



Development and Evaluation of a Context-Focused Mobile Web Learning Application to Enhance Knowledge and Mental Health Literacy among Hill Tribe Junior High School Students in Northern Thailand

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Received: September 6 2025; Revised: November 27 2025; Accepted: December 12 2025

Abstract

The objectives of this study were to develop and evaluate the hill tribes' context-focused mobile web learning application learning to enhance knowledge and mental health literacy among hill tribe junior high school students in Chiang Rai Province. This study was conducted in four phases. Phase I involved a situation analysis and needs assessment through 20 in-depth qualitative interviews. Phase II was the design and development phase, Phase III was a pilot test, and Phase IV was implemented with a target of 60 hill tribe junior high school students. Data were collected from December 2023 to September 2024. The qualitative data were analyzed using content analysis, and the quantitative data were analyzed using repeated-measure ANOVA. The result revealed that mobile web learning applications to promote and support adolescent health should comprise six key functions: (1) Animation-oriented learning stories for mental health literacy in seven languages: Akha, Lahu, Karen, Lisu, Hmong, Yao and Thai, (2) Infographics regarding mental health (3) Mental health screening and recommendation (4) Space or platform to release and express feelings and emotions and (5) A system for providing

Frequently Asked Questions (FAQs), and (6) A platform for consulting through the system Line Official Account: [www. Wai-Roon-Yak-Roo.com](http://www.Wai-Roon-Yak-Roo.com) and Facebook Messenger. After the quasi-experiment, a one-group pretest-posttest and follow-up design, it was found that knowledge, mental health literacy, and essential counselling skills were increasing with a statistically significant p -value <0.05 . In addition, most participants were very satisfied with the proposed mobile web learning application and mental health literacy training program. In conclusion, promoting mobile web applications combined with mental health literacy programs to increase knowledge, mental health literacy, and counselling skills should be encouraged among this population.

Keywords: Mobile web application, Mental health literacy, Hill tribe students

What was Known

- Mental health issues remain a significant public health challenge for example, among hill tribe junior high school students in Chiang Rai Province, Thailand.
- These students often have limited knowledge and mental health literacy.
- There is a lack of mobile web learning applications tailored to enhance knowledge and mental health literacy within the hill tribe context.

What's New and Next

- Development of a hill tribes' context-focused mobile web learning application is one of the technologies that can promote adolescents' knowledge and mental health literacy.
- Further, enhance and expand the mobile web learning application for hill tribe students in other grades and non-formal education groups is recommended.

Introduction

There has been growing concern over mental health among adolescents as it can be the leading cause of physical illness and disabilities or even suicide. This problem has occurred around the world, including Thailand¹. The data report in 2024 from the Department of Mental Health, Ministry of Public Health, Thailand showed that nearly 10% of Thai youth aged under 20 years old were at risk of having depression⁽¹⁾.

Depression is not only an incident occurring in general adolescents but also in the hill tribe youth⁽²⁾. The hill tribe youth are often stigmatized and frequently seen as marginalized group due to their unique culture and lifestyles^(3,4,5). Moreover, there are many possible factors such as their socioeconomic backgrounds and limited access to healthcare services that heighten the risk of having poor mental health. These factors are considering as one of the most important social determinants of health^(2,6).

Previous studies in Thailand have shown that young hill tribes do experience health disparities as compared to other groups of population^(3,4). Health disparities among hill tribes can come in form of poor healthcare access and insufficient health knowledge, particularly, psychological health^(7,8). Nowadays, technology has become adolescent's best friend specifically mobile phone, therefore, it can be the tool helping decrease the gap between this group of people and the mental healthcare service as well as increase the mental health literacy among this population^{9,10}. Supporting adolescents to have mental health literacy means support them so they can have social and perceptual skills to motivate and indicate ability to access, understand, and use the health information for enhancing and maintaining their good health and well-being⁽¹¹⁾. The support system should encourage easier access and decreases the delay in diagnosis⁽¹²⁾. Therefore, using technology in support systems is advantageous. Besides having technology in a supportive system to assist this young population, considering their diverse languages, beliefs, and cultural practices, integrating local context and values into the application's design may enhance user engagement and learning effectiveness⁽¹²⁾. Despite increasing use of mobile learning applications in urban Thai schools, there is still a lack of culturally contextualized digital interventions addressing mental health literacy among hill tribe adolescents in northern Thailand⁽²⁾. The academic evidence base on "mental health literacy" and "digital intervention" among early secondary school adolescents should be expanded².

Consequently, developing the innovation using the application can be very effective medium and help reach the Sustainable Development Goal 3 "Good Health and well-being" and

Goal 10 “Reducing inequalities for a person with mental health impairments or psychosocial disabilities”⁽¹³⁾. From previous studies, it was found that the health application had many benefits including easier access to risk group, help reducing the potential stigma from having highly vulnerable health problems as well as connect the health-gap between people⁽¹⁴⁾.

Therefore, this study aimed to develop and evaluate the hill tribes’ context-focused mobile web application learning approach to promote adolescents’ knowledge and mental health literacy among junior hill tribe high school students in Chiang Rai Province, Thailand.

Materials and Methods

Study design and setting

A research and development (R&D) method using qualitative approaches comprised four phases: phase I was a situation analysis and needs assessment using qualitative research; phase II was the design and development of the mobile web learning application and program; phase III was a pilot test; and phase IV assessed the effectiveness of the mobile web application among hill tribe junior high school students in Chiang Rai Province using a quasi-experimental study (a one group pretest-posttest and follow-up design).

Phase I: the situation analysis and needs assessment

Qualitative research was applied to in-depth interviews with 20 participants: 15 hill tribe junior high school students and 5 school teachers⁽¹⁵⁾.

The inclusion criteria for hill tribe junior high school students were i) students of the six main ethnic hill tribes, namely Akha, Lahu, Hmong, Yao, Karen, and Lisu, who are studying in secondary school in Chiang Rai Province ii) being male or female, attending one of the study schools, and iii) being able to communicate well. The exclusion criteria for the participants were those who were absent on the day the data were collected.

The inclusion criteria for school teachers were i) being a school teacher and responsible for guidance, student affairs, or a nurse's room teacher; ii) voluntarily participating in the research and receiving complete information. Participants who could not be contacted for interviews were excluded from the study.

The semi-structured interview was used. Data was taped and transcribed individually and was analyzed using thematic analysis.

Phase II: the design and development of the program and mobile web learning application

The mobile web application was designed and developed based on the findings from phase I and the literature review. Additionally, face validity was verified by three experts: a psychologist, a pediatrician specializing in family medicine, and an expert in public health. The application and program were subsequently revised in accordance with the suggestions provided by these experts.

Phase III: the pilot test

The mobile web application and program were pilot-tested by 6 junior hill tribe students and 1 school teacher. The application and program had been revised following the suggestions, feasibility, and ease of use from the pilot test.

Phase IV: the assessment of effectiveness of the mobile web learning application

The effectiveness of a hill tribes' context-focused mobile web learning application learning approach to promoting knowledge and mental health literacy was assessed using a quasi-experimental study, a one group pretest-posttest and follow-up design. The study was implemented with the target participants of 60 hill tribe junior high school students from 3 schools: pretest-posttest-and 4-week follow-up.

The sample size for phase IV was determined using G*Power software version 3.1, for which the desired power test was set at 0.80, 95% CI=0.05, and the effect size at 0.35. Consequently, the sample size was calculated to be 52 participants. To account for potential dropouts, the sample size was increased by 10%, resulting in a total of 60 participants.

The inclusion criteria for participants were i) students of the six main ethnic hill tribes, namely Akha, Lahu, Hmong, Yao, Karen, and Lisu, who are studying in secondary school in Chiang Rai Province ii) being male or female, attending one of the study schools iii) being able to communicate well, and iv) willing to participate in the study, vi) participants needed to have their own mobile phone. The exclusion criteria for the participants were absent on the day the data were collected.

Research instruments

The research instruments consisted of two instruments:

1) Data collection instruments: A self-administered questionnaire comprised 5 parts: *Part 1* of the questionnaire asked for general information about participants. This part included age, sex, ethnicity, religion, and education level. *Part 2* of the questionnaire measures mental health literacy (MHL)^(9,16). The questionnaire was adapted from previous literature. It

consists of 18 questions with three levels and five subscales: the ability to access (4 items), understand (4 items), questioning (3 items), make decisions (3 items), and application (4 items) of mental health-related information. Respond with a 5-point Likert scale where 1 = never to 5 = very easy. The possible score for each participant was between 18 and 90 points, with higher scores indicating higher mental health literacy. The IOC in the present study was 1, and Cronbach's alpha was 0.89. *Part 3* asks about knowledge of mental health in adolescents. This questionnaire was developed by the researchers. It comprises 10 items, which a dichotomous format with two response options: Yes and No. Correct answers receive 1 point, while incorrect responses receive 0 points. The IOC in the present study was 1, and Kuder-Richardson (KR) was 0.81. *Part 4* of the questionnaire measures essential counselling skills and the questionnaire was developed by the researchers. It consists of 5 items questions. The dichotomous format questions with the Yes and No answer. Correct answers receive 1 point, while incorrect responses receive 0 points. The IOC in the present study was 1, Kuder-Richardson (KR) was 0.78. *Part 5* of the questionnaire assesses satisfaction. It consists of 3 items with a 5-point Likert scale where 1= very dissatisfied to 5= very satisfied. It can be classified into 5 levels; very high (4.51–5.00), high (3.51–4.50), moderate (2.51–3.50), low (1.51–2.50), and very low (1.00–1.50).

Research instrument: the research instrument in this study includes 1) the Hill tribes' context-focused mobile web learning application to enhance adolescents' knowledge and mental health literacy ("Wai-Roon-Yak-Roo") that was developed from phase II and III. And 2) the 5 modules of the mental health literacy training program consists of i) activities to develop skills in understanding mental health information ii) activities to develop skills in accessing mental health information using demonstrations and retrospective demonstrations iii) activities to develop communication skills and exchange information on mental health iv) activities to

2) develop decision-making skills and media literacy and v) activities to enhance the ability and skills in mental health management and basic counselling (application)^(9,16,17).

Content validity and reliability

Three experts assessed the instruments for the content validity before gathering data. It was assessed by using the Item Objective Congruence (IOC). An overall IOC of more than 0.5 was accepted. A pilot test of the instrument was conducted with 30 students who had characteristics similar to those of the study participants. The reliability coefficient obtained from this pilot test for Part II was Cronbach's $\alpha = 0.89$ and for the questionnaire Part III and Part IV using the Kuder-Richardson (KR) was 0.81 and 0.78 respectively.

Statistical analysis

All analyses were performed using Stata/SE, version 17 (StataCorp LLC, College Station, TX, USA). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize participant characteristics. Changes over time were examined using repeated-measures analysis of variance (repeated-measures ANOVA). Prior to analysis, the assumptions of repeated-measures ANOVA were assessed. Normality test was evaluated using the Shapiro–Wilk test, and the sphericity assumption was examined using Mauchly’s test. Statistical significance was set at $p < 0.05$.

Results

Phase I

Qualitative data: the results show that the mental health problems, especially depression, are profound among junior hill tribe high school students in Chiang Rai Province.

Table 1 Situation Analysis

Situation of Mental Health	Quotation
From teacher	<i>“Right now, there are students with depression around 30 people, 8 students still received the medication from Mae Chan Hospital. Out of 30 people, around 17 students already treated... some of the students were transferred to other schools that is closer to their home so the parents can look after them closely... For our school, the youngest student with the symptoms is only 5th grader. Some students even cut their arm, To hide it, they cut the upper part, so the teacher won’t notice. Students with depression mostly don’t know how to take proper medication. Some take more dose, some don’t take at all, some share with friends... some parents aren’t accepting that their kids have these symptoms because when the kids are at home, they look normal...”</i> [Teacher, Female, 58 years old]
From student	<i>“I have one friend that has depression. Right now, he is getting better. At first, he did not show that he had the symptoms. After he got depressed, he dropped out of the school and moved to Bangkok to live with his parents. Because when he stayed up on the hill, he didn’t take medicine. The doctor let him go to Bangkok to receive proper medication. Now he is back and better.”</i> [Male, Hmong, 15 years old]

The needs assessment revealed two themes: (1) The application for hill tribe adolescents' health that contains comprehensive content knowledge through video and infographics, channels for giving advice and accessing services, and self-guided mental health screening. Further, a safe space to express feelings. (2) Daily life skills, including counselling skills.

Table 2 Need Assessment

Themes	Subthemes	Quotations
Mobile Web Application	Animation-oriented learning stories for mental health in seven languages: Akha, Lahu, Karen, Lisu, Hmong, Yao, and Thai	<i>"Maybe having the VDO as a media to help student knows more about depression. They will know more about themselves. They might have an open minded to do the screening test by themselves as well. Depression can occur to any student. If having a cartoon that both dress in Thai and hill tribe style in each tribe would be great because it will be more interesting and I'm proud of that."</i> [Teacher, Female, 30 years old]
	Infographics regarding mental health	<i>"I wanna see the short VDO giving some knowledge and some infographic, that's it."</i> [Female, Akha, 15 years old]
	Mental health screening and recommendation	<i>"The school never had any screening for depression. But for past 4-5 months, the teacher had let the students did on website in computer room. I think they didn't answer the real thing. Some of them didn't want people to know their results so they just did it...If you do the application and having the screening test, results, solutions, where to reach out, that would be only us to know in app right...For my friend, if I have any uncomfortable feelings or story and talk to him, he usually judge me and respond just huh..okay?. And because we are hill tribe people right...we don't know either where to find the information if have these problems."</i> [Male, Akha, 15 years old]
	Space or platform to release and express feelings and emotions	<i>"If having the place to consult would be great. Sometimes we repressed our feelings inside us, don't wanna tell anybody. But we might wanna tell people in the application so we can release our feelings there."</i> [Female, Karen, 14 years old]

Table 2 Need Assessment (Cont.)

Themes	Subthemes	Quotations
	A platform for consulting	<i>"I wanna have someone to consult with, sometimes it just a small problem but I cannot tell anyone. I cried then they asked 'why crying It was just a small thing'. But for me it was a big deal...Having application that can talk to anyone is good. I can talk about anything to anyone by chatting or calling. Somehow talking with stranger is better because something small if we talk with someone close, they will see us differently, it was awkward"</i> [Female, Lisu, 15 years old]
	A system for providing Frequently Asked Questions (FAQs)	<i>"I wanna have like the depression center, what is depression, the causes, and how to manage it. Nowadays students like quick and concise information. Just click it then you know."</i> [Male, Yao, 15 years old]
Daily Life Skills	Counseling Skills	<i>"I wanna have counseling skill or some active listening skills because sometimes I can only say Fighting!...And sometimes I wanna have anyone to talk with or counsel with. I think my friend and family can be my safe zone but no...I was wrong...I wanna have some space to clear out my uncomfortable feelings. Just to let it out. Because sometimes when we talk to friends they also have something going on in their life, stress, stories. If I talk to them they will collect these stories and make them become blue."</i> [Female, Hmong, 14 years old]

Phase II and III

The result revealed that mobile web learning application to enhance knowledge and mental health comprise six key functions: (1) Animation-oriented learning stories for mental health in seven languages: Akha, Lahu, Karen, Lisu, Hmong, Yao and Thai, (2) Infographics regarding mental health (3) Mental health screening and recommendation (4) Space or platform to release and express feelings and emotions and (5) A system for providing Frequently Asked Questions

(FAQs), and (6) A platform for consulting through the system Line Official Account: [www. Wai-Roon-Yak-Roo.com](http://www.Wai-Roon-Yak-Roo.com) and Facebook Messenger (Figure 1-2).

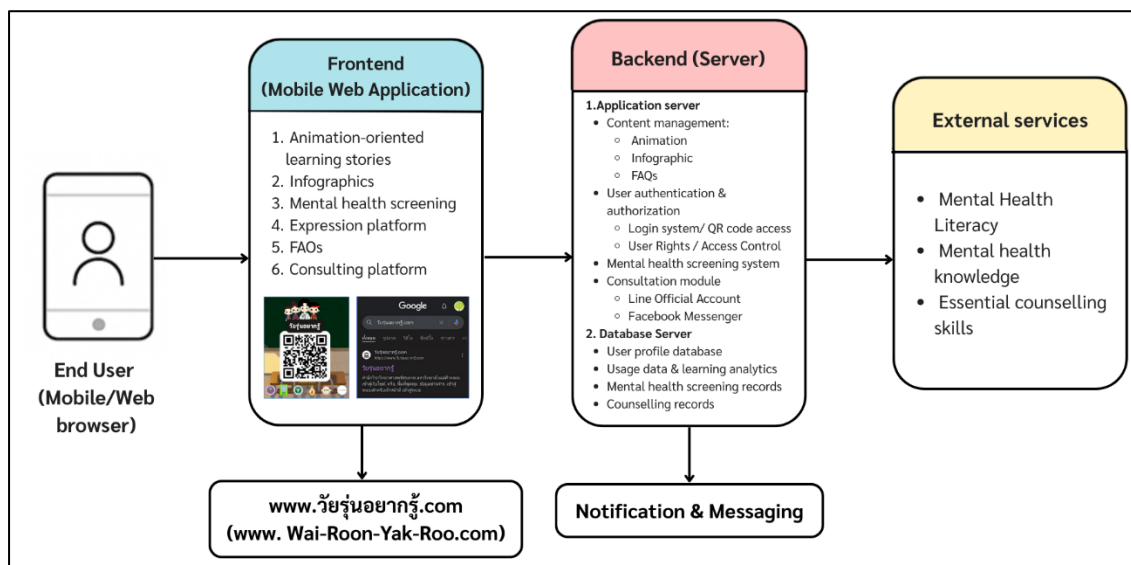


Figure 1 Overview of the working structure within the mobile web application

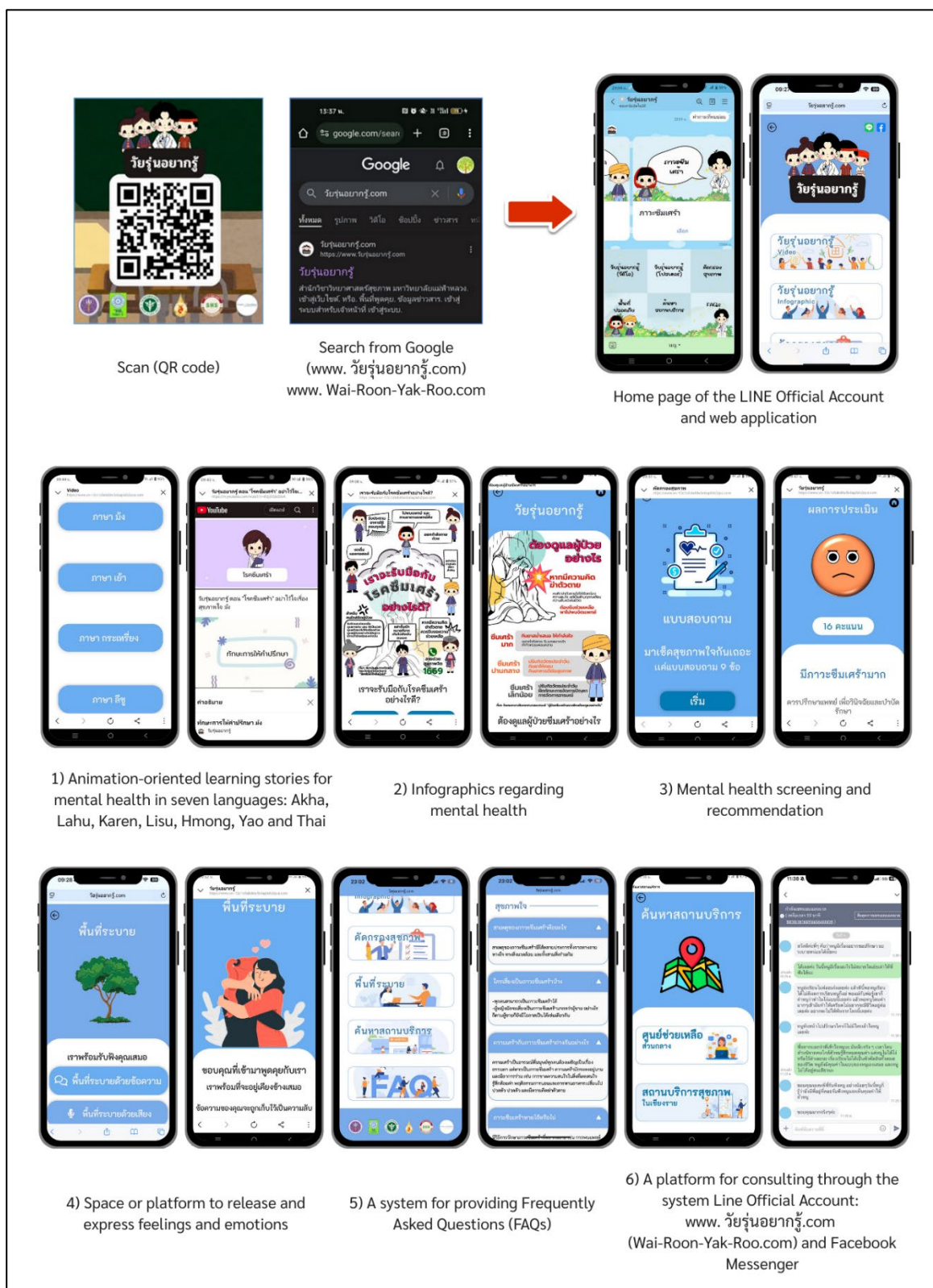


Figure 2 Mobile web application of Wai Roon Yak Roo.com

Phase IV

There were 60 participants in this study. More than half of the participants were female (63.8%), with an average age of 14.87 years (SD = 1.16), ranging from 13 -17 years. 56.7% were Akha, and 20.0% were Yao, respectively. Most of them were Buddhist (56.7%), and 41.7% were in grade 9 (Table 3).

After the quasi-experiment, it was found that knowledge, mental health literacy, and essential counselling skills were increasing with a statistically significant p -value < 0.05 (Table 4). In addition, most of the participants were highly satisfied with the proposed mobile web learning application and mental health literacy training program (Table 5).

Table 3 General characteristics of the participants (n=60)

Variables	Number	%
Age (years)		
≤14	27	45.0
15	21	35.0
≥16	12	20.0
Mean=14.87 SD =1.16 Min =13 Max =17		
Sex		
Female	37	61.7
Male	23	38.3
Tribe		
Akha	26	43.4
Yao	14	23.3
Lahu	10	16.7
Hmong	5	8.3
Lisu	3	5.0
Karen	2	3.3
Religion		
Buddhist	34	56.7
Christianity	24	40.0
Ancestral worship	2	3.3
Education level		
Grade 7	15	25.0
Grade 8	20	33.3
Grade 9	25	41.7

Table 4 The result from before-after and follow up after health literacy training program and mobile web learning application (n=60)

Variables	Before	After	Follow-up	F	df	p-value
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD			
Mental health literacy	68.30 $\pm$ 12.56	74.50 $\pm$ 11.84	70.53 $\pm$ 1.84	12.58	1.26	0.001*
Knowledge about mental health	7.17 $\pm$ 1.57	7.95 $\pm$ 1.16	7.68 $\pm$ 1.31	11.66	1.74	<0.001*
Essential counselling skills	3.05 $\pm$ 0.93	3.68 $\pm$ 1.03	3.87 $\pm$ 0.75	24.69	1.54	<0.001*

SD: Standard Deviation

*Significant at p -value < 0.05 Repeated measure ANOVA.

Table 5 Satisfaction with the Mobile web learning application combined with the health literacy program (n=60)

Satisfaction level	Mean $\pm$ SD	Level
Mobile web application	4.68 $\pm$ 0.68	Very high
Mental health literacy program	4.68 $\pm$ 0.54	Very high
Overall	4.72 $\pm$ 0.83	Very high

SD: Standard Deviation

Discussion

The present study developed and evaluated the hill tribes' context-focused mobile web learning application to enhance knowledge and mental health literacy among hill tribe junior high school students in Chiang Rai Province. The findings demonstrated that the mobile web learning application, which integrated six key functions, including animation-based learning in multiple languages, mental health-related infographics, mental health screening and recommendations, expressive platforms, FAQs, and online consultation channels, was effective in improving knowledge and mental health literacy. After the quasi-experimental intervention, participants showed significant improvement in knowledge, mental health literacy, and essential counselling skills. In addition, user satisfaction with the program and the mobile web application was very high, indicating its feasibility and acceptance among junior hill tribe high school students.

This finding about mental health literacy is consistent with previous studies in different countries, including the Nigeria⁽¹⁸⁾, and Singapore⁽¹⁹⁾, which reported that health education programs can increase mental health literacy and knowledge. Martinez et al.⁽²⁰⁾ revealed that 'C'mon, let's talk application can enhance the mental health literacy among Filipino migrant domestic workers in the UK. It is also consistent with previous studies in the USA by Hernandez et al.⁽²¹⁾, who reported that entertainment education (E-E) by Spanish language Foto Novela can improve depression literacy and knowledge. A study in Portugal⁽²²⁾ also revealed that digital audiovisual

psychoeducational intervention can promote depression literacy. Another study in Australia⁽²³⁾ has shown that a multilingual information website intervention can improve depression literacy among the minority population. Additionally, a study conducted by Pama SA et al²⁴ in Indonesia reported that the mental health program can also promote essential counselling skills. A systematic review found that using web- or app-based interventions can enhance the knowledge, essential skills, and mental health literacy with a comprehensive strategy⁽²⁵⁾.

Similarly, several previous studies in Thailand^(26,27) also confirmed that mental health literacy programs can enhance adolescents' mental health literacy, knowledge and counselling skills, particularly in high school students. The findings may be due to the mobile web learning application being a new technology designed based on the social and cultural context of the hill tribe and their specific needs. Furthermore, an application can provide easy and convenient access to adolescent health information, regardless of the area in which they live. Health education applications for mobile devices such as smartphones and tablets allow students to engage and learn at anytime and anywhere^(28,29). Moreover, the health literacy framework not only can improve knowledge but also enhance various skills related to mental health information, such as the ability to access, understand, question, make decisions, counselling skills and increase application for daily usage^(9,17,30).

From the results of this study that proposed about the mobile web learning application, it is one of the tools that can also assist parents, teachers, and communities to promote mental health of the hill tribe junior high school students since it has easy access and way to understand about the mental health information follow by the decision-making of the students to receive the mental health services as required. While the current mobile web learning application primarily utilizes VDOs and infographics as the main media formats, there is potential to enhance the learning experience by incorporating a wider range of interactive elements, such as gamification, in future updates. On the other hand, a notable strength of the present study is its prior innovative approach. It is the first context-focused mobile web learning application designed specifically for hill tribe adolescents to enhance their knowledge, mental literacy, and essential counselling skills related to psychological health issues. Moreover, the advantage is that the functions of this application align with two key levels of prevention from a public health perspective: primary prevention through mental health knowledge, and secondary prevention through screening and providing information on accessing mental health services (e.g., hospitals, contact details). Thus, the application has the potential to improve health outcomes,

promote lifelong self-learning, and promote long-term healthy behaviors by integrating interactive learning, mental health screening, and counseling support.

Despite the novelty of the research, this study has some limitations. First, this study used a one group pretest-posttest and follow-up design, which has several limitations because it relies on a single sample group. Second, the follow-up period was relatively short, making it difficult to assess the intervention's long-term effects. Third, data were collected from self-reported questionnaires, which may be subject to considerable bias, such as social desirability bias or misinterpretation of questions. Further studies should consider using a two-group pre-posttest design or a randomized controlled trial (RCT) to enhance internal validity. Enhance and expand the mobile web learning application for hill tribe students in other grades and non-formal education groups should be considered.

Conclusion

In conclusion, a context-focused mobile web learning application combined with a mental health literacy training program can increase knowledge, mental health literacy, and essential counselling skills. It should be scaled up to benefit hill tribe high school students in other areas. The findings of this study are crucial for health promotion and clinical practice among hill tribe high school students. This context-focused mobile web learning application can serve as a practical tool for schools, health educators, and community healthcare professionals to promote culturally and linguistically appropriate mental health literacy. The application supports early identification of mental health issues and promotes mental health literacy.

Ethical Approval Statement

This study was approved by the Ethical Review Committee for Human Research of the Chiang Rai Provincial Public Health Office, Thailand (CRPPHO 193/2566) The research was conducted in accordance with the Declaration of Helsinki. All participants were informed of the study's objectives, and written informed consent was obtained from each participant prior to participation in the study.

Author Contributions

TR, TK, SU, SS, KK, UC, and FY designed the study, developed the research instrument, and collected data. TR, SP, NP, FY, and TK designed the web application toiletry. TR, TK, and FY carried out reliability testing and analyzed the data. TR, TK, and CT analyzed data, interpreted

the results, and drafted the manuscript. TR, TK, and CT approved the final manuscript. All authors read and approved the final manuscript.

Acknowledgements

We would like to thank the National Research and Innovation Information System support grant. Finally, we are grateful to the participants and their guardians, who agreed to participate in this study.

Source of Funding

This study was fully funded by the National Research and Innovation Information System (Grant No 04/2566). The funder had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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