairment students in the target group selected using purposive sampling and five experts in special education and multimedia technology. The data were analyzed using mean, standard deviation, and paired t-tests, in-depth interviews, a communication skills test to assess Thai communication skills, and ratings of language quality on the multimedia form. The results indicated that the LISL's obstacle for students with visual impairments was not the lack of students learning potential, but limited accessibility to adaptive instructional media and technology involving difficulties accessing digital files that are not compatible with screen reading software. The multimedia package built comprised 12 audio based learning units of three levels of difficulty (easy, moderate and difficult) which incorporated all four communication skills. A significant difference was observed between students' pre-test ($M = 11.27$) and post-test ($M = 15.55$) scores based on a t-test ($t = 21.90$, $p < .001$) following the implementation. The students and the experts rated the materials extremely high in terms of both suitability ($M = 4.64$ ratings) and satisfaction ($M = 4.48$ ratings). From the results, it is found that the use of accessibility-oriented, audio-based multimedia can effectively support the Thai communication skills of visually impaired learners in an effective and meaningful way, which can subsequently be used in education for broader purposes.

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1. Introduction

For related purposes, higher education institutions are increasingly enrolling students with diverse learning needs and developing specialized support units at universities in Thailand. For example, the Special Education Center (SEC) at Nakhon Ratchasima Rajabhat University consists of three coordination units: the Early Intervention (EI) unit for early childhood development and school readiness for children with special needs; the Disability Service Center (DSC) for vocational skill training and independent living for people with disabilities; and the Disability Support Services (DSS) unit, which provides instructional media, counseling programs, and facilities for students with disabilities enrolled in degree programs. These units demonstrate a range of institutional commitments, predominantly directed toward integrating learning, communication, and daily living into a unified whole — not three separate areas. Including disabled and non-disabled students in the same classroom always brings obstacles, and especially during the COVID-19 pandemic, when learning has gone virtual, there are increased obstacles. The co-teaching educational approach also presents practical challenges as teaching moves online during the COVID-19 pandemic. Descriptive interviews with the Administrator and teachers in the Special Education Center (SEC) in Phra Nakhon Si Ayutthaya province revealed that both teachers and administrators used recorded videos for lessons and relied on parents to carry out the remaining instructions for children when they were unable to access them directly through an online platform, during both the first wave of infection and relaxation (March to December 2020) and during the re-emergence of infections in January 2021.

Instructional clips were developed around each learner's documented capability, ensuring they matched the student's Individualized Education Program (IEP), and higher quality clips were

shared through various platforms such as video-sharing sites and institutional websites. This is in line with the international evidence on how Covid-19 has produced inequities in the learning approach of students with disabilities, such as those with visual impairments, and needs of learners have differed among institutions in assessing and closing the resulting learning gaps (Aquino & Scott, 2023; Ghoneim et al., 2024). A systematic study of studies on teachers of blind and visually impaired students identifies four common categories of barriers: accessibility, technology, teaching policy, and psychological wellbeing, and suggests that overcoming them involves a multi-faceted approach that is more effective when they are overcome as a group instead of individually (Ghoneim et al., 2024). These findings give us a compelling reason to consider how to design instruction using the media of print, face-to-face, and online/medial: education systems must have alternatives; they must be usable both face-to-face and at a distance, and they must not attribute access solely to one medium. This is especially true for students for whom hearing is a primary way of learning rather than seeing. Improving students' communication skills in Thai is important since it is a skill that can be used and is recommended in almost any Thai course students may take in the future, so it has wider implications than just communication learning in the Thai Language classroom — it is actually learning for all other subjects to come.

The conceptual rationale for this design is well documented. The classic literature on learning psychology emphasizes the importance of consciously addressing perception, motivation, memory, learner involvement, individual differences, and the transfer of learning from one context to another, and of deliberately considering these factors in instruction to increase the likelihood that instruction will attain its goals. Individual differences - in intelligence, beliefs, culture, interests, and aptitudes - directly

influence the speed and depth of knowledge acquired by a specific learner presented with a new concept or body of knowledge; some learners will assimilate quickly, while others will require more time or accommodations. Good instructional designers recognize this and design materials so that the learning experience can occur with students who vary widely in their backgrounds without being dependent on one "typical" student. This resonates with the Universal Design of Learning (UDL) (Nieminen & Pesonen, 2020; Chick, 2025) body of work, which considers making a product or service accessible a design philosophy rather than an assemblage of fixes added to the end of the product or service in response to an after-the-fact analysis of who might be struggling. Universal design and UDL in higher education have consistently correlated with both students' and instructors' satisfaction when applied to course materials, pedagogy, and assessment (Nieminen & Pesonen, 2020; Chick, 2025).

Visual impairments can be technological and/or institutional rather than ability barriers. In national e-government access assessments, for instance, interfaces designed for sighted users often have consistently poor compatibility with screen readers, even when there is no legal or technical barrier to remediation (AlSaeed et al., 2020). Research on deep-learning-based reading assistive technologies and other technologies for visually impaired learners demonstrates that designed solutions are highly effective in reducing this gap, with purpose-designed technologies outperforming technologies designed for sighted viewers of text, added afterward, when applied to support blind users (Ganesan et al., 2022). The conclusion from international contexts is similar. Teachers who teach visually impaired students in Turkey report that instruction in screen readers is inconsistent and poorly delivered, although the technology is mature (Kirboyun Tipi, 2026). Blind or low-vision students in specialized schools in China report that integration problems relate to economic, social, and policy issues, not to the deficient capabilities of the student (Zhu et al., 2025). For people with low vision and/or

blindness who work, proficiency in multiple screen readers is key to completing tasks efficiently and independently (McDonnall et al., 2025). Overall, this body of evidence confirms the main idea in the present study: namely, that what is truly a barrier is the lack of fit between the instructional media and the learner's channel of access, rather than any lack of underlying capability to learn. In particular, in the area of audio-based instructional design, there has been a body of research for visually impaired learners in several fields.

Over the last few years, sound-based curricula have been used to enable blind students to develop scientific representations and acquire scientific knowledge, including conceptual models such as understanding gas behavior in chemistry, via their auditory sense, which has been found to be as effective as students with vision who use visual representations to develop the same representations and acquire similar knowledge (Lahav et al., 2019). The literature reviewed here indicates that well-formulated auditory representation is more than just a facsimile of the visual imagery; there are some respects in which it can assist in types of reasoning that are not so strongly activated by the image. Students' use value of assistive technologies (AT) like text-to-speech computer tools and speech-to-text tools continues to be assessed as useful many years after their introduction in the writing classroom (usefulness is not guaranteed across all tasks or students, however: Almgren Bäck et al., 2022/2024). Likewise, an investigation of single-subject digital text-comprehension tools for students with mild intellectual disability found that text with synchronized audio produced clear comprehension gains for some, but not all, students (Fälth et al., 2025).

The overall mixed but positive results suggest that careful design and use of evidence, and not simply assuming that any audio-based tool is going to be effective with anyone, is needed. Under such circumstances, the present study aimed at designing and testing a series of visual impairment university students' multimedia

learning materials, which mainly features narration, teaching, motivating sound as supporting materials in the form of audio books. Materials were developed based on Passive Learning and Active Learning, organized into 12 learning units with three types of difficulty (Easy, Moderate, and Difficult) in four communication skills: listening, speaking, reading, and writing.

This response is driven in particular by the documentation of disrupted instruction in the Ayutthaya case study and the wider international literature presented above: one of the few interventions that consistently serves visually impaired learners – regardless of format – both on campus and at a distance – with independent access to the materials themselves via alternative media. This study will expand beyond the immediate population served. As Thailand's translation skills also filter into all of the other university subjects, which influence or inform a visually impaired student's comprehension and expression, being more proficient in this particular language skill can be a boon for him/her in the rest of the coursework, and ultimately in the advanced classes at the university. It would only ease the way to the other subjects that require him/her to use his/her readings for either comprehension or expression. At an institutional level, work of this nature would give the Special Education Centre, or other institutions which might have similar units, assets to call upon in deciding how to allocate its resources for audio-first multimedia development, instead of, or alongside, incremental formatting for existing sighted-oriented materials.

The consistent theme in this study and the literature cited above is the need to make digital systems accessible because the real problem isn't learner ability—the real problem is a lack of accessibility. This indicates that providing screen-reader compatibility and accessible instructional design should not be treated as an ancillary feature of a digital learning platform, but rather as a baseline requirement. A baseline requirement should be implemented not after a learner identifies a problem, but rather as a requirement

when purchasing an existing or building a new digital learning platform intended for public higher education. This study sought to develop a set of supportive materials for use in one Thai-language classroom and to generate transferable evidence of the actions required to plan, produce, and evaluate accessibility-first multimedia design from an educational and resource-limited special-education support unit at a regional university.

2. Materials and Methods

The design employed for the present study was a developmental mixed-methods research design that consisted of a needs assessment analysis (qualitative) and an evaluation of the multimedia materials created (quantitative). This research took place over one year and six months, from October 1, 2024, to March 31, 2026, during the first and second semesters of 2025. Data collection for this research lasted for 1 year and 6 months, from 1st October 2024 to 31st March 2026, in the first and second semesters of 2025, at the Special Education Center, Nakhon Ratchasima Rajabhat University. There were two subsamples that formed the target group. The first subsample consisted of 11 undergraduate students with a visual impairment (VI) registered at the Special Education Center, selected through purposive sampling to ensure the sample closely represented the characteristics needed for the purposes of the study: enrollment at the undergraduate level and documented visual impairment requiring instructional accommodation. The second subsample consisted of five experts in special education and multimedia technology, who evaluated and rated the quality of the materials developed, in addition to two employees from the Special Education Center who participated in an interview to obtain the institutional point of view related to students' needs for support.

During data collection, analysis, and reporting, the identities of the student informants were not disclosed to other participants and were identified only by code (Informant 01-11). Three instruments were used. The first instrument was a structured interview schedule with two parts: Part 1 collected demographic data (name, sex,

age, education level, faculty, and field of study), and Part 2 used open-ended questions that focused on the instructional problems faced by visually impaired students in their school, their opinions about the information needed to design the multimedia materials, and their opinions about the multimedia materials designed. The second instrument was a Thai language skills test consisting of a pretest and a posttest that involved listening, speaking, reading, and writing skills at three levels of difficulty, as represented in

the materials used. The third tool was a multimedia quality evaluation sheet completed by the five subject matter experts, rating the content, format, and usability of the final materials on a 5-point scale. To develop and validate the final pattern of the fishing community, the entire study time frame was divided into stages, from the initiation of the needs assessment process to the analysis and reporting of the data, as illustrated in Figure 1.

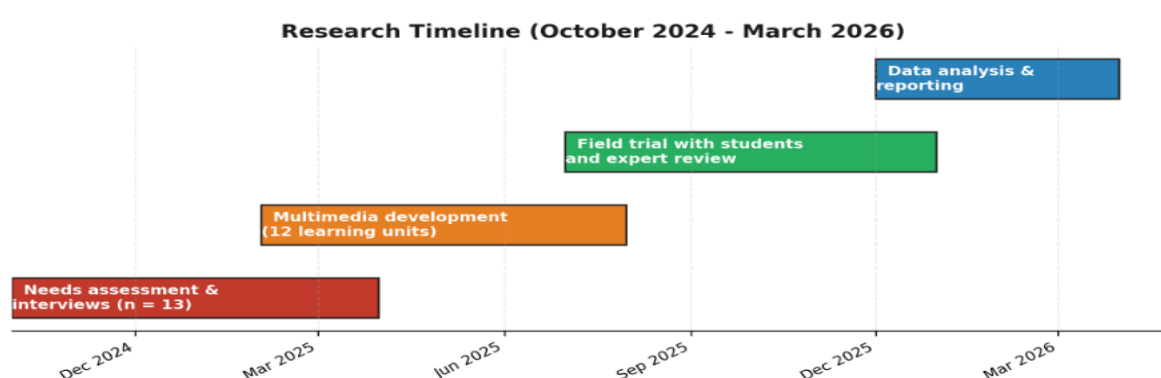


Figure 1. Research timeline, October 2024–March 2026, showing the four sequential phases of the study.

The preparation of the multimedia materials went through three general phases. The first phase involved in-depth interviews with 11 student informants and two teachers from the Special Education Center to determine the instructional problems, barriers, and needs to be addressed by the materials. In the second phase, the needs analysis distilled the stems into the design and production of audio-based multimedia learning materials (which are mainly developed as audio books with narration, illustrative sound, and related texts that favor listening-based learning and facilitate multisensory learning overall). There are twelve learning units in total, with the materials organized to engage learners by involving them rather than passively including listening, speaking, reflection, and communicative response across three difficulty levels – easy, moderate, and difficult – in four Thai communicative skills – listening, speaking, reading, and writing.

Each listening skill was supported by a written description to help learners follow the narrative. Each speaking skill was accompanied by text-based listening tasks, such as summary writing, answering yes/no questions, and reflective and response tasks, to provide learners with written and oral support for their listening. Each reading skill was accompanied by audio and short written passages to support understanding and interpretation of the written text. Each writing skill was supported by audiovisual listening passages, as well as by yes/no, reflective, and response text. The three parts of each lesson comprised an introduction, a teaching phase, and a summary phase, grounded in the need to involve the learner through discussion and high-level responsiveness to the learner's own experiences in activity, question-and-answer, and writing sessions that were interspersed throughout the entire lesson. The third phase involved the student participants ($n = 11$) using the completed materials in a 1-group pre-test-post-test design, as well as the five experts using

the multimedia evaluation form. Data analysis was conducted in two parallel strands.

Qualitative interview results were analyzed using analytical description: analysis was conducted while reading and coding the data, so the data obtained were classified according to recurring problems and needs to be met; in addition, the data were synthesized into thematic findings throughout the data collection process. The quantitative data analysis, which included descriptive statistics (mean and standard deviation) and a paired-samples t-test, was performed to determine whether there was a significant difference between pre-test and post-test communication skills scores at the .05 level. By the nature of their participation, all informants were voluntary and could refuse to answer interview questions, either to specific questions or altogether, at any time during the study. To enhance the trustworthiness of the qualitative data, interview data were transcribed, and each classification was coded independently before being compared with the others for consistency, with any discrepancies settled through discussion until agreement was reached. Since the same four communication skills were assessed at three consistent difficulty levels both pre- and post-intervention, it was possible to make direct comparisons between the scores obtained on the pre-test and the post-test, and the paired t-test could isolate the change related to using the multimedia materials from any change in the standard being assessed.

3. Results and Discussion

The general research approach (from needs assessment to the development, testing, and effectiveness evaluation of materials) is depicted in Figure 2. Interview data revealed a situation very similar to that described in the literature from around the world, namely that visually impaired students did not face restrictions on their learning abilities but rather on access to teaching and learning media that can be adapted to satisfy their needs, to LMS, and to evaluation platforms. The major day-to-day challenges

students identified as keeping them from being able to utilize digital files included online learning (e-learning) and online testing (e-testing), which were not screen-reader friendly, and access to the Internet and digital devices. This is in line with web accessibility research, which demonstrates that for institutional digital systems in other national contexts, government e-service platforms, standard web-accessibility standards are often not met, especially where there are no legal or technical barriers to this improvement (AlSaeed et al., 2020), and is consistent with evidence of the significant gap that can be reduced with purpose-built assistive reading technologies when accessibility is considered a core engineering principle rather than an optional add-on (Ganesan et al., 2022). It was noted that students' listening skills were the most developed communication skill, and that listening was used as their primary mode of learning, while the two other areas (speaking and reading or writing) primarily reflected students' perceptions of the format of the materials used and of assistive technology designed to help them read and write. Despite the repeated mention by students of their inability to speak, they described a very strong ability to listen, and they noted speaking as the most persistent difficulty, especially in academic environments that call for confidence and organization of ideas under time pressure.

Reading and writing difficulties were reported as form-related (e.g., difficulties using assistive technology) rather than skill related. Table 1 summarizes the characteristics of the target group that participated in the study, which are discussed below. The characteristics of the target group that participated in the study are summarized in Table 1 below. The findings of this study are based on the interview and trial data collected by all 11 student participants and five (5) subject-matter experts in the evaluation phase, and the institutional perspective for needs assessment provided by the two staff of the Special Education Center during the needs-assessment phase.

Table 1. Characteristics of the study participants and their role in the research.

Participant Group	n	Role in the Study
Undergraduate students with visual impairments	11	Interviews (needs assessment); pre-test/post-test trial; satisfaction rating
Experts in special education and multimedia technology	5	Quality evaluation of the multimedia materials
Special Education Center staff	2	Interviews (institutional needs-assessment perspective)

Three mutually complementary types of multimedia were developed, based on the concept of accessibility, to ensure that the primary method of access was listening; audio media, video with audio description, and interactive media. As a result, the twelve ensuing learning units were distributed across four

communication skills and three difficulty levels, with each skill area represented at three difficulty levels (easy, moderate, difficult) ranging from basic understanding to analysis/critical thinking (see Table 2). This distribution is also plotted in Figure 2.

Table 2. Distribution of the 12 multimedia learning units across the four Thai communication skills and three difficulty levels.

Communication Skill	Easy Level	Moderate Level	Difficult Level	Total Units
Listening	1	1	1	3
Speaking	1	1	1	3
Reading	1	1	1	3
Writing	1	1	1	3
Total	4	4	4	12

**Distribution of the 12 Multimedia Learning Units
Across the Four Thai Communication Skills
(each skill offered at easy, moderate, and difficult levels)**



Figure 2. Distribution of the 12 multimedia learning units across the four Thai communication skills, each offered at easy, moderate, and difficult levels.

The field trial results indicated a clear and statistically significant improvement in students' Thai communication skills. The district mean pre-test score was 11.27, and the mean post-test score was 15.55 after using the multimedia materials. This difference was statistically significant at the .05 level ($t = 21.90, p < .001$), as determined by a paired-samples t-test (Table 3 and Figure 3). The magnitude of the improvement is comparable to the learning gains found with audio-based (Lahav et al., 2019) and sound-mediated instructional materials (SMI) (Comoli and Dahlinger, 2019) among students who are blind or have low vision in typical, highly visual content domains, such as science learning. It also aligns with research on students with dyslexia and other written-language difficulties, which has found that text-to-speech and other

assistive technologies have remained useful over time – in short, usefulness increases with longer use, although a one-size-fits-all approach is not possible, as usefulness varies from student to student and task to task (Almgren Bäck et al., 2024). It is also generally consistent with single-subject research on the use of this kind of resource pairing to improve comprehension outcomes for some students with intellectual disabilities, though not all, over extended periods of use of this type of assistive technology (Fälth et al., 2025). Taken together, this literature supports the interpretation that these gains could be considered truly instructional rather than a characteristic of this single sample, and that no automatic generalization can be assumed without individual attention, given this.

Table 3. Pre-test/post-test scores, expert quality ratings, and student satisfaction ratings for the multimedia materials.

Measure	n	M	SD	t / p
Pre-test score	11	11.27	1.42	
Post-test score	11	15.55	1.18	$t = 21.90, p < .001$
Expert quality rating	5	4.64	-	Highest level
Student satisfaction rating	11	4.48	-	Highest level

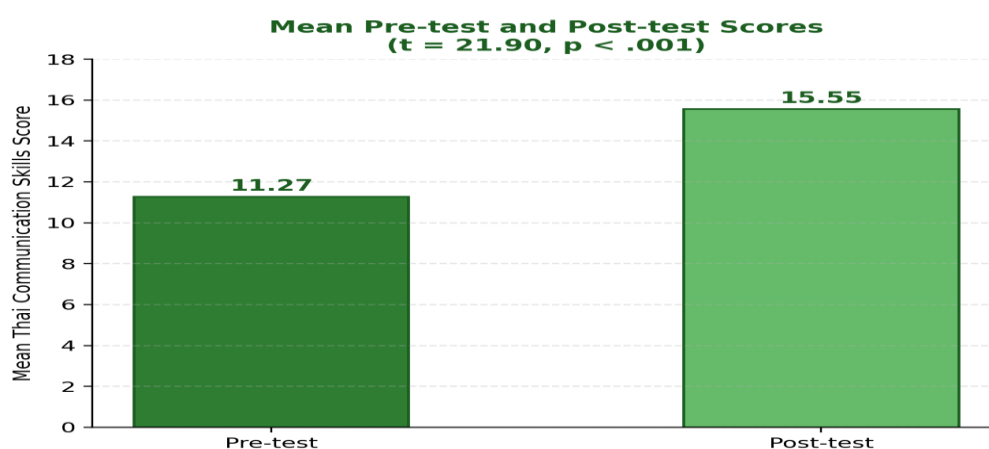


Figure 3. Mean pre-test and post-test Thai communication skills scores following use of the multimedia materials ($t = 21.90, p < .001$).

The measurement results of the quality of the materials were equally positive. The overall suitability of the multimedia materials was rated very high by five of the experts, with a mean rating of 4.64, while the 11 student participants gave their satisfaction with the multimedia materials at the highest level, with a mean rating of 4.48, as can be seen in Figure 4. When looked at in detail by domain, all 3 dimensions, content, format, and usability, were rated at the "high" to "highest" level, with content and particularly format being rated highly by experts and students. This overlap between professional judgment and those of end-users indicates not only that the materials are technically achievable by professional standards, but also that they are not only technically 'good, but are also easy or pleasant for them to use as well: a distinction that is important as materials included as accessible in the context of their formal design checklist do not always register as being easy or pleasant to use in practice for end-users.

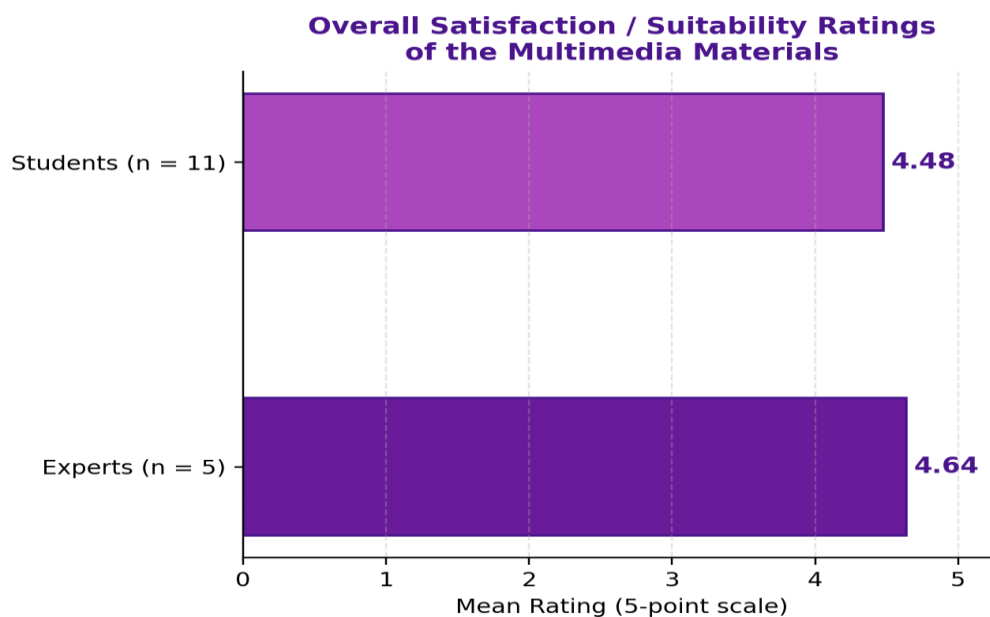


Figure 4. Mean overall suitability rating by experts (n = 5) and satisfaction rating by students (n = 11).

The results can be placed within a broader rationale for audio-plebisciting and accessibility-first design. First, regarding the problem of instructional access, the results indicate that barriers attributed to learners were not linked to their abilities but instead stemmed from typical issues across various media and platforms, which aligns with the international literature on teachers working with teachable disabled students, wherein the four overlapping areas of challenge identified as access, technology, instructional policy, and psychological well-being are to be tackled in concert and not independently (Ghoneim et al., 2024). This also aligns with teachers of VI students in other national contexts who reported the continued lack of consistency in hands-on teaching and learning with screen-readers (Kirboyun Tipi, 2026), as well as reports by students from non-inclusive/special schools

whose challenge was found to stem from factors other than their own learning capacities, but related to economic, social and policy barriers (Zhu et al., 2025). Second, in terms of the design of the materials themselves, the rationale followed, which was to construct primarily audio media, with audio description for videos and interactive media, reflects that of Universal Design for Learning (UDI), which suggests that accessibility is a design criterion to be built into from the beginning of the design of learning products, as opposed to adding it on as an afterthought. It is also considered to be linked in higher education to positive results for access and general student satisfaction when enacted consistently (Nieminen & Pesonen, 2020; Chick, 2025; Moriña, 2017). Third, from the perspective of effectiveness and learning outcomes, the present pre-test-to-post-test gain represents a

consistent finding in the larger literature on sonified and sound-based instructional systems with blind students; namely that well-designed auditory representations can facilitate true conceptual learning, instead of serving as a suboptimal alternative to visual material (Lahav et al., 2019). The user satisfaction, as an additional factor – fourth, as it has been interchanged in the previous discussions – was measured in a similar fashion to assistive-technology research more broadly: High ratings from experts, combined with high ratings from the students, rated the instruments high in quality, since they are instruments that they find useful to use day to day; moreover, the instrumentation observed here, in which both expert ratings and student ratings were high, is a particularly useful sign of usability (Almgren Bäck et al., 2024; McDonnall et al., 2025).

Overall, the results could infer that the developed multimedia instructional materials as an instructional intervention and well received multimedia learning resources were effective, and such could be extended to other instructional setting contexts where other visually impaired learners are in this institution, or elsewhere. The findings have implications for planning approaches to supporting visually impaired students in general. The barriers found in this research occurred almost exclusively between pages of incompatible digital formats and platforms, and not from a lack of student abilities. Thus, institutional investments will likely benefit most from investment in accessible-by-design pages and platforms, and continuous creation of course content in audio format, rather than from repeated, one-off remediation of individual inaccessible files that disrupted coursework. High scores from subject-matter experts and student end users add to the evidence in this study that designing for accessibility doesn't have to sacrifice professional instructional quality or robust content. The model of needs assessment, audio-based material development, and expert/learners' evaluation in the classroom, which has been employed in this study, is not limited to the Thai classroom, but may be applicable in several language-related fields in

other subject areas of the classroom or in other classrooms.

4. Limitations and Directions for Future Research

The interpretation of the results must take into account the limitations listed below. The 11 students who were selected to participate were undergraduates with visual impairments through purposive sampling, but the size of the sample was appropriate to the type of intensive, interview based needs assessment that the design called for, and was too small to allow the scale of the pre- to post-test improvement to be extrapolated to other visually impaired students or other levels of schooling. The absence of a comparison or control group also contributes to these gains, making observed gains difficult to distinguish from gains due strictly to repeated testing or familiarity with the test format, or to normal maturation over the intervention period. Furthermore, the research participants were university students already attending either a university center for supporting their needs, as a function of an established referral link, or a university-belonging center, so that results cannot be immediately extended to non-university-age education learners, particularly those learners with visual impairments that are not referred to a center, or to learners in childhood with learning disabilities and differing instructional contexts from that of university students.

Lastly, the materials were created and tested mainly in the context of Thailand communication skills; future research is needed before they can be integrated into other subjects using the same design principles with the same effectiveness. The restrictions suggest many avenues for further studies. Experiments involving larger and more geographically representative sample sizes of students with visual impairments, with comparison or control groups, would further enable researchers to reach better estimates for the magnitude and longevity of learning effects that result from instruction with audio-based multimedia materials to students with visual impairments, and to better draw conclusions

about the degree to which learning effects are attributed to the materials or maturational or testing effects. Finally, whether the design principles reviewed here are applicable in other subject areas of the curriculum. Future work should also investigate education beyond the primary level (at the secondary and vocational school stages) because the main access issues encountered in this study include incompatibility of digital materials with screen-reading software, and the lack of accessibility of the learning-management or testing platform, which are not limited to Thailand or Thai-language education.

This work can also be furthered with the integration of new technologies such as those based on AI designed for the creation of speech systems and sonifying interfaces for adaptive learning, which recent studies cite as useful and efficient tools for improving reading and access to information for blind learners and persons with low vision (Ganesan et al., 2022; Zhu et al., 2025). Last but not least, although there seems to be common agreement on the utility of AT in solving problems for students with low vision or blindness, future research should further investigate potential variations between individuals regarding the usefulness of audio tools in learning, as future versions of such packages of audio support will be further customized to individual learners' needs rather than considered a one-size-fits-all tool (Almgren Bäck et al., 2024; Fälvh et al., 2025).

5. Conclusion

The study aimed to explore visual impairment students' university learning difficulties, to create multimedia learning materials that will enhance the Thai communication skills of visual impairment students, and to test the effectiveness of these materials. The information revealed in the three objectives indicated that the problem faced by the students was not related to their learning capacity but to the lack of fit between the materials used in the teaching-learning process and their media. The information also showed that the students' major problem was not related

to the students' own abilities but rather to the materials that had not been adapted to the students' learning media. As a direct response to this problem, 12 sets of audio-centered multimedia learning units were developed, covering each subject across all four communication skills in Thai, addressing all three difficulties, and integrating learning through a combination of audio media, video with audio description, and interactive media; the design of the audio-centered multimedia learning units took accessibility as a starting point rather than an end-point. These materials were found to yield a statistically significant increase in communicative skill scores when used with 11 visually impaired students and were highly rated by subject-matter experts and by the students who used them, in terms of quality and satisfaction. In combination, the results are significant, as they show that carefully designed, audio-based multimedia can make meaningful contributions to closing the accessibility gap for visually impaired learners, contribute to a significant improvement in a core academic skill, and do so through an audio-based media component that is seen to be well designed and satisfying to use by both professional evaluators and end users. Based on this, the use of the multimedia materials in this study seems appropriate and can continue to be used in the educational process in a wide and expanded way for students with visual impairment, and the principles used in the design of the materials seem transferable from the academic institution to the academic institution with students with various visual impairments.

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