

## **A Simulation-Based Kinesthetic Learning Model of Indonesian-Thailand College Students to Prevent Long-Term Musculoskeletal Health Problems in Rural Areas**

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### **Abstract**

Musculoskeletal health problems are among the most common health issues affecting communities, particularly in rural areas, due to heavy physical labor, non-ergonomic working postures, and limited access to health education. These conditions can reduce productivity, impair quality of life, and increase the risk of disability if preventive measures are not implemented early. Community-based health promotion programs that combine educational approaches with hands-on practice represent an effective strategy to enhance community knowledge and skills in preventing musculoskeletal problems. Furthermore, cross-national collaboration in community service initiatives can enrich learning methods and broaden perspectives in delivering health education. This community service program aimed to provide health promotion to prevent musculoskeletal health problems in rural areas by involving students from Indonesia and Thailand. The program employed a pre- and post-intervention design to evaluate improvements in knowledge and skills among 20 participants in a rural community. The results demonstrated increased competency following student-led simulations, with correct responses rising to 95% in injury prevention, 90% in stretching and muscle strengthening, and 90% in the ability to identify populations vulnerable to musculoskeletal problems. Specifically, participants' ability to perform back-strengthening exercises improved to a mean score of  $4.10 \pm 1.02$ , indicating that direct demonstration of techniques had a significant impact. Participants also showed the highest level of confidence when performing upper-arm stretching exercises, with a mean score of  $4.65 \pm 0.87$ , reflecting strong understanding among the participants. Another key finding revealed that video was the most preferred learning method, chosen by 55% of participants. The use of this learning medium has considerable potential to support musculoskeletal health promotion in rural communities. Overall, the program achieved its intended objectives and provides a replicable model for similar health promotion initiatives in other rural areas. These findings may inform future health promotion strategies by emphasizing the use of multimedia and experiential learning approaches in delivering education and enhancing skills within musculoskeletal health programs.

**Keywords:** Community Services, Health Science Students, Learning Style, Musculoskeletal Problem.

### **Abstrak**

Masalah kesehatan muskuloskeletal merupakan salah satu permasalahan kesehatan yang banyak dialami masyarakat, khususnya di daerah pedesaan, akibat aktivitas fisik berat, postur kerja yang kurang ergonomis, serta keterbatasan akses terhadap edukasi kesehatan. Gangguan ini dapat menurunkan produktivitas, kualitas hidup, dan meningkatkan risiko disabilitas apabila tidak dilakukan upaya pencegahan sejak dini. Promosi kesehatan berbasis komunitas yang melibatkan pendekatan edukatif dan praktik langsung menjadi salah satu strategi efektif dalam meningkatkan pengetahuan dan keterampilan masyarakat terkait pencegahan masalah muskuloskeletal. Selain itu, kolaborasi lintas negara dalam kegiatan pengabdian masyarakat dapat memperkaya metode pembelajaran serta memperluas perspektif dalam penyampaian edukasi kesehatan. Program pengabdian masyarakat ini bertujuan untuk memberikan promosi kesehatan dalam upaya pencegahan masalah kesehatan muskuloskeletal di daerah pedesaan dengan melibatkan mahasiswa dari

Indonesia dan Thailand. Program ini menerapkan desain pra dan pascaintervensi untuk mengevaluasi peningkatan pengetahuan dan keterampilan pada 20 peserta di daerah pedesaan. Hasil menunjukkan adanya peningkatan kompetensi setelah dilakukan simulasi oleh mahasiswa, dengan jawaban benar meningkat menjadi 95% pada aspek pencegahan cedera, 90% pada aspek peregangan dan penguatan otot, serta 90% dalam kemampuan mengidentifikasi populasi yang rentan terhadap masalah muskuloskeletal. Secara khusus, kemampuan warga dalam melakukan latihan penguatan punggung meningkat menjadi  $4,10 \pm 1,02$ . Hal ini menunjukkan bahwa demonstrasi teknik secara langsung memberikan pengaruh yang signifikan. Masyarakat juga menunjukkan tingkat kepercayaan diri tertinggi saat melakukan peregangan lengan atas, dengan nilai rata-rata  $4,65 \pm 0,87$ , yang menandakan pemahaman yang kuat di antara peserta. Temuan penting lainnya menunjukkan bahwa video menjadi teknik pembelajaran yang paling disukai, dipilih oleh 55% peserta. Penggunaan media pembelajaran ini berpotensi besar dalam mendukung promosi kesehatan muskuloskeletal di kalangan masyarakat pedesaan. Secara keseluruhan, program ini telah mencapai tujuan yang diharapkan dan memberikan model yang dapat direplikasi untuk kegiatan promosi kesehatan serupa di daerah pedesaan lainnya. Temuan ini dapat menjadi masukan bagi strategi promosi kesehatan di masa mendatang dengan menekankan penggunaan multimedia dan pembelajaran berbasis pengalaman sebagai pendekatan utama dalam penyampaian edukasi serta peningkatan keterampilan pada program kesehatan muskuloskeletal.

**Kata Kunci:** Gaya Belajar, Mahasiswa Ilmu Kesehatan, Masalah Muskuloskeletal, Pengabdian Kepada Masyarakat.

## A. INTRODUCTION

Musculoskeletal health problems represent a major public health concern, particularly in rural areas and commonly manifests as arthritis and chronic pain in the lower back, neck, and shoulders (Indrayani et al., 2025; Oakman et al., 2019; NIOSH, 2018). The potential reason of these musculoskeletal problem have been identified due to lack of physical activity, inadequate exercise, and poor rest habits (Yirdaw & Adane, 2024). The effect of lack motivation in maintaining musculoskeletal health including injuries, physical strain, and fatality (Dianat et al., 2020). Exercise and education has been systematically searched and proof to be effective program to musculoskeletal health problem (Indrayani et al., 2024a; Palsson et al., 2020). In rural settings, these challenges are often exacerbated by limited access to healthcare services and environmental factors related to climate change, such as temperature fluctuations and occupational exposure, which further increase the risk of developing musculoskeletal disorders (Indrayani et al., 2025). Preventing these issues requires effective educational strategies that engage learners actively and practically.

The current community services in the designated village is dedicated after research finding of students and the rural community health problem. A pilot study of Indrayani et al. (2024b) explored learning style for Indonesia-Thailand college student, who are future generation for healthcare providers, resulting simulation-based kinesthetic methods of learning strategy are the most preferred to earn cognitive and skills. This alignment supported by other studies that significantly enhanced the students' academic outcomes by allowing them to engage more actively and meaningfully with the learning material (Anbari, 2020; Alfarsi et al., 2023). Recognizing this learning preference, the researchers strategically tailored health science Indonesia-Thailand student to align with kinesthetic methods while delivering health promotion to community in achieving better musculoskeletal health. Melinggih Village, located in Gianyar Regency, Bali Province, has been designated as a pilot village in Indonesia for the development of Long-Term Care services. A survey conducted by Suyasa et al. (2023) involving 1,053 elderly individuals aged 60 and above revealed that 8% of them experience problems with Instrumental Activities of Daily Living (IADL) and tend to have lower levels of independence and overall health status including their musculoskeletal condition, hence the residents and their families require comprehensive training and assistance to improve their knowledge and skills over musculoskeletal condition, also relatives improve one' mental (Susanti et al., 2025). This is essential for promoting better health outcomes and enhancing the quality of life through a structured long-term care process.

By incorporating simulation techniques that replicate real-life situation related to musculoskeletal health, it equip students with the necessary knowledge and skills to prevent long-term musculoskeletal problems within their communities. The educational learning model foster practical competencies and promoting health advocacy (Johnson et al., 2023; Li et al., 2024).

Therefore this community service effort aims to empower Melinggih Village residents that delivered by students, by improving residents' understanding and management of musculoskeletal health, thereby enhancing the overall quality of life and promoting sustainable long-term care. The approach reinforces the value of experiential learning while fostering a supportive network between students, health professionals, and community partners, ensuring that knowledge transfer leads to tangible health benefits for the elderly population.

## **B. METHODS AND IMPLEMENTATION**

This community service program was conducted in Melinggih Village in May 2025 and targeted local residents as participants. The program aimed to promote the integration of stretching exercises into daily activities and to educate villagers on maintaining musculoskeletal health. The initiative involved collaboration between one faculty member from Boromarajonani College of Nursing Nonthaburi and nine faculty members from the Institute of Technology and Health Bali, each contributing expertise from their respective fields. A one-group pre-test and post-test design without a control group was purposively applied to 20 participants. The primary objective was to enhance participants' cognitive understanding and practical skills in performing exercises and adopting healthy lifestyles to prevent musculoskeletal problems. Evaluation instruments were developed to measure both knowledge and the ability to perform the intervention.

The program was implemented through structured face-to-face phases consisting of pre-intervention, implementation, and evaluation. During the pre-intervention phase, stakeholder engagement was conducted at an early stage to ensure contextual appropriateness and accurate targeting of the program within the community (Watts & Green, 2023). In the intervention phase, health promotion, simulation, redemonstration, implementation, and monitoring were carried out while considering environmental context and interactions with caregivers (Sutini et al., 2024; Suyasa et al., 2024). A paper-based pre-test was administered at the beginning of the program to assess participants' baseline knowledge and capabilities related to musculoskeletal health problems and stretching exercises.

The health promotion and education activities were delivered by the community service team with active involvement from caregivers, family members, and community members as key partners. The program emphasized the consequences of musculoskeletal disorders and highlighted the importance of regular physical activity and exercise as preventive measures. Through interactive and practical sessions, participants gained knowledge and skills to support musculoskeletal health for themselves and those under their care. All materials and presentations were delivered in Bahasa Indonesia to ensure clarity and effective communication.

Simulation sessions were designed to create a realistic practice environment in which participants could actively perform specific tasks related to the intervention. This hands-on approach enabled community members and caregivers to practice skills safely before applying them in real-life situations. Flyers were distributed to all participants to support learning. By mimicking real-life scenarios demonstrated by Thai and Indonesian students, the simulation helped build confidence, improve technique, and deepen understanding of appropriate methods for preventing musculoskeletal problems.

Following the simulation, participants engaged in redemonstration, during which they were asked to repeat at least two out of four techniques for each skill. This step ensured that the knowledge gained was correctly understood and applied. It also provided facilitators with the opportunity to offer feedback, clarify misunderstandings, and reinforce correct practices. Redemonstration strengthened skill retention and empowered participants to confidently implement preventive measures in their daily routines.

The implementation phase involved active participation from all targeted residents under the supervision of the faculty team. Students were given the opportunity to directly facilitate activities with participants, enhancing both community engagement and experiential learning.

Monitoring and evaluation were conducted through pre-test and post-test assessments to measure changes in knowledge and skills. The pre-test established baseline data on participants' understanding of musculoskeletal health prevention and exercise practices. After the educational and practical sessions, the post-test measured improvements in knowledge and skill levels. This

comparison allowed the team to evaluate the effectiveness of the program, identify successful components, and determine areas requiring further reinforcement. Through this systematic approach, the community service team ensured that learning objectives were achieved and gathered insights for future program development.

### C. RESULTS AND DISCUSSION



**Figure 1.** Theoretical brainstorming in a group discussion between Thai and Indonesian students before demonstrating in community practice.



**Figure 2.** Demonstrating and evaluating musculoskeletal health promotion before delivering to communities, demonstrating in community practice.



**Figure 3.** Collaboration of Indonesian and Thai student in delivering the health promotion.



**Figure 4.** Demonstration of musculoskeletal injury pain health promotion by Thai and Indonesian students

The evaluation has been projected according to IPPKI (2017) to understand cognitive and ability of doing the program.

**Table 1.** Knowledge of musculoskeletal prevention among villagers in Melinggih.

Question items	Pre (f/%)		Post (f/%)	
	Incorrect	Correct	Incorrect	Correct
Knowledge category 1: musculoskeletal injury prevention	13 (65%)	7 (35%)	1 (5%)	19 (95%)
Knowledge category 2: pose of stretching	9 (45%)	11 (55%)	2 (10%)	18 (90%)
Knowledge category 3: pose of strengthening	6 (30%)	14 (70%)	2 (10%)	18 (90%)
Knowledge category 4: vulnerable population in musculoskeletal problems	12 (60%)	8 (40%)	2 (10%)	18 (90%)

*Note: Total score is out of 20 items*

Table 1 illustrates an improvement in villagers' competence related to musculoskeletal injury prevention following the educational health promotion that has been conducted in Melinggih. Before the health promotion deployed, a majority of participants answered incorrectly in all four knowledge categories: 65% for injury prevention, 45% for the purpose of stretching, 30% for strengthening, and 60% for identifying vulnerable population in musculoskeletal problem. Evaluating after the promotion, results show an increase of competence across all categories, with correct answers rising to 95% for injury prevention, 90% for both stretching and strengthening, and 90% for identifying vulnerable population in musculoskeletal problem.

**Table 2.** Ability to perform musculoskeletal prevention among villagers in Melinggih.

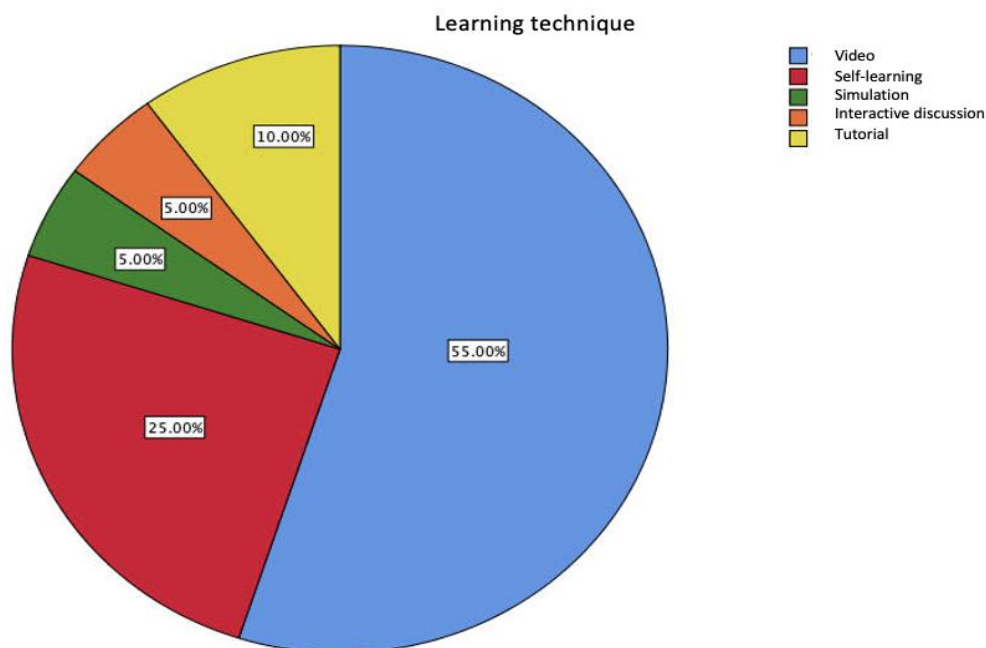
Ability to demonstrate musculoskeletal prevention	Pre (M±SD)	Post (M±SD)
Skill of stretching	3.90±0.33	4.50±0.88
Skill of strengthening	3.75±1.16	4.40±0.82
Skill of back strengthening	3.40±1.31	4.10±1.02
Skill of upper limb stretching	4.25±1.06	4.65±0.87

Table 2 shows an overall improvement of residents' ability in redemonstrating musculoskeletal prevention skills following the instruction. The mean scores for each skill increased post health promotion education, indicating enhanced performance. The skill of stretching improved from a pre-test (3.90±0.33) to 4.5±0.88 post-test, and strengthening skills rose from 3.75±1.16 to 4.40±0.82. Notably, the ability of residents to perform back strengthening, which had the lowest initial average 3.40±1.31, also improved to 4.10±1.02, suggesting that targeted demonstration with the technique was considerable. Communities expressed the highest confidence while demonstrating upper limb stretching 4.65±0.87, indicating a strong grasp of this particular technique among participants.

**Table 3.** Media to promote musculoskeletal health in Melinggih.

Learning technique	f (%)
Video	11 (55%)
Self-learning	2 (25%)
Simulation	1 (5%)
Interactive discussion	1 (5%)
Tutorial (brochure or handouts)	2 (10%)

Table 3 highlights the preferred media used to promote musculoskeletal health among the villagers. Video emerged as the most favored learning technique, chosen by 55% of participants. This was followed by on-site learning (25%), with other methods like simulation, discussion, and printed materials such as brochures or handouts receiving minimal use (5–10%). This finding of majority population preferred video as the learning technique, it can be highlighted as a recommendation for future program implementation.



The result suggests that the musculoskeletal promotion based on kinesthetic simulation by Indonesian and Thai student was effective in enhancing the villagers' understanding of musculoskeletal health and preventive practices. Interestingly, the data indicate that the villagers in Melinggih already demonstrated a relatively high baseline understanding and ability in performing strengthening poses prior to the health promotion intervention, with a pre-test mean score of 3.75 ( $\pm 1.16$ ). Following the intervention, this ability improved further to a post-test mean of 4.40 ( $\pm 0.82$ ), suggesting not only pre-existing exposure but also an enhanced mastery of the skill through targeted education. The trend of posture visualization skills (Han et al., 2023) implies that strengthening exercises may have already been familiar within the community, potentially through informal learning or previous exposure to similar health initiatives.

Given this foundation, future interventions may not require intensive direct instruction for the skill set. Instead, a community-based participatory approach could be implemented, wherein individuals who have demonstrated competency are empowered to take on peer-educator roles. These trained individuals can facilitate the dissemination of knowledge and skills to other members of the community who have not yet been exposed. This model aligns with principles of sustainable health promotion, emphasizing capacity-building and local ownership, and may enhance the scalability and cultural relevance of future musculoskeletal prevention programs (Johnston et al., 2023). As the communities prefer health education through video, as video present better visualization in interpretation (Su et al., 2023), these results suggest that practical approaches particularly video content are more preferable and engaging for this community in learning health-related skills. The importance of long-term practice or program sustainability to strengthen the musculoskeletal health learning. This insight can inform future health promotion strategies by emphasizing multimedia and experiential learning tools.

One practical application in a health promotion program focused on reducing musculoskeletal pain, where students applied kinesthetic learning by directly participating in health education and preventive interventions. Kinesthetic learning helped students delivering interventions because the

design promotes active engagement, experiential understanding, and better retention of practical skills interaction between the sender and receiver (Li et al., 2024; Mozzafari et al., 2020). By physically participating in preventive activities through health education, students are more likely to internalize proper techniques, encourage confidence, and apply knowledge accurately in real-world. The educational intervention addresses cultural and contextual factors unique to rural populations in both countries, fostering practical competencies and promoting health advocacy (Johnson et al., 2023; Li et al., 2024). Through active involvement such as performing physical demonstrations, leading exercise sessions, or engaging in community based education the students not only deepened their understanding but also improved their ability to retain and apply knowledge. This kinesthetic learning strategy not only benefited the students but also had a positive impact on the community (Wilson et al., 2024). As students applied their learning in real-world contexts, local residents gained awareness and practical guidance on managing and preventing musculoskeletal pain. The mutual benefit reinforced the value of experiential learning, promoting better health outcomes in the community while enhancing students' professional competencies. On the other hand, this community service program was limited by the small number of participants and the short duration of the intervention. In the future, community service program should involve a larger participant within longer intervention. Additionally, practical recommendations for the community service program in rural area should consider incorporating instructional videos attached with independent exercise modules to support sustainability and enable wider implementation.

## CONCLUSION

The current community service program implemented in Melinggih demonstrated relevance and effectiveness in knowledge and skill improvement of musculoskeletal health which aligned with public health goals aimed at reducing preventable physical injuries in rural communities. The program used engagement in preferred educational medium and cost-effective learning media such as video-based instruction which increased confidence and competence among villagers indicate successful knowledge retention and potential for long-term behavioral change. Overall, the program achieved its intended outcomes and provides a replicable model for sustainable musculoskeletal health promotion in similar rural settings. A continuity of follow-up in long-term capacity and the integration of interactive learning methods are recommended to enhance program impact and sustainability.

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