Development of audio-based sport massage learning media to enhance vocational teachers' skills for students with visual impairment

Desarrollo de medios de aprendizaje de masaje deportivo basados en audio para mejorar las habilidades de los docentes de formación profesional en la enseñanza a estudiantes con discapacidad visual

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Abstract

Introduction: This study is motivated by the limited availability of instructional media and the insufficient competence of teachers in delivering sports massage content within vocational education. It aims to develop audio-based instructional media to facilitate more effective and inclusive learning in sports massage.
Methodology: The study adopts a research and development approach encompassing 10 stages, from research and information collection to dissemination and implementation. The participants included 6 respondents in the preliminary field test stage, 15 in the main field test, and 42 in the operational field test. Research instruments comprised expert validation sheets, feasibility questionnaires, and skills tests. Data were analyzed using Aiken's V for content validity, descriptive percentage analysis, and paired-samples t-tests, following the fulfillment of normality and homogeneity assumptions.
Results: The findings indicate that the developed media achieved a high level of validity, with an Aiken's V coefficient of 0.83, categorized as highly valid. Feasibility testing demonstrated an improvement in media quality, reflected in the increase of the "Very Good" category from 53.33% in the main field test to 78.57% in the operational field test. Effectiveness testing revealed a statistically significant improvement in pre-test and post-test scores across both stages, with a p-value of 0.000 (< 0.05), indicating that the media effectively enhanced practical sport massage skills.
Conclusions: The developed audio-based sport massage instructional media are valid, feasible, and effective in improving practical skills while supporting more inclusive learning for students with visual impairments.

Keywords

Development, audio, sport massage, learning media, vocational teachers.

Resumen

Introducción: Este estudio se fundamenta en la limitada disponibilidad de medios de enseñanza y en la insuficiente competencia del profesorado para impartir contenidos de masaje deportivo en el ámbito de la educación vocacional. Su objetivo es desarrollar un medio didáctico basado en audio que facilite un aprendizaje más eficaz e inclusivo en el masaje deportivo.
Metodología: El estudio adopta un enfoque de investigación y desarrollo, que comprende diez etapas, desde la recopilación de información hasta la difusión e implementación. Los participantes incluyeron 6 sujetos en la fase de prueba preliminar, 15 en la prueba de campo principal y 42 en la prueba de campo operativa. Los instrumentos de investigación consistieron en hojas de validación de expertos, cuestionarios de viabilidad y pruebas de habilidades. Los datos se analizaron mediante el coeficiente V de Aiken para la validez de contenido, análisis porcentual descriptivo y pruebas t para muestras relacionadas, tras verificarse los supuestos de normalidad y homogeneidad.
Resultados: Los hallazgos indican que el medio desarrollado alcanzó un alto nivel de validez, con un coeficiente V de Aiken de 0,83, clasificado como altamente válido. La prueba de viabilidad mostró una mejora en la calidad del medio, reflejada en el aumento de la categoría "Muy Bueno" del 53,33 % en la prueba de campo principal al 78,57 % en la prueba de campo operativa. La prueba de efectividad evidenció una mejora estadísticamente significativa entre las puntuaciones de pretest y postest en ambas etapas, con un valor de significación de 0,000 (p < 0,05), lo que indica que el medio mejoró eficazmente las habilidades prácticas de masaje deportivo.
Conclusiones: El medio didáctico de masaje deportivo basado en audio desarrollado es válido, viable y eficaz para mejorar las habilidades prácticas, al tiempo que favorece un aprendizaje más inclusivo para estudiantes con discapacidad visual.

Palabras clave

Desarrollo, audio, masaje deportivo, medios de enseñanza, docentes de formación profesional.

Introduction

Learners with visual impairments encounter distinctive challenges in accessing instructional content, particularly within vocational education that emphasizes practice-based skills such as sport massage. Meulen et al., (2024) asserts that learning effectiveness is largely determined by the alignment between media characteristics and learners' sensory channels; consequently, optimizing auditory and tactile modalities is essential for students who are blind or have low vision. Instructional practices in vocational education often fall short of fully embracing inclusive approaches that are responsive to diverse learner needs (Dimitrova et al., 2024; Smeplass, 2025). The universal design for learning highlights the importance of providing multiple forms of facilities, resources, media, and instructional strategies to ensure equitable accessibility for all learners (Cumming & Rose, 2022; Espada-Chavarria et al., 2023). Limitations in both learning media and pedagogical approaches, therefore, constitute significant barriers that must be addressed to enhance the quality of vocational instruction in sport massage.

Teachers often lack the confidence and competence to utilize assistive technologies and implement specialized pedagogical approaches for learners with visual impairments. Within the technological pedagogical content knowledge framework, integrating technological, pedagogical, and content knowledge is a critical prerequisite for effective teaching (Arifin et al., 2020; Tseng et al., 2022; Younis, 2025). Low levels of teacher self-efficacy in using technology also contribute to the limited degree of innovation in instructional practice (Antonietti et al., 2022; Na & Isa, 2024). This condition directly constrains learners' access to meaningful and adaptive learning experiences. In this context, the development of audio-based instructional media represents a strategic solution, offering structured, accessible guidance tailored to learners with visual impairments while simultaneously supporting more effective, inclusive content delivery.

Educators play a pivotal role in facilitating learning for students with visual impairments; however, a growing body of research indicates that many still encounter constraints in utilizing assistive technologies and implementing inclusive pedagogical strategies. The insufficient integration of technological, pedagogical, and content knowledge within instructional practice limits the adaptability of teaching and its capacity to deliver meaningful and accessible learning experiences (Ajani, 2024; Fahrurozi et al., 2019). Low levels of teacher self-efficacy in adopting technological innovations can adversely affect instructional effectiveness (Dong et al., 2020; Saienko et al., 2020; Zarafshani et al., 2020). The integration of technology into teaching has been shown to enhance both instructional quality and overall learning outcomes (Pan & Jiang, 2025; Wu, 2024). In this context, the use of audio-based media not only supports teachers in presenting content more structurally and inclusively but also strengthens teacher confidence and improves student learning outcomes.

For learners with visual impairments, sport massage therapy within vocational education serves not only as a pathway to economic independence but also as a means of fostering autonomy in everyday life. From a skills-based learning perspective, the acquisition of vocational competence is strongly shaped by the clarity of instruction and the provision of structured practical experiences (Otero, 2024). For learners who are blind, the development of spatial awareness and procedural understanding relies heavily on optimizing non-visual senses, particularly the auditory and kinaesthetic modalities, as articulated in multisensory learning theory (Griffin-Shirley et al., 2024; Nayak et al., 2026; Zhu et al., 2026). Audio-based instructional media offer considerable potential to support this learning process, as they can deliver step-by-step guidance that is both accessible and easy to follow, while reinforcing conceptual understanding and practical skills (Griffin-Shirley et al., 2023; Soleimani et al., 2022). Accordingly, the development of structured, contextually relevant audio media represents a viable strategy for addressing communication and learning barriers while also supporting learners' professional success in vocational fields.

Research on the development of instructional media for learners with visual impairments in vocational education remains limited, particularly in practice-based skills such as sport massage. Most existing studies have focused primarily on basic literacy and the use of general assistive technologies, while relatively little attention has been directed toward the development of contextualized, practice-oriented instructional media that support vocational skill acquisition. As a result, learners with visual impairments continue to experience difficulties in accessing structured and accessible practical learning materials that align with the demands of vocational education. In sport massage learning, students require

instructional guidance that can effectively replace visual demonstrations through accessible sensory modalities, particularly auditory input. Instructional media development should account for learners' diverse needs by providing multiple forms of representation and inclusive learning strategies (Awang-Hashim et al., 2019; Kaimara et al., 2022). In addition, Krismadinata et al., (2020) highlight the importance of systematically structured instructional materials to facilitate the gradual acquisition of competence. There is a clear need to develop structured, inclusive, and contextually relevant instructional media that effectively support the acquisition of vocational skills among learners with visual impairments.

The development of audio-based instructional media for sport massage is essential to enhancing vocational teachers' competence and improving learning outcomes for students with visual impairments. Such media provide practical responses to key challenges, including limited access to learning materials, insufficient teacher preparedness in using assistive technologies, and low levels of student engagement in practice-based learning. The integration of technology, pedagogy, and content enables teachers to deliver instruction more effectively and in ways that are responsive to learners' needs (Ajani, 2024; Gu, 2024). The use of audio-based media also reflects the provision of multiple means of representation to ensure accessibility and equitable participation (Hatami & Chegini, 2024; Shirley & Ward, 2021). By delivering clear, systematic, and easy-to-follow instructions, audio media can further promote learner autonomy and strengthen professional competence in vocational contexts. This study is therefore expected not only to address practical challenges in educational settings but also to make a meaningful contribution to advancing inclusive education practices and developing more responsive and innovative vocational learning.

Method

This study employs a Research and Development (R&D) approach to design and produce audio-based instructional media for sport massage, accompanied by a teacher's guide and Braille materials for learners with visual impairments. The R&D approach is selected as it extends beyond product development to enable systematic evaluation of the product's quality, validity, and practical usefulness within authentic learning contexts (Burkhardt & Schoenfeld, 2021; Kosiol et al., 2024). During the research and information-collecting phase, a needs analysis was conducted through observations, interviews, and document analysis to identify the challenges faced by teachers and students in learning sport massage, particularly for learners with visual impairments. The planning stage involved defining learning objectives, selecting appropriate content, and designing the structure of the audio-based media, including integrating instructional strategies suitable for inclusive education.

Grounded in established principles of systematic instructional design, this approach emphasizes alignment between learner needs, content structure, and delivery methods. From an instructional design perspective, the development of structured, user-centered media is essential to ensure the effective attainment of learning objectives (Garcia-Lopez et al., 2020). The application of the R&D method in this study is therefore expected to yield instructional media that are not only theoretically sound but also effective and adaptable in supporting inclusive teaching practices in vocational education. This approach aligns with the principles of inclusive pedagogy, which advocate removing barriers to learning and providing equitable opportunities for all students to participate meaningfully in educational activities. The design of the instructional media incorporates clear sequencing, explicit instructions, and repetition to support comprehension and skill acquisition, particularly for learners with visual impairments. Such features are essential in vocational education contexts, where mastery of procedural knowledge and practical skills is critical.

Procedure

The research procedure follows the research and development, which comprises ten systematic stages to produce high-quality instructional products with demonstrated effectiveness: (1) research and information collecting, (2) planning, (3) developing the preliminary form of the product, (4) preliminary field test, (5) main product revision, (6) main field test, (7) operational product revision, (8) operational field test, (9) final product revision, and (10) dissemination and implementation (Borg & Gall, 2003). Phases include a preliminary study, product development, and evaluation and dissemination, each representing

a critical component in ensuring the quality and applicability of the developed instructional media. This model emphasizes an iterative development process, with continuous validation and revision, to ensure alignment among the product, user needs, and the learning context. In its implementation, these ten stages are organized into three main phases, as illustrated in the figure below.

Figure 1. Stages of the research procedure

Based on the figure, the research and development process is implemented in a structured, systematic manner across three main phases: product development, product evaluation, and dissemination. The first phase focuses on needs exploration and the design of the initial product, encompassing research and information collecting, planning, and the development of a preliminary product prototype. The second phase emphasizes evaluation through a series of field trials, followed by product revisions and operational refinements to ensure the product's validity, practicality, and effectiveness. The third phase involves dissemination and implementation, aimed at promoting wider utilization of the developed media. This model is applied with the expectation that the study will produce audio-based instructional media that are not only pedagogically effective but also inclusive and responsive to the vocational learning needs of students with visual impairments.

Research Participant

This study was conducted in several special schools (SLB) in Karimun Regency, Riau Islands Province, Indonesia, which provide secondary-level education for students with visual impairments. The participants consisted of three groups. The first group comprised vocational teachers who acted as the primary users of the audio-based sport massage instructional media and participated in the implementation and practicality evaluation stages. The second group included students with visual impairments who were involved as indirect users during the instructional process facilitated by the teachers. The third group consisted of six experts involved in the validation stage, including three sport massage experts and three instructional media experts, who evaluated the content accuracy, instructional design, accessibility, audio quality, and technical feasibility of the developed product.

Participant involvement was carried out across several stages of the research and development process, including preliminary field testing (6 participants), main field testing (15 participants), and operational field testing (42 participants). The validation process employed expert judgment using structured validation sheets, and the results were analyzed using Aiken's V to determine content validity. Furthermore, feasibility data obtained from questionnaires were analyzed descriptively using percentage scores and predefined feasibility categories, while the effectiveness of the instructional media was examined using paired-samples t-tests after fulfilling normality and homogeneity assumptions through the Shapiro–Wilk and Levene's tests. The selection of participants and analytical procedures was guided by development research principles emphasizing collaboration between users and experts to ensure that the developed instructional media were valid, practical, and contextually appropriate for inclusive vocational education settings.

Research Instruments

Data collection in this study employed a range of instruments designed to obtain comprehensive information, including interviews, questionnaires, observations, massage skills tests, and documentation. The use of multiple instruments aligns with the principle of triangulation, which aims to enhance the

validity and reliability of findings by integrating diverse data sources and collection techniques (Biddix & Bourke, 2025; Jalaluddin et al., 2025). Questionnaires, observations, and documentation were used in a complementary manner to evaluate the media's feasibility, examine its implementation in instructional practice, and provide supporting evidence to strengthen the credibility of the findings. In addition, skills tests were administered to assess the effectiveness of the audio-based instructional media for sport massage in enhancing vocational teachers' competencies in teaching students with visual impairments. The integration of these instruments enabled the collection of more comprehensive data, encompassing perceptions, learning processes, and learning outcomes.

The data obtained were analyzed using both qualitative and quantitative approaches to provide a comprehensive account of the quality and effectiveness of the developed instructional media. Qualitative analysis was employed to interpret interview and observational data, enabling an in-depth, contextualized understanding of the phenomena under study. In contrast, quantitative analysis was used to process questionnaire data in the form of rating scores, allowing for an objective assessment of the product's feasibility. This combined approach is consistent with the characteristics of development research, which integrates qualitative and quantitative data within the product evaluation process (Matović & Ovesni, 2023). The integration of these approaches facilitates a more comprehensive understanding of the media's effectiveness, encompassing both learning processes and outcomes. It supports the formulation of more precise recommendations for the development of inclusive instructional media.

Data Analysis

Data analysis in this study integrated qualitative and quantitative approaches to provide a comprehensive evaluation of the quality and effectiveness of the developed instructional media. Qualitative data obtained from interviews and observations were analyzed through systematic stages of data reduction, data display, and conclusion drawing to identify patterns, themes, and meanings relevant to the research objectives (Alam, 2020; Meulen et al., 2024). Meanwhile, quantitative data from questionnaires and massage skills tests were analyzed by calculating mean scores and feasibility percentages to determine the appropriateness of the media against predefined criteria. This combination of analytical techniques is consistent with the nature of development research, which emphasizes comprehensive product evaluation across both process and outcome dimensions (Chen et al., 2026; Hidayat et al., 2026). The results of these analyses were subsequently used to assess the initial effectiveness and readiness of the instructional media for broader implementation within inclusive vocational education contexts.

Results

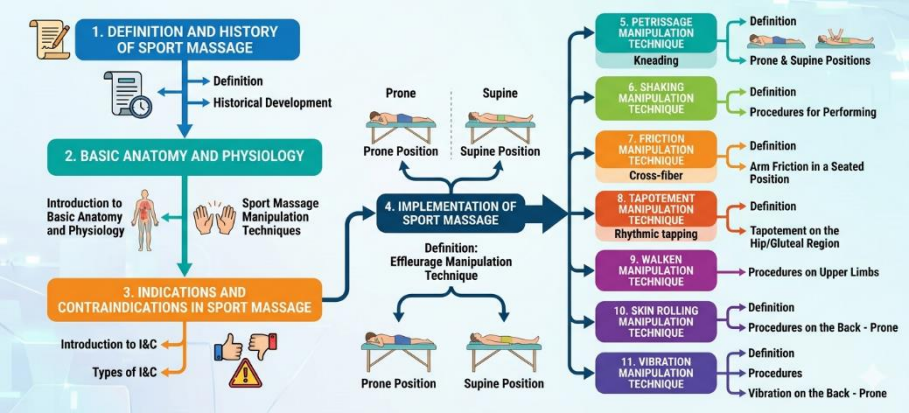
Session 1: Develop Products

In the first phase, namely product development, the research and information collecting stage generated comprehensive data on the learning needs associated with sport massage for students with visual impairments. The findings revealed a lack of accessible instructional media, particularly in the delivery of practical content, which remains predominantly visually oriented. In addition, vocational teachers were found to require instructional media that provide systematic, easy-to-follow guidance aligned with the learning characteristics of students with visual impairments. These findings informed the formulation of product specifications, including the content design, presentation format, and instructional approach to be adopted during development.

At the planning stage, the study developed a structured, systematic conceptual design for the instructional media. This design encompassed formulating learning objectives, organizing content sequences, and developing an audio-based delivery framework tailored to users' needs. The learning materials were organized into a concept map covering the definition and history of sports massage, basic anatomy and physiology, indications and contraindications, and the application of key manipulation techniques, including effleurage, petrissage, friction, tapotement, and vibration. In addition, this stage resulted in the design of integrated supporting materials, namely a teacher's guide and Braille resources for students, ensuring coherence between the audio media and its accompanying instructional materials.

Subsequently, the development of a preliminary product stage resulted in the initial design of audio-based sport massage learning media to enhance vocational teachers' skills for students with visual impairments, as illustrated in the figure. This preliminary product takes the form of audio media that delivers instructional guidance in a structured, step-by-step manner, supported by systematically organized content aligned with the sequence of practical learning activities. The product design also emphasizes clarity of narration, logical sequencing of procedures, and ease of use for both teachers and students. This development serves as an initial prototype, ready to be tested in subsequent stages to obtain feedback and enable further refinement. The following section presents the design of the audio-based sport massage learning media.

Figure 2. Design of the audio-based sport massage learning media



Based on the figure, the design of the audio-based sport massage instructional media is organized systematically through a concept map and an integrated workflow. The content structure begins with definitions and historical background as a conceptual foundation, followed by basic anatomy and physiology relevant to massage practice, enabling learners to understand body structures and their functions. Indications and contraindications are then presented as essential safety guidelines. At the implementation stage, the media provides structured, step-by-step practical instructions. Learning begins with an introduction to prone and supine positions, after which learners progressively acquire manipulation techniques from basic to advanced levels. Each technique includes its definition, procedural steps, and application to specific body areas. This structured presentation facilitates systematic engagement with the instructional content, integrating both theoretical knowledge and practical application. As a result, the media supports more structured learning and helps students with visual impairments develop practical skills in sports massage.

Session 2: Test Results

In the second phase, a preliminary field test was conducted to evaluate the validity of the audio-based sport massage learning media for enhancing vocational teachers' skills in working with students with visual impairments. This stage involved six experts, comprising three specialists in sport massage, Prof. Dr. Ali Satia Graha, M.Kes; Dr. Deri Putra, M.Pd; and Helvi Darsi, S.Pd., M.Pd; and three experts in instructional media, Prof. Dr. Alwen Bentri, M.Pd; Dr. MHD. Natsir, S.Sos., S.Pd., M.Pd; and Ilham Gantar Friansyah, S.Kom., M.MSI. The evaluation process employed an instrument covering content validity, material presentation, audio quality, and the suitability of the media for learners with visual impairments. The data obtained from each expert were subsequently analyzed to determine the overall validity of the developed media. A summary of the evaluation results from the preliminary field test stage is presented in Table 1 below.

Table 1. Validity of the audio-based sport massage learning media

	E1	E2	E3	E4	E5	E6	Mean
Mean	4,40	3,70	4,40	4,40	4,90	4,10	4,32
Standard Deviation	0,52	0,67	0,52	0,52	0,32	0,74	0,55
Achievement Percentage	88%	74%	88%	88%	98%	82%	86,33%
V Aiken Values							0,83

Based on Table 1, the audio-based sport massage learning media to enhance vocational teachers' skills for students with visual impairments demonstrates high validity, as indicated by Aiken's V coefficient of 0.83. This value suggests that the experts provided consistent evaluations of the media's feasibility across the assessed dimensions, confirming that it meets the validity criteria. Furthermore, the high mean scores reported by each evaluator indicate that the quality of content, presentation, and alignment with learning needs falls within the good to very good categories. Although some variation in scores was observed among the experts, these differences were not substantial and remained within a positive evaluation range. Overall, these findings affirm that the developed media are sufficiently valid to proceed to the next stage of field test, with minor revisions incorporated in response to expert feedback.

The main field test, operational product revision, operational field test, and final product revision were conducted sequentially to evaluate feasibility and refine the developed media. The main field test involved 15 participants and served as a limited trial to obtain an initial understanding of user acceptance and the practicality of the media. Subsequently, the product was revised based on findings from this stage before being re-evaluated in the operational field test phase, which involved 42 participants to generate more comprehensive and representative data. Following this, a final product revision was undertaken to produce the refined media, incorporating insights from all testing stages. The feasibility assessment at both field test stages was categorized into several levels based on predetermined scoring intervals. The distribution of feasibility results from the main field test and operational field test stages is presented in Table 2 below.

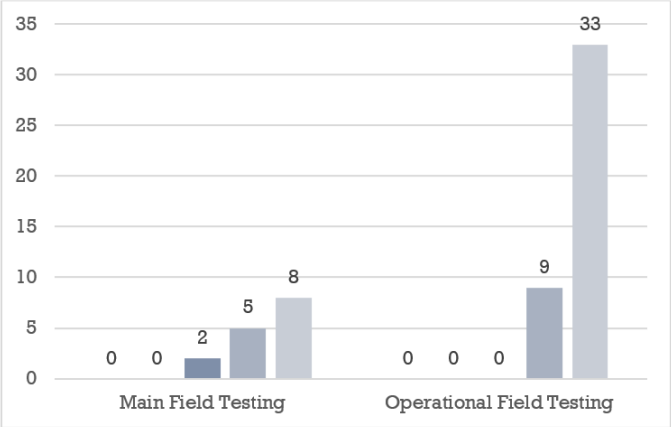
Table 2. Feasibility of the audio-based sport massage learning media

No	Score Interval	Category	Main Field test		Operational Field test	
			Frequency	Percentage	Frequency	Percentage
1	41-50	Very Good	8	53.33	33	78.57
2	31-40	Good	5	33.33	9	21.43
3	21-30	Fair	2	13.33	0	0.00
4	11-20	Poor	0	0.00	0	0.00
5	1-10	Very Poor	0	0.00	0	0.00
Total			15	100	42	100

The feasibility results from the main field test stage indicate that the majority of participants rated the media as "Very Good" (53.33%), followed by "Good" (33.33%) and "Fair" (13.33%), with no ratings in the "Poor" or "Very Poor" categories. In the operational field-testing stage, a notable improvement is observed: most participants rate the media as "Very Good" (78.57%) and the remainder as "Good" (21.43%), with no ratings in the lower categories. These findings suggest that revisions to the product improved its overall quality, thereby increasing feasibility and user acceptance. The concentration of ratings in the "Good" and "Very Good" categories indicates that the developed media are highly feasible and suitable for instructional practice. When the data presented in the table are expressed as a frequency distribution, they can be illustrated as shown in the figure below.

The frequency distribution presented in the figure further demonstrates a positive shift in participants' evaluations following the revision process. These improvements reflect the success of the iterative revision process in refining both the content and technical quality of the media based on user feedback and expert recommendations. In addition, the findings suggest that the audio-based instructional media were able to meet the learning needs of vocational teachers and support more inclusive sport massage instruction for students with visual impairments. The results confirm that the developed media possess strong practicality and readiness for broader implementation in inclusive vocational education settings.

Figure 3. Effectiveness of the developed product



The effectiveness test was conducted to examine the impact of the Audio-Based Sport Massage media on improving students' practical skills in performing sport massage. The analyzed data included students' skill levels before (pre-test) and after (post-test) the intervention, across both the main field test and operational field test stages. Effectiveness was assessed using a paired-samples t-test (dependent t-test). Before this analysis, prerequisite tests were performed, including tests of normality and homogeneity, to ensure the data were suitable for analysis. Normality was examined using the Kolmogorov–Smirnov and Shapiro–Wilk tests, while homogeneity was assessed using Levene's test. The results of the normality and homogeneity tests for both study stages are presented in Tables 3 and 4 below.

Table 3. Tests of normality

Tests of Normality							
	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Main Field Test	Posttest-Pretest	.187	15	.164	.883	15	.053
		.192	15	.142	.888	15	.062
Operational Field Test	Posttest-Pretest	.121	42	.133	.965	42	.214
		.102	42	.200*	.968	42	.289

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The normality tests indicate that all datasets in both the main and operational field test phases satisfy the assumption of normality. This is evidenced by the p-values from the Kolmogorov–Smirnov and Shapiro–Wilk tests, which generally exceed the established threshold for statistical significance. In the main field test phase, the Shapiro–Wilk significance values for the difference between post-test and pre-test scores are 0.053 and 0.062, indicating that the data are normally distributed, albeit close to the critical threshold. In contrast, the operational field test phase yields higher significance values of 0.214 and 0.289, further confirming the normality of the data distribution.

Table 4. Test of homogeneity

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Main Field Test	Based on Mean	.003	1	28	.960
	Based on Median	.001	1	28	.971
	Based on Median and with adjusted df	.001	1	27.999	.971
	Based on the trimmed mean	.002	1	28	.961
Operational Field Test	Based on Mean	.002	1	82	.961
	Based on Median	.002	1	82	.961
	Based on Median and with adjusted df	.002	1	81.916	.961
	Based on the trimmed mean	.002	1	82	.961

The results of the homogeneity-of-variance tests indicate that the data from both the main field test and the operational field test phases exhibit homogeneous variance. This is demonstrated by the significance values obtained from Levene's test across all approaches (based on the mean, median, median with adjusted degrees of freedom, and trimmed mean), all of which are well above the established significance threshold. In the main field test phase, the significance values range from 0.960 to 0.971, while in the operational field test phase, all values are consistently 0.961. This high level of consistency across both phases indicates that there are no statistically significant differences in variance between the data groups. Accordingly, the assumption of homogeneity is satisfied, confirming that the data are suitable for further analysis using parametric statistical tests in the subsequent stage.

A paired-samples t-test (dependent t-test) was conducted to determine whether there was a statistically significant difference in students' skill scores before (pre-test) and after (post-test) the intervention using audio-based sport massage media. This analysis was performed in both the main field test and operational field test stages to evaluate the effectiveness of the developed media in enhancing practical sport massage skills. The results indicate a consistent increase in mean scores from pre-test to post-test across both stages, suggesting an improvement in students' skills following the use of the media. Moreover, the high t-values and very low significance levels obtained in both testing phases confirm that these differences are statistically significant. These findings demonstrate that the developed audio-based instructional media are effective in improving students' practical skills in sport massage. The complete results of the paired-samples t-test are presented in Table 5 below.

Table 5. Uji t dependent

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Main Field Test	Posttest-Pretest	4.933	.258	.067	5.076	4.790	74.000	14	.000
Operational Field Test	Posttest-Pretest	4.929	.342	.053	5.035	4.822	93.490	41	.000

Based on Table 5, there is a statistically significant difference between the pre-test and post-test scores in both the main field test and operational field test stages. This is evidenced by the positive mean differences of 4.933 in the main field test stage and 4.929 in the operational field test stage, indicating an increase in post-test scores. In addition, the very high t-values (74.000 and 93.490, respectively) and the significance levels (Sig. 2-tailed) of 0.000 in both stages confirm that these differences are statistically significant. The 95% confidence intervals, which do not cross zero, further support the consistency of the observed improvement. It can be concluded that the use of audio-based sport massage media is effective in enhancing students' practical sport massage skills across both testing stages. These findings indicate that the developed instructional media not only improved students' practical performance but also demonstrated consistent effectiveness across different stages of implementation.

Session 3: Desimination

In the third phase, Dissemination and Implementation were carried out to promote and apply the Audio-Based Sport Massage Learning Media to Enhance Vocational Teachers' Skills for Students with Visual Impairments in real educational settings. This phase involved training sessions and direct implementation with teachers across several special schools in the Riau Islands Province. In Karimun Regency, the activities were conducted at SLB Negeri Karimun, SLB Sehati Karimun, and YPPB Karimun. In Batam City, implementation took place at SLB Negeri Batam, SLB Putrakami, and SLB Kartini Batam. Meanwhile, in Tanjung Pinang City, the activities were held at SLB Negeri 1 Tanjung Pinang, SLB Negeri 2 Tanjung Pinang, and SLB Mutiara. These activities included training in media use, guided support during classroom implementation, and a preliminary evaluation of its application by teachers. The dissemination process aimed to ensure that the developed media could be widely adopted and effectively utilized to enhance the quality of sport massage skills instruction for students with visual impairments. A comprehensive account of these dissemination and implementation activities is presented in Figure 5.

Figure 5. Dissemination and implementation process

Based on the overall findings from the development process, feasibility testing, effectiveness evaluation, and field implementation, the audio-based sport massage media is recommended for adoption as a core instructional resource in future massage learning. This recommendation is supported by consistent evidence demonstrating that the media enhances practical skill acquisition, facilitates clearer instructional delivery, and increases learner engagement in the learning process. Moreover, the media is considered practical for teachers to use and can be flexibly integrated into instructional activities, both during demonstrations and independent practice. Accordingly, its sustained implementation is expected to improve the quality of vocational education, particularly in sport massage training for students with visual impairments.

Discussion

The findings indicate that the developed audio-based sport massage media demonstrates high validity, as reflected in Aiken's V coefficient of 0.83. This result confirms that the media are appropriate in terms of content, design, and alignment with learning needs. This finding is consistent with Aiken's view, which suggests that a high Aiken's V coefficient indicates strong agreement among experts regarding the relevance and quality of an instructional product (Ahmad et al., 2024; Tajuddin et al., 2025). The effectiveness tests reveal a statistically significant improvement between pre-test and post-test scores in both the main field test and operational field test stages, indicating that the developed media effectively enhance practical sport massage skills. This result is supported by learning theories emphasizing that appropriately designed instructional media can substantially improve learning outcomes.

Consistent improvement across both testing stages, the main field test and the operational field test, indicates that the developed media is effective not only in limited trials but also in wider implementation contexts. Learner-centered instructional design theory emphasizes that media tailored to users' characteristics can optimize information processing by aligning content with learners' needs and abilities (Muh. Rizal Samad, 2026; Qin, 2024). This aligns with Roemintoyo & Wibawanto (2023) findings, which highlight that structured, media-based instructional interventions have a significant impact on learners' performance. In summary, the high validity and demonstrated effectiveness of the developed media indicate strong potential for its wider application in vocational education, particularly in supporting students with visual impairments.

Audio-based sport massage media function effectively in delivering practical instruction gradually and systematically, enabling users to follow each procedural step with greater ease. This finding aligns with Jayalath & Esichaikul (2022) perspective that structured and sequential presentation of information enhances procedural understanding in learning. In addition, the use of audio media allows instructions to be delivered clearly and repeatedly, thereby supporting the internalization of practical skills more effectively. This is consistent with the work of (Falkenberg et al., 2025; Klingenberg et al., 2020), which demonstrates that audio-based media are particularly effective for teaching skills that require step-by-step guidance. This approach facilitates independent practice by allowing learners to control the pace and repetition of instructional content to suit their individual learning needs. Independent practice is

supported, as learners can control the pace and repetition of instructional content to meet their individual learning needs.

Results indicate that the use of the developed media improves vocational teachers' competence in managing instruction in a more structured and systematic manner. This finding aligns with the Technological Pedagogical Content Knowledge framework, which emphasizes integrating technology to enhance teaching practice (Reich et al., 2021; Younis, 2025). Increased teacher confidence in using instructional media was also observed during implementation. This supports Gagnon & Dubeau (2023) which posits that successful engagement with tools or strategies can strengthen individuals' beliefs in their ability to perform tasks effectively. Audio-based instructional media serve not only as pedagogical support tools but also as a means of enhancing teachers' professional competence in vocational education contexts.

Findings indicate that the audio-based sport massage media demonstrate a high level of alignment with the characteristics of learners with visual impairments, particularly in accommodating auditory and kinaesthetic learning needs through clear, structured, and easy-to-follow instructions. The Universal Design for Learning (UDL) framework emphasizes the provision of multiple means of representation to support diverse learning needs and ensure accessibility for all learners across different instructional contexts (Priyadharsini & Sahaya Mary, 2024). The use of audio media in this study effectively supports procedural understanding and movement orientation by stimulating the auditory modality, which is predominant among learners with visual impairments. This aligns with the work of Griffin-Shirley et al., (2024) who argue that optimizing non-visual modalities can enhance learning effectiveness for individuals with visual impairments. Audio-based instruction enables learners to build more accurate mental representations of sequential movements, thereby improving precision in skill execution.

Implementation results further reveal high levels of engagement and positive user responses from both teachers and students, as reflected in the ease of use of the media and the enthusiasm shown during learning activities. These findings are consistent with Edeh et al., (2021) Technology Acceptance Model, which highlights that perceived ease of use and perceived usefulness significantly influence user acceptance. The strong learner engagement observed suggests that the developed media foster a more interactive and meaningful learning experience. Active engagement plays a crucial role in improving learning outcomes (Dimitrova et al., 2024; Li et al., 2024). Overall, the strong alignment of the media with the characteristics of learners with visual impairments, combined with high levels of user acceptance, indicates that the media are both effective and relevant for application in inclusive vocational education contexts.

Findings from this study demonstrate a clear element of novelty through the development of audio-based sport massage media specifically designed to support learners with visual impairments in acquiring practical skills in vocational education contexts. This contribution aligns with Ebuenyi et al., (2020) view that the value of research lies in its capacity to offer new solutions to underexplored problems in the literature. The developed media extend beyond considerations of accessibility by integrating systematic procedural instruction, thereby addressing the specific demands of sport massage skills training. This is consistent with Nwachukwu et al., (2025) who argue that adaptive and flexible instructional design enhances learning effectiveness for individuals with special educational needs. Innovation presented in this study also provides a scalable model that can be adapted to other vocational skill areas requiring structured, practice-oriented instruction.

The implementation of this media has positive implications for inclusive practices in special schools, particularly by enhancing the quality of vocational education provision to be more equitable and responsive. This finding aligns with the principles of inclusive education, which emphasize equal access to and learning opportunities for all learners (Kaufmann et al., 2022; Schmid & Veerle Garrels, 2022). In addition, the use of audio-based media in this study demonstrates potential for replication and adaptation across other vocational skill domains. This is supported by Yang et al., (2025) who highlight that innovation in instructional strategies and media is fundamental to the sustainable development of inclusive education practices. Overall, this study contributes not only to the advancement of instructional media development but also to the strengthening of more adaptive, inclusive educational practices that are responsive to the needs of learners with visual impairments.

This study has several limitations, including a relatively small sample size and a restricted research scope limited to several schools within a single province; therefore, the generalisability of the findings

should be interpreted with caution. This limitation is consistent with (Sharma, 2024) view that sample size and contextual constraints may affect the extent to which research findings can be generalized. In addition, the study did not fully control for external variables that may have influenced the results, such as differences in participants' prior abilities, prior learning experiences, and variations in the teaching methods used during implementation. This aligns with Gallego-Jiménez et al., (2025) argument regarding the importance of controlling variables to enhance internal validity. These limitations indicate a need for more rigorous experimental designs in future studies to strengthen the validity and generalisability of findings, particularly by improving control of confounding variables, expanding sample representation, and applying more robust and systematic data collection procedures.

Despite these limitations, the findings provide a solid foundation for further development, particularly in extending the scope of implementation and refining the media design. Future research is therefore recommended to involve larger, more diverse samples and to be conducted across different regional contexts to strengthen the generalisability of the findings. This recommendation aligns with Findley et al., (2021) who emphasizes that replication across multiple contexts can enhance external validity. Future development of the media could incorporate additional technologies, such as mobile applications or interactive digital features, to improve flexibility and enrich the user learning experience. Integrating digital technologies into educational frameworks can significantly enhance learner accessibility and facilitate more impactful pedagogical outcomes (Abimbola et al., 2024; Akintayo et al., 2024; Al-Zahrani, 2025). Further research is expected not only to reinforce the current findings but also to foster more adaptive and sustainable innovations in instructional media. Such efforts may also contribute to broader adoption of inclusive learning practices in vocational education settings by promoting more accessible, flexible, and learner-centered instructional approaches across diverse educational environments.

Conclusions

This study successfully developed audio-based sport massage instructional media that demonstrate high validity and excellent feasibility, as evidenced by expert evaluations, and show significant effectiveness in improving practical sport massage skills. Field test at both the main and operational field test stages revealed consistent increases in pre-test and post-test scores, indicating that the developed media effectively support the learning process. Furthermore, the media are well aligned with the characteristics of learners with visual impairments, as they employ a systematic and easy-to-follow auditory approach that facilitates comprehension of instructions and enhances learner engagement. Implementation across several special schools also indicates that the media are practical to use and help improve teachers' competence in delivering instruction in a more structured manner.

Overall, this study makes a meaningful contribution to the development of inclusive and adaptive vocational instructional media, particularly for learners with visual impairments. The audio-based media developed are not only effective in enhancing practical skills but also show strong potential for sustained integration into massage instruction within special school settings. However, the study is limited by its sample size and geographical scope, indicating the need for further research involving larger samples and more diverse contexts. Future development should also incorporate more advanced, innovative technologies to enhance flexibility and enrich the learning experience, thereby extending the applicability of this media to a wider range of vocational skill domains.

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