

Research Type (Research Article)

A Study of Change Agents in the Community of University of Phayao Students

Narin Nonthamand^{1*}, Narissara Suaklay², Arpapun Prathumthai³, Nattapong Promwong⁴
^{1,2,3,4} University of Phayao, Phayao, Thailand
Corresponding author: narin.no@up.ac.th

Received: 9 June 2025 Revised: 12 Junio 2025 Accepted: 20 June 2025 Published: 30 June 2025

Article info	Abstract
<p>Keywords: Change Agents Community University of Phayao</p>	<p>The objectives of this study are (1) to study changes in the community existing among students at the University of Phayao and (2) to compare change agents in the community found among students based on their fields of study at the University of Phayao. The samples in this survey study were 328 students at the University of Phayao because of stratified random sampling. Categorized by their academic fields, there were 109 health science students, 109 science and technology students, and 110 humanities and social sciences students. The research instrument used in this study was a questionnaire on change agents in the community, and the data collected was analyzed using descriptive statistics and one-way ANOVA.</p> <p>Results: University students possessed the qualities of change agents in the community at a high level (M = 3.92, SD = 0.59). In addition, they had the qualities of community transformational leadership at a high level in all aspects, namely life-long learning, entrepreneurship, teamwork, and expertise, respectively. University students in various fields of study had different qualities of change agents in the community. In other words, the possessions of change agents in community qualities between health science students and science and technology students were statistically significantly different at the .05 level.</p>

1. Introduction

The vision of the University of Phayao is to create wisdom for sustainable community development with innovations of international standards, while its missions are to build human resources with high capabilities and future skills, to conduct research and innovative development to serve the economy, society, and communities, to provide academic services using knowledge and innovation, and to promote and preserve Thai arts, culture, and identity [1]. In addition, the philosophy of education at the University of Phayao focuses on developing skills, capabilities, and experiences of learners who will become intellectual community change agents through the learning-by-doing in outcome-based education [2]. Following this educational philosophy, all undergraduate and graduate programs, including general education courses, have been designed and developed to enable students to implement their knowledge and ability through community study, fostering their capacity to positively impact their communities and become intellectual community change agents.

In this study, community transformational leadership refers to the ability of an individual learner to serve as a confident, understanding, and accessible change agent within the community. An effective community change agent can collaborate closely with people in the community, facilitate relationship building among community members, introduce innovations to tackle problems or aid development in the community and take on community-related responsibilities, along with the ability to learn and self-reflect to ensure continuous improvement and problem-solving for the benefits of the community [3], [4], [5].

The crucial role of university students as community change agents is to bridge the university with its community and facilitate their collaboration through various methods to create sustainable changes [6]. The presence of change agents in the community enhances its capacity and addresses communal issues, which requires a collaborative approach that uses mutual knowledge transfer between university students and community members [7]. In cultivating community change agents, students are assigned duties and



responsibilities to engage with people in the community. By doing so, students will develop self-confidence, a positive attitude, community awareness, creativity, and practical experiences [8]. Promoting change agents in the community involves developing the following four characteristics of active citizenship in students:

(1) Knowledge—understanding citizens’ rights and responsibilities and awareness of social problems and solutions; (2) Skills—developing various skills related to communication, collaboration, problem-solving, and experiential learning; (3) Attitudes—believing in transformational change, enthusiasm, and responsibility to the community; and (4) Values—fostering community engagement, respect for others’ rights and differences, and support for human rights and democracy [9].

According to the concept of transformational leadership proposed by [4], change agents should possess certain skills and abilities, including communication, cultural context awareness, adaptability, collaboration, and empathy. In addition, as stated in the study by [10], the characteristics of teacher change agents include counseling skills, collaboration skills, innovative solution development skills, and continuous learning skills. Conforming to the educational philosophy of the University of Phayao, the learning-by-doing approach through outcome-based education has been adopted to cultivate community change agents equipped with the required skills, capabilities, and experiences [2]. In addition, general education courses aim to provide students with the opportunity to support community development [11]. There are four expected characteristics of community change agents at the University of Phayao. Firstly, mastery refers to the ability to give extensive consultations based on existing knowledge and accurate information obtained by systematic literature search, demonstrating dedication, sincerity, and confidence in one’s capacities. Secondly, collaboration refers to the ability to work effectively with others, facilitate team members, offer moral support and encouragement, recognize the importance of others, and apply required skills to achieve mutual goals. Next, entrepreneurship refers to the ability to invent, design, innovate, understand the entrepreneurial spirit, and initiate changes to meet new challenges with an awareness of the impacts on society and the environment. Finally, lifelong learning refers to learning from work and experience, exchanging experiences with colleagues, and identifying strengths and weaknesses, leading to long-term self-development to reach one’s full potential.

The characteristics of community change agents, gathered from the literature reviews, were adopted and adapted to suit the context of this present study. The expected characteristics of community change agents among university students were defined as follows: (1) Mastery—the ability of students, as community change agents, to understand and reach out to community members, provide constructive suggestions, demonstrate dedication, generate motivation, and instill confidence in solving communal problems and promoting community development; (2) Collaboration—the ability of students, as community change agents, to effectively collaborate with and facilitate cooperation among community members; (3) Entrepreneurship—the ability of students, as community change agents, to introduce innovations to solve community problems or develop sustainable initiatives while maintaining responsibility towards the community; and (4) Lifelong learning—the ability of students, as community change agents, to learn and self-reflect to rectify previous mistakes and develop oneself to have the capability to continuously solve problems or develop the community [12], [13], [14], [15], [16].

Hence, this study endeavors to evaluate the attributes of student community change agents at the University of Phayao. The acquired data holds the potential for informing the design and implementation of instructional strategies and curricula aimed at building community transformational leadership among university students.

2. Methodology

The present study is classified as survey research. The objective of this study was to study about change agents in the community existing among students at the University of Phayao and to compare change agents in community found among students based on their fields of study at the University of Phayao. The Research Framework is shown in Fig. 1.

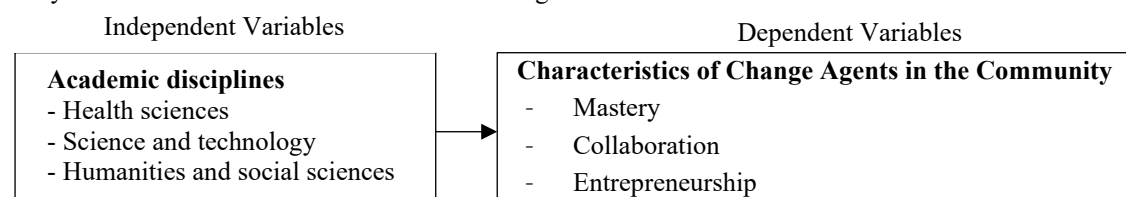


Fig. 1 Research framework



2.1. Population and sample group

The population of this study was second-year undergraduate students in the academic year 2013 at the University of Phayao. To determine the sample size, G*Power software was employed with the alpha error probability and power set at 0.05 and 0.95, respectively. The effect size was set at a moderate level of 0.25, as [17] suggested for multiple comparisons, and there were three experimental groups. The sample size was initially estimated at 252, and after adding 30% for non-response rate compensation, the final computed sample size was 328. Stratified random sampling was employed to achieve a representative sample of university students according to academic disciplines. As a result, the sample in this study included 109 health sciences students, 109 science and technology students, and 110 humanities and social sciences students.

2.2. Research instrument

A community transformational leadership questionnaire was used to assess the characteristics of community change agents among students at the University of Phayao. The questionnaire was divided into two parts: Part 1 contained demographic information questions, including gender, year of study, and title of faculty or college; and Part 2 included 5-point rating scale questions related to the four community change agent characteristics: mastery, collaboration, entrepreneurship, and lifelong learning.

2.3. Development of research instruments

The steps in developing the research instrument used in this study were as follows: (1) Studying concepts, theories, and related research to synthesize variables of community transformational leadership among students at the University of Phayao (2) Constructing and developing questionnaire items to align with the studied variables. The questionnaire exploring university students' opinions on community transformational leadership among students at the University of Phayao consisted of two parts. Part 1: General information of students a checklist questionnaire comprising gender, year of study, and title of faculty or college. Part 2: Self-assessment of the four community change agent characteristics: mastery, collaboration, entrepreneurship, and lifelong learning 30 five-point rating scale questions (highest, high, moderate, low, and lowest) (3) Conducting a content validity test with five experts three in education and community development and two in measurement and evaluation to review the questionnaire's language accuracy and the index of item-objective congruence (IOC) The experts evaluated whether each questionnaire item accurately measured the theoretical constructs associated with the targeted characteristics. The IOC was then calculated, and the analysis revealed that all 30 questionnaire items had IOC values between 0.80 and 1.00, indicating the questionnaire's high content validity. (4) Conducting a reliability test by administering the developed questionnaire to 35 students from the College of Education who were not part of the research sample as a tryout. Subsequently, the collected data were analyzed using Cronbach's alpha method to calculate the alpha coefficient. The analysis revealed an alpha coefficient of 0.96, indicating the questionnaire's high reliability.

2.4. Data collection

The steps in collecting the data in this study were as follows: 1. Drafting and submitting a request for cooperation in data collection to the Educational Services Division of the University of Phayao 2. Contacting the Educational Services Division of the University of Phayao to request permission to collect data from students at the University of Phayao using an online questionnaire 3. Distributing online questionnaires to the students to gather data for the research.

2.5 Data analysis

The steps in analyzing the collected data were as follows: (1) Analyzing the collected data of the sample group and dependent variables using descriptive statistics, i.e., frequency, percentage, mean, and standard deviation, to understand the distribution and dispersion characteristics of the data with statistical analysis software. (2) Analyzing the collected data to compare the community transformational leadership characteristics among students at the University of Phayao across different academic disciplines using a one-way ANOVA and a test of homogeneity of variance. Levene's test was used to check if the variance of the dependent variable was equal across different sample groups, and a post-hoc test was conducted using Bonferroni's test and Dunnett's T3 test in case the variances were not homogeneous across different sample groups.

3. Results



The findings are divided into two parts to address the research objectives. The first part deals with the community transformational leadership of university students at the University of Phayao, and the second part compares the community transformational leadership of university students at the University of Phayao by academic disciplines.

Part 1 Community transformational leadership of university students at the University of Phayao The results indicated that the majority of the respondents were female students, with a total of 236 individuals accounting for 72.00% of the sample. Male students comprised 92 individuals, representing 28.00% of the sample. Overall, students at the University of Phayao possessed a high level of community transformational leadership ($M = 3.92$, $SD = 0.59$). Additionally, when categorized by characteristics, it was found that students exhibited a high level of community transformational leadership in all areas, as shown in Table 1.

Table 1. Means and standard deviations of community transformational leadership by characteristics (n=328)

Characteristics of Change Agents in the Community	Mean	SD	Interpretation
Mastery	3.84	0.64	High
Collaboration	3.91	0.65	High
Entrepreneurship	3.97	0.61	High
Lifelong learning	4.01	0.65	High
All Mean	3.92	0.59	High

Part 2 Comparison of community transformational leadership of university students at the University of Phayao by academic disciplines. The analysis of the means and standard deviations of community transformational leadership, categorized by academic disciplines, revealed that students of all academic disciplines exhibited a high level of community transformational leadership. According to Table 2, health sciences students demonstrated the highest level of community transformational leadership (Mean = 4.04, $SD = 0.48$), followed by humanities and social sciences students (Mean = 3.92, $SD = 0.61$), and science and technology students (Mean = 3.80, $SD = 0.66$), respectively, as shown in Table 2.

Table 2. Means and standard deviations of community transformational leadership by academic disciplines (n=328)

Characteristics of Change Agents in the Community	Academic Discipline					
	Health Sciences		Science and Technology		Humanities and Social Sciences	
	Mean	SD	Mean	SD	Mean	SD
Mastery	3.93	0.55	3.73	0.71	3.85	0.64
Collaboration	4.04	0.52	3.80	0.72	3.87	0.68
Entrepreneurship	4.09	0.52	3.84	0.68	3.97	0.60
Lifelong learning	4.16	0.53	3.84	0.72	4.03	0.66
All Mean	4.04	0.48	3.80	0.66	3.92	0.61

Comparing community transformational leadership across academic disciplines using one-way ANOVA, it was found that students of different academic disciplines obtained statistically significant differences in community transformational leadership at the .05 level, as demonstrated in Table 3

Table 3. Comparison of community transformational leadership by academic disciplines (n=328)

Academic Discipline	N	Level of Community Transformational Leadership		F-test	p-value
		Mean	SD		
Health Sciences	109	4.04	0.48	4.69*	0.01
Science and Technology	109	3.80	0.66		
Humanities and Social Sciences	110	3.92	0.61		

*Significant at $p < .05$

The multiple comparison results of community transformational leadership across academic disciplines revealed that health sciences students and science and technology students obtained statistically significant differences in community transformational leadership at the .05 level ($sig. = 0.01$). Health sciences students and humanities and social sciences students obtained statistically the same levels of

community transformational leadership. Similarly, science and technology students and humanities and social sciences students obtained statistically the same levels of community transformational leadership, as demonstrated in Table 4.

Table 4. Pair comparison of community transformational leadership by academic disciplines (n=328)

Academic Discipline	Mean	Mean Difference		
		Health Sciences	Science and Technology	Humanities and Social Sciences
Health Sciences	4.04	4.04	3.80 0.24* (sig. = 0.01)	3.92 0.12 (sig. = 0.28)
Science and technology	3.80			- 0.12 (sig. = 0.39)
Humanities and Social Sciences	3.92			

*Significant at $p < .05$

4. Discussion

The results can be discussed on research objectives (1) to explore community transformational leadership among students at the University of Phayao and (2) to compare community transformational leadership among university students of different academic disciplines as follows:

1. Overall, students demonstrated a high level of community transformational leadership. It was found that students exhibited a high level of all characteristics of community transformational leadership. This could be attributed to the outcomes-based education framework implemented at the University of Phayao. Under this framework, all university courses aim to enhance students' content knowledge and life skills. Through the integration of the university's vision to create wisdom for sustainable community development with innovations of international standards, the learning-by-doing approach through outcome-based education adopted in all curricula and courses [1], as well as management of general education courses for all university students, the team of instructors created lessons using the design thinking method to promote critical thinking, teamwork, creativity, and communication skills [18]. Additionally, students can develop their community skills and entrepreneurial skills through general education courses, particularly in life skills courses. The courses are as follows: (1) "Aesthetics in Life" focuses on providing students with knowledge about life philosophy, living in diverse social and cultural contexts, history, and local ways of life in Phayao. It also covers the aesthetics in life, the environmental management for sustainable living in society and communities, physical and mental health management, one's roles and responsibilities in working with others, influencing and motivating others, demonstrating positive ethical behaviors, and understanding the laws in daily life; (2) "Skills Development and Lifelong Learning" emphasizes providing students with learning about the philosophy of thinking, principles of critical and analytical thinking, principles of creative thinking, teamwork and communication, lifelong learning principles, and growth-oriented concepts. It aims to develop social skills, personality, and expressions in society, as well as critical thinking, creative thinking, critical thinking, communication, and lifelong learning skills necessary for the future, and it also covers personal finance skills; (3) "Collaborative Learning for Community Building" focuses on providing students with community learning skills, cultural education and lifestyles of communities, teamwork, teamwork psychology, public speaking, planning, strategic planning, and operational planning in teamwork. It covers individual rights and responsibilities under the laws for living in society, cooperation and adaptation to changing environments, citizenship responsibility, awareness of the value and importance of Thai social identity, and acceptance of cultural diversity and respect for others; (4) "Health, Environmental, and Community Management" focuses on providing students with health knowledge, analyzing their health problems, ensuring safety in daily life, identifying environmental issues in the community, and planning and implementing health and ecological projects in participatory community settings. It emphasizes leadership in health, environmental issues, and community development. Lastly, (5) The course "Design Thinking for Digital Entrepreneurship and Knowledge Integration for Professional Innovation" focuses on providing students with fundamental knowledge of digital entrepreneurship, financial planning and transactions for digital entrepreneurs, characteristics of digital entrepreneurship, using tools for digital entrepreneurs, design thinking processes,



concepts of creating work through design thinking, and ethics and morality of digital entrepreneurship [19]. These courses promote community skills development among the students, resulting in a high level of community transformational leadership.

2. All groups of students across different academic disciplines possessed a high level of community transformational leadership. However, health sciences students from seven faculties Dentistry, Medicine, Nursing, Pharmacy, Medical Sciences, Allied Health Sciences, and Public Health demonstrated the highest level of community transformational leadership. This may be attributed to the nature of these curricula, which emphasize learning through hands-on experiences, such as internships at the hospital, healthcare center, and actual community, through the learning-by-doing in outcome-based education. This approach aims to develop students' knowledge, skills, attitudes, and community engagement abilities. After completing the Bachelor of Medicine program, students are equipped to address health issues in the community systematically and efficiently, communicate effectively with patients and their families, and collaborate effectively with other health professionals [20]. In the same way, the expected outcome of the Bachelor of Nursing program emphasizes holistic nursing care for individuals of all ages and health conditions, respecting cultural diversity and operating within legal and ethical frameworks. In addition, the Bachelor of Public Health in Community Health program aims to produce new-generation public health scholars who possess comprehensive knowledge of health and public health operations and can integrate such knowledge into health care at the individual, family, and community levels, aligning with community and societal contexts and ethical principles [21]. Furthermore, various university courses incorporate activities that allow students to work with others, including community members. This enables them to gain professional experience in the community and apply their learned knowledge to address community health issues. This approach fosters communication skills, cultural awareness, teamwork, and empathy with community members [22].

3. Students of different academic disciplines had varying levels of community transformational leadership. This could be due to differences in learning styles, characteristics of curriculum, courses, and the expected learning outcomes of each program and course. This aligns with another previous study, which found that students of different academic disciplines exhibited various levels of expertise, empathy, and collaboration [23]. Additionally, it was clear that students' learning styles significantly affected their success in promoting learning [24]. Different learning styles led to distinct quality of [25]. For instance, students who preferred active experimentation (AE) based on Kolb's learning styles were more likely to accept and significantly benefit from the innovative behavior of entrepreneurs in their work [26]. Moreover, students with different learning styles based on Kolb's learning styles, particularly those with active experiencing and reflective observation modes, tended to have the highest levels of lifelong learning. In addition, assimilator and diverger learning styles were associated with higher lifelong learning levels than others [27]. In a nutshell, students at the University of Phayao of different academic disciplines had different learning styles [28], contributing to differences in their community transformational leadership.

4. Students from the health sciences and science and technology disciplines demonstrated different levels of community transformational leadership, possibly due to differences in their learning styles and specialized expertise. The health sciences disciplines study human health, diseases, treatment methods, nursing care, and health promotion. Students in these disciplines acquire essential knowledge and skills for various professions, such as medicine, nursing, pharmacy, physiotherapy, and nutrition [29]. On the other hand, the science and technology disciplines concentrate on principles of science and various technologies, preparing students for careers in engineering, science, mathematics, and information technology. These differences in expertise contribute to variations in students' community transformational leadership. Furthermore, each academic discipline has different learning concepts, including curriculum design, course content, instruction management, and assessment. These concepts should align with the goal of producing graduates who meet the intended learning outcomes of each academic discipline. Faculty members also play a crucial role as role models for students in their respective disciplines, influencing students' professional conduct. These factors shape students' distinct characteristics in each academic discipline [30].

5. There was no significant difference in community transformational leadership between health sciences students and humanities and social sciences students. Similarly, science and technology students and humanities and social sciences students obtained the same level of community transformational leadership. This may be attributed to the university's curriculum design, which employs the concept of outcome-based education (OBE), emphasizing observable and measurable learning outcomes that students should demonstrate upon completing their courses [31]. and aims to enhance students' motivation for learning and improve the effectiveness of instruction by developing students' problem-solving skills [32].



Moreover, aligning the curriculum outcomes with the university's vision and mission provides a framework for setting learning outcomes at the course and topic levels. These learning outcomes at all levels are consistent with and derived from the university's vision and mission [33]. This approach ensures coherence in defining learning outcomes across the university's programs. The University of Phayao has integrated its vision to become the university that creates wisdom for sustainable community development with innovations of international standards as a framework for setting program-level learning outcomes at the University of Phayao [1]. This may contribute to the similarity in community transformational leadership among students across different disciplines.

5. Conclusions

In conclusion, this research has demonstrated that university students at the University of Phayao exhibit a high level of community transformational leadership, a crucial trait for driving positive change in their communities. Across all academic disciplines, students consistently showed strong leadership qualities, with health sciences students standing out significantly in comparison to their peers in science and technology. These findings highlight the importance of integrating leadership development programs within university curricula, particularly in fields where leadership scores were lower, to ensure that all students are equipped with the necessary skills to contribute effectively to their communities.

Acknowledgment

The researchers gratefully acknowledge the financial support provided for this study by the School of Education, University of Phayao, during the academic year 2023 under Agreement number SE6602.

References

- [1] University of Phayao, 'Philosophy and Aspiration University of Phayao,' [Online]. Available at https://www.up.ac.th/Intro_About2.aspx. [2024].
- [2] University of Phayao, 'Announcement of the University of Phayao on Philosophy of Education,' [Online]. Available at http://www.council.up.ac.th/?page_id=378. [2022a].
- [3] Fullan, M. G, 'Why teachers must become change agents,' Educational leadership, 1993, 50, pp. 12-12.
- [4] Lunenburg, F. C, 'Managing change: The role of the change agent,' International journal of management, business, and administration, 2010, 13(1), pp. 1-6.
- [5] Malik, P, 'The Role of a Change Agent: Characteristics, Types, Skills,' [Online]. Available at <https://whatfix.com/blog/change-agent/>. [2022].
- [6] Budowle, R., Krszjzaniek, E., & Taylor, C, 'Students as change agents for community–university sustainability transition partnerships,' Sustainability, 2021, 13(11), 6036.
- [7] Ocktilia, H., Nurwati, N., Darwis, R. S., & Widiowati, D, 'Knowledge Transfer as a Change Agent Strategy in Community Empowerment,' Journal of Namibian Studies: History Politics Culture, 2023, 34, pp. 2875–2888-2875–2888.
- [8] Henderson, D. X., Majors, A. T., & Wright, M, 'I am a change agent": A mixed methods analysis of students' social justice value orientation in an undergraduate community psychology course,' Scholarship of Teaching and Learning in Psychology, 2021, 7(1), 68.
- [9] Akin, S., Calik, B., & Engin Demir, C, 'Students as change agents in the community: Developing active citizenship at schools,' EDUCATIONAL SCIENCES-THEORY & PRACTICE, 2017, 17(3).
- [10] Lukacs, K. S, 'Teacher change agent scale,' The International Journal of Educational and Psychological Assessment, 2009.
- [11] Division of Educational Services, University of Phayao, 'Academic Service Information: Department of General Studies,' [Online]. Available at <https://does.up.ac.th/announce>. [2020]
- [12] Bacq, S., Hertel, C., & Lumpkin, G, 'Communities at the nexus of entrepreneurship and societal impact: A cross-disciplinary literature review,' Journal of Business Venturing, 2022, 37(5), 106231.



- [13] Ben-Tzur, N., Zanbar, L., & Kaniasty, K, 'Mastery, social support, and sense of community as protective resources against psychological distress among Israelis exposed to prolonged rocket attacks,' *Journal of Traumatic Stress*, 2021, 34(3), 501-511.
- [14] Heath, R. G., & Frey, L. R, 'Ideal collaboration: A conceptual framework of community collaboration,' In *Communication yearbook* 28, 2004, pp. 192-233.
- [15] Van der Heijden, H., Beijaard, D., Geldens, J., & Popeijus, H, ' Understanding teachers as change agents: An investigation of primary school teachers' self-perception,' *Journal of Educational Change*, 2018, 19, pp. 347-373.
- [16] Van der Heijden, H., Geldens, J. J., Beijaard, D., & Popeijus, H. L, ' Characteristics of teachers as change agents,' *Teachers and Teaching*, 2015, 21(6), pp. 681-699.
- [17] Cohen, J, 'Statistical power analysis for the behavioral sciences,' Academic press, 2013.
- [18] Thephinlap, C., Nonthamand, N., Suaklay, N., Pumila, K., Intha, S., Promwong, N., & Chantaramanee., N. C, 'Development of Learning Activities Based on Design Thinking Process in General Education Courses to Enhance Desirable Characteristics According to the National Higher Education Qualifications Framework of University of Phayao Student,' *Dhammathas Academic Journal*, 2022, 22(3), pp. 205–220.
- [19] University of Phayao, 'Undergraduate Curriculum, General Education,' Revised Curriculum, 2022b
- [20] School of Nursing, 'Bachelor of Nursing Science,' [Online]. Available at <https://www.nurse.up.ac.th/course-information>. [2024].
- [21] School of Public Health, 'Bachelor of Public Health in Community Health,' [Online]. Available at <http://www.ph.up.ac.th/ContentRead.aspx?C=CommunityHealthProgramNew01>. [2024].
- [22] Holmes, D., Zayas, L. E., & Koyfman, A, ' Student objectives and learning experiences in a global health elective,' *Journal of community health*, 2012, 37, pp. 927-934.
- [23] Wicherts, J. M., & Vorst, H. C, 'The relation between specialty choice of psychology students and their interests, personality, and cognitiveabilities,' *Learning and Individual Differences*, 2010, 20(5), pp. 494-500.
- [24] Ariastuti, M. D., & Wahyudin, A. Y, 'Exploring academic performance and learning style of undergraduate students in English Education program,' *Journal of English Language Teaching and Learning*, 2022, 3(1), pp. 67-73.
- [25] Alfonseca, E., Carro, R. M., Martín, E., Ortigosa, A., & Paredes, P, ' The impact of learning styles on student grouping for collaborative learning: a case study,' *User Modeling and User-Adapted Interaction*, 2006, 16, pp. 377-401.
- [26] Gemmell, R. M, ' Learning styles of entrepreneurs in knowledge-intensive industries,' *International Journal of Entrepreneurial Behavior & Research*, 2017, 23(3), pp. 446-464.
- [27] Saffari, M., Rshidi Jahan, H., Mahmoudi, N., Pakpour, A., & Sanacinasab, H, 'Relationship of Learning Styles in Students of Health Sciences with Lifelong Learning,' . *Iranian Journal of Health Education and Health Promotion*, 2016, 4(2), pp. 89-100.
- [28] Nuankaew, P., Nuankaew, W., Phanniphong, K., Imwut, S., & Bussaman, S, 'Students model in different learning styles of academic achievement at the university of Phayao, Thailand,' *International Journal of Emerging Technologies in Learning*, 2019, 14(12), pp. 133.
- [29] University of Wisconsin, ' What Can You Do With a Health Sciences Degree?,' [Online]. Available at <https://flex.wisconsin.edu/stories-news/what-can-you-do-with-a-health-sciences-degree/>. [2024]
- [30] Ayuthaya, J. C. n, 'the students identities of srinakharinwirot university,' the comparative study among students in different group of majors, 2013, 5(10), pp. 1-13.
- [31] Amirtharaj, S., Chandrasekaran, G., Thirumorthy, K., & Muneeswaran, K, ' A systematic approach for assessment of attainment in outcome-based education,' *Higher Education for the Future*, 2022, 9(1), pp. 8-29.
- [32] Yang, P., Lai, S., Guan, H., & Wang, J, 'Teaching Reform and Practice Using the Concept of Outcome-Based Education: A Case Study on Curriculum Design for a Microcontroller Unit Course,' *International Journal of Emerging Technologies in Learning (iJET)*, 2022, 17(3), pp.68-82.
- [33] Sinha, G, 'Assessment tools for mapping learning outcomes with learning objectives,' IGI Global, 2020.

