



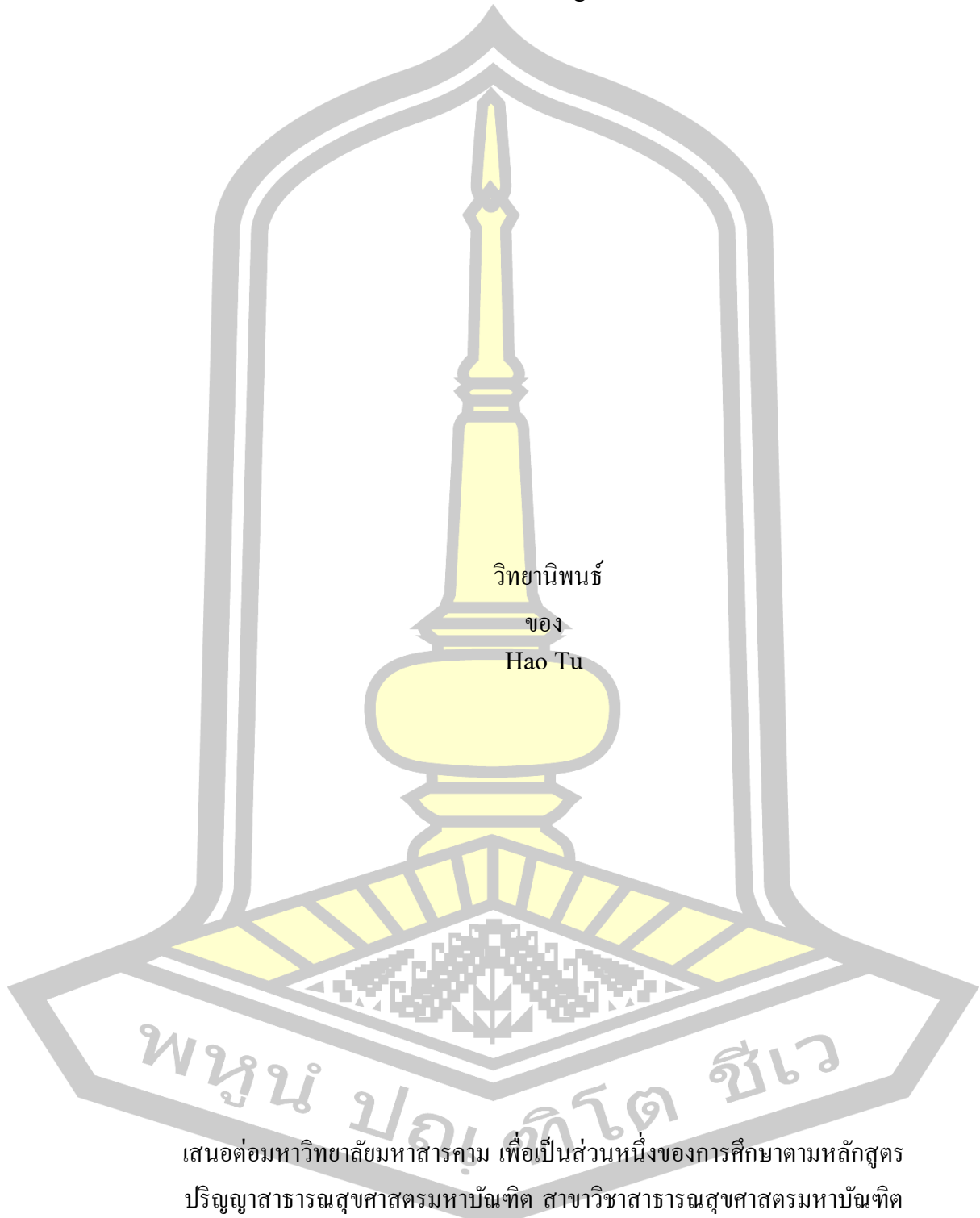
Digital health literacy skills in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation

Hao Tu

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Master of Public Health in Public Health
March 2025

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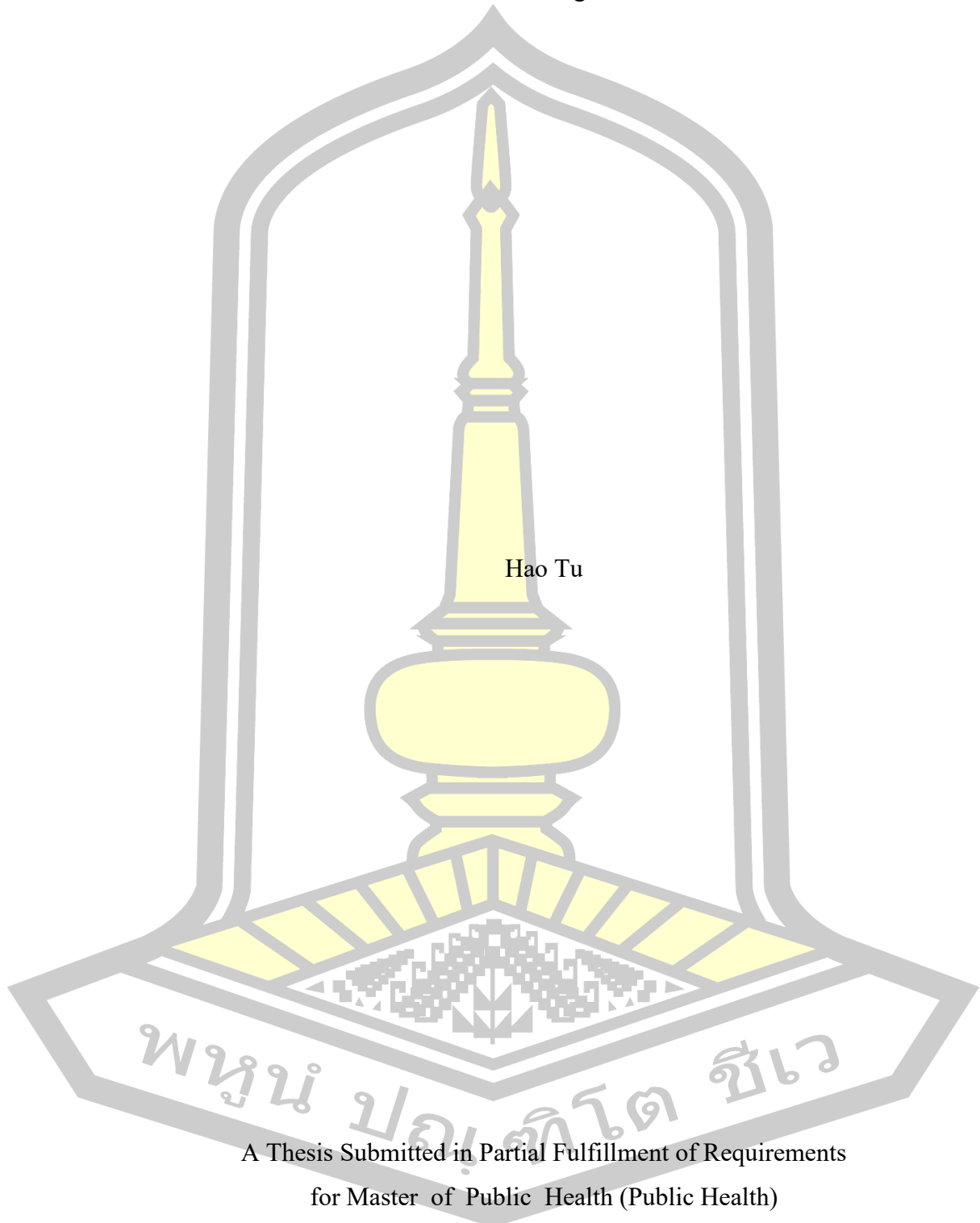


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A Thesis Submitted in Partial Fulfillment of Requirements
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March 2025

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TITLE	Digital health literacy skills in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation		
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ABSTRACT

Digital health literacy (DHL) is the ability to identify, understand, and use health information from digital sources. The differences in DHL levels among individuals are due to many factors. Thus, this study investigated DHL and its associated factors among vocational college medical students in Sichuan, China, after the COVID-19 pandemic. This mixed-method study in which we integrate both quantitative and qualitative studies with included 1062 students. The demographic data were gathered. A DHL questionnaire was administered and the health information seeking was rated. A multivariate logistic regression was performed to evaluate how different factors influenced DHL. Among the participants, 52.26% had high DHL levels. Age (ORadj = 0.83), study of year [sophomore (ORadj = 2.68), junior (ORadj = 1.82)], major [nursing (ORadj = 0.63), major (rehabilitation (ORadj = 0.64), medicine and food or education and sports (ORadj =0.60)], having had a family member or friend infected with COVID-19 (ORadj = 1.64), health education (ORadj = 2.00), and health information seeking (ORadj = 2.33) influenced the participants' DHL. This study's findings indicate that the DHL level of some vocational college medical students is still low. Therefore, improving these skills requires teaching strategies and a curriculum that encourages students to locate and evaluate digital sources.

Keyword : Digital health literacy, Influencing factors, Vocational college medical students

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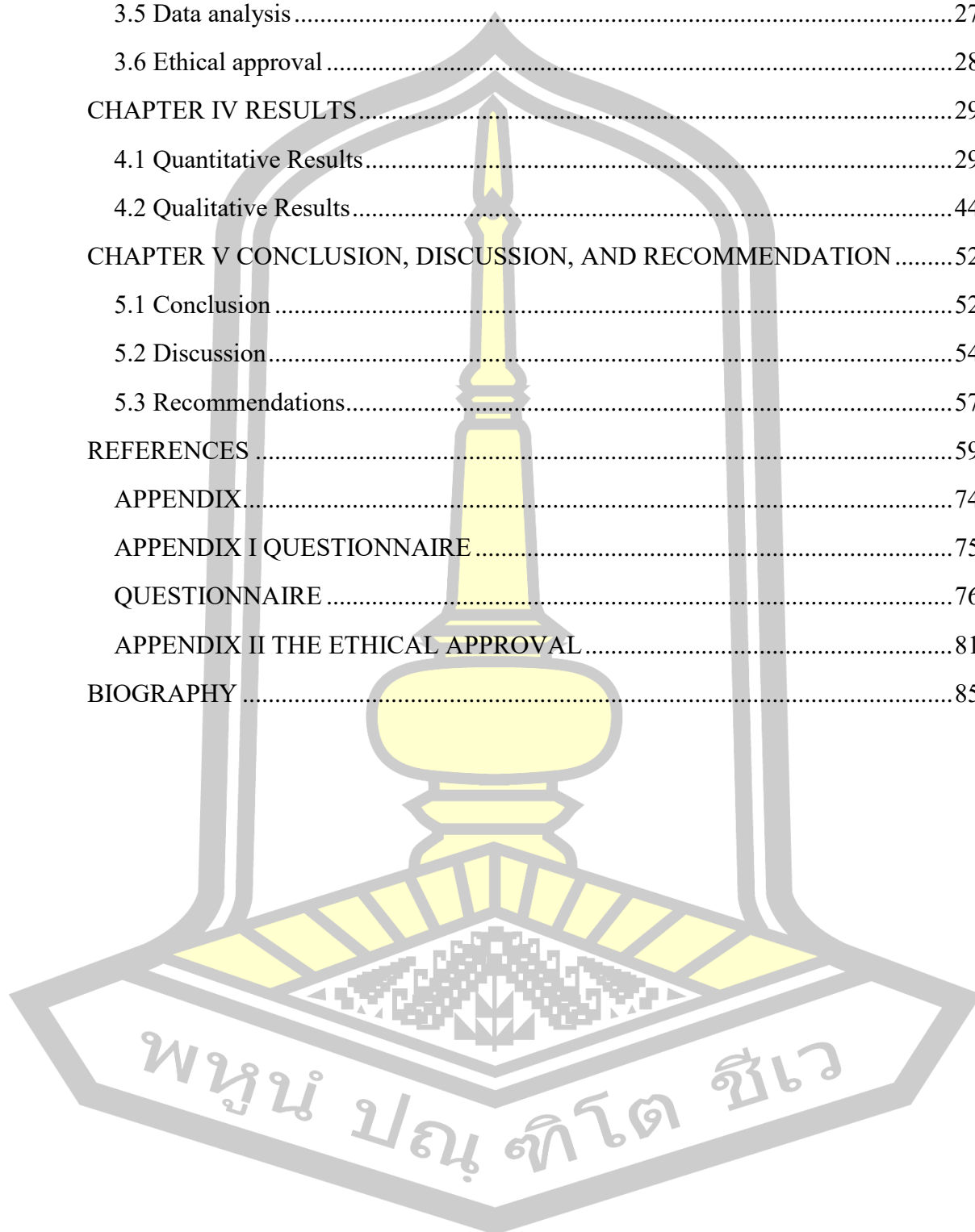
In conclusion, I am truly thankful to all who have contributed to my success and will continue to repay them with practical actions on my academic exploration path.

Hao Tu

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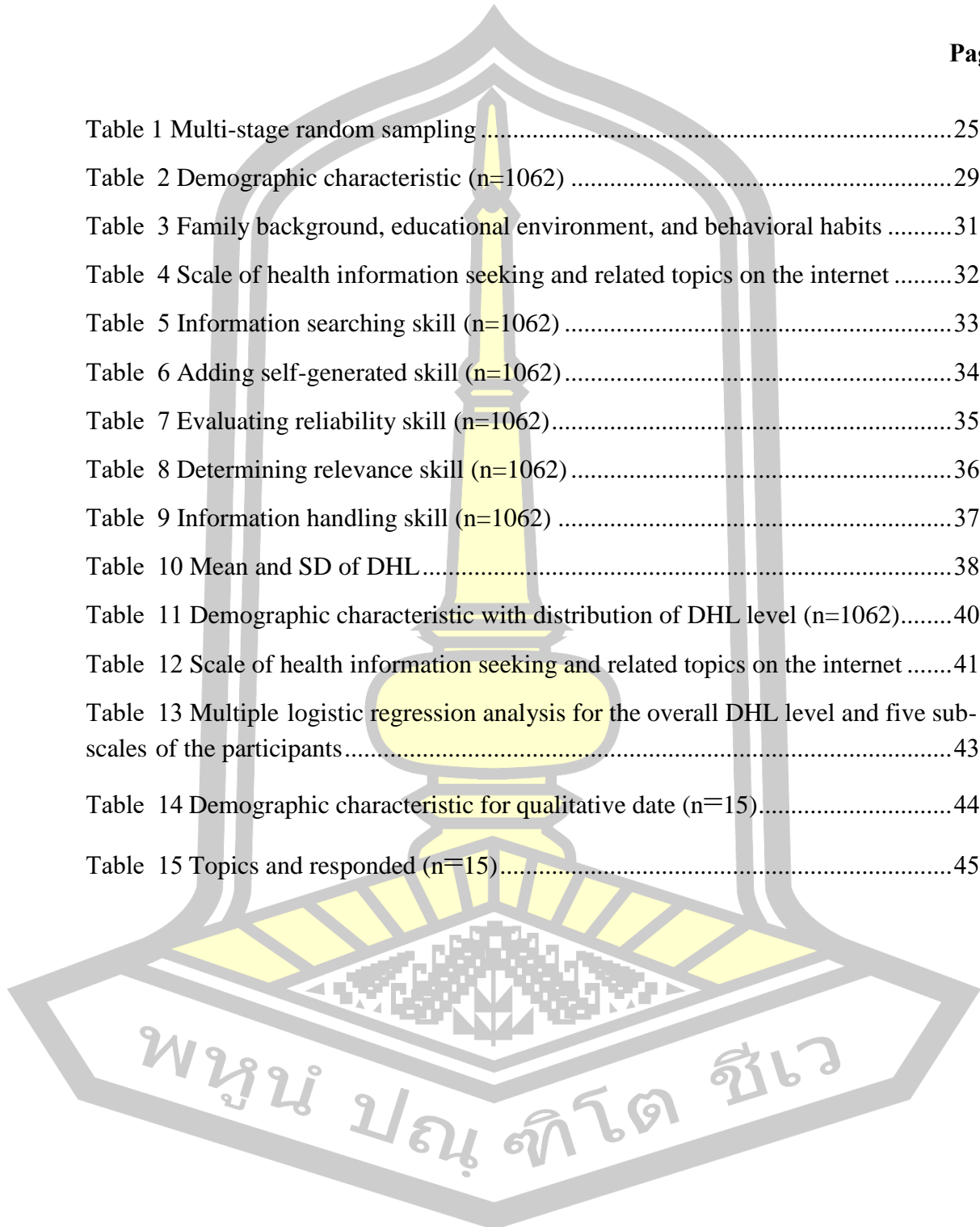
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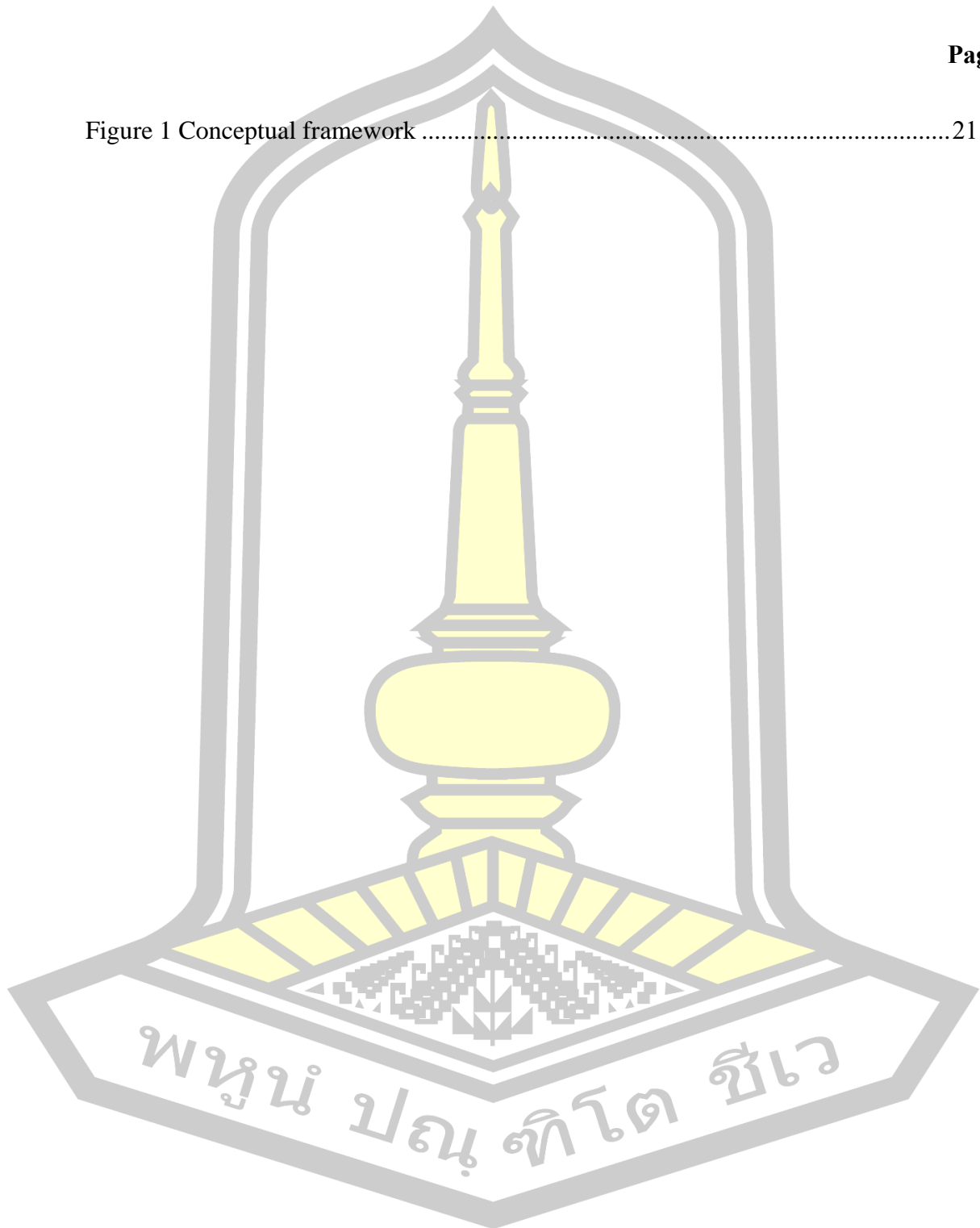
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CHAPTER I INTRODUCTION

1.1 Background

COVID-19 first broke out in China at the end of 2019 and then around the world in 2020, which has had a great impact on the lives and health of people around the world (Xu, Z et al, 2020). Globally, nearly 1.9 million new cases and over 12,000 deaths were reported in January 2023 (WHO, 2023). The epidemic prevention policy of Wuhan, China, at the beginning of 2020 is very important (Fu, C et al, 2021). During the epidemic period in China, the community has made significant contributions to epidemic prevention and control (Gong, Y et al, 2021). According to the official website of the Centers for Disease Control and Prevention (CDC), there were reported 215958 hospitalized cases of COVID-19 infection in 31 provinces (autonomous regions, municipalities directly under the Central Government) and Xinjiang Production and Construction Corps, and 26156 severe cases, including 1894 severe cases of COVID-19 infection and 24262 cases of severe underlying diseases combined with COVID-19 infection (Health China, 2023). COVID-19 can cause many health-related problems (WHO, 2020), especially respiratory problems as well as immune system and musculoskeletal problems. Symptoms include nausea, muscle pain, loss of sense of smell and taste, headache, sore throat, and so on. Severe patients are extremely vulnerable to death (Delgado-Enciso, I et al, 2021; Baqui, P et al, 2020).

Besides, during the COVID-19 pandemic, information and communication technologies (ICTs) were considered a tool to track the spread and sharing of health-related information to raise public awareness for healthcare providers on reducing health problems (Bittlingmayer, U. H et al, 2020) . It helps to access high-quality, cost-effective healthcare service delivery by increasing health professionals' communication (Jackson, D. N et al, 2021). This technology improves the skills

needed to search, select, appraise, and apply online health information. These skills are known as digital health literacy (DHL) or eHealth literacy (van der Vaart, R et al, 2017).

Digital health literacy (DHL) has been defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to prevent, address, or solve a health problem (Dunn, P et al, 2019). In China, social media has a great advantage: network information transmission speed is particularly fast for effective spread COVID-19 epidemic prevention and health knowledge has great help (Li, X et al, 2020). According to the China Internet Network Information Center (CNNIC) report data, as of June 2022, there were 1.051 billion Chinese Internet users, with an Internet penetration of 74.4% (China Internet Network Information Center, 2022).

DHL varies among people depending on their literacy levels and socioeconomic status, presenting health issues, motivation to seek online information, and familiarity with technology and electronic gadgets (Stormacq, C et al, 2019). Furthermore, literature has depicted that digital health literacy positively influences health-promoting behaviors and people's health-related quality of life. Digital health literacy is also influenced by educational background, motivation for seeking the information, the technologies used, frequent internet use, computer literacy, digital health training, knowledge regarding the availability and importance of health information, perceived usefulness, having higher internet efficacy, and attitude toward using web-based health information resources (Juvalta, S et al, 2020; Mengestie, N. D et al, 2021; Adil, A et al, 2021; Zakar, R et al, 2021)

In post COVID-19, the economy, finance, society, and politics of cities around the world have been affected, with a significant impact on vulnerable groups and non economic centers at the micro level (Florida, R et al, 2023). However, in terms of technology, various enterprises are also promoting the transformation and

development of digitalization, promoting some needs that are not limited by geographical location, but network security and privacy are also important in this process (Almeida, F et al, 2020).

In China, although the infection rate is low in the population, compared to other countries, the natural immunity level is also low, and there is a problem of vaccine hesitation. Policies such as large-scale testing and isolation treatment have disrupted people's lives and work, and the government has brought an increase in financial burden. In addition, excessive attention to COVID-19 has led to the neglect of other diseases, and the strict zero COVID-19 policy has led to family separation. The impact of food supply shortages and reduced healthcare resources (The Lancet Regional Health-Western Pacific, 2023). The accompanying mental illness also exposes the shortcomings of China's insufficient allocation of related resources (Xiao, Y et al, 2023).

The post COVID-19, the university student population is facing psychological impacts that threaten their health and well-being, and at the same time, they experience challenges when seeking reliable online information (Dodd, R. H et al, 2021). A study among students in Germany reported difficulties in finding the correct information on specific health-related topics, evaluating the reliability of online information (Dadaczynski, K et al, 2021). Similarly, students in Slovenia faced difficulties in accessing the reliability of the online information (Vrdelja, M et al, 2021).

In Sichuan province, Sichuan Vocational College of Health and Rehabilitation banned students from returning to school in February 2020 and began network teaching until the same year in May, under the epidemic prevention and control policy, after temperature measurement, mobile network travel data, and nucleic acid reports, tried to restore offline teaching because some students to unfamiliar prevention measures have psychological pressure and often appear to have

high temperatures. As the school is a key place for dense people, it has been taking a number of mandatory epidemic prevention measures, such as weekly nucleic acid testing and wearing masks throughout. However, some students are very resistant to wearing masks. In 2021, students will need to receive the COVID-19 vaccine, but some teachers and students have not been vaccinated or received the third dose. In December 2022, the Chinese government announced that, due to the nationwide compulsory nucleic acid and mobile network travel data offline, school students had been infected with the COVID-19 virus. It can be seen that the DHL level of students at the Sichuan Vocational College of Health and Rehabilitation is limited. However, previous studies emphasized the importance of HL post COVID-19 in health care workers, and it was found that HL was related to COVID-19 prevention behavior—few studies have focused on DHL and its associated factor among college students.

1.2 Research question

What is the level of DHL and its related factors post COVID-19 among college students in the Sichuan Vocational College of Health and Rehabilitation?

1.3 Research objectives

1.3.1 To assess the DHL level the post COVID-19 in college students

1.3.2 To determine the factors related to DHL level the post COVID-19 in college students

1.4 The importance of research

This study focuses on assessing the DHL level of the students of the Sichuan Vocational College of Health and Rehabilitation in Zigong, Sichuan Province, China, the post COVID-19 and the related factors affecting DHL. The results of this study, so as to effectively improve the DHL level of college students in the future.

1.5 Scope of research

1.5.1 Scope of population

In this study, we integrate both quantitative and qualitative-data collection-

1) In the quantitative, we focus on investigating demographic characteristics, health information source factors, internet factors, and DHL level, as well as the relevant factors affecting DHL the post COVID-19 pandemic. The population in this phase is 1062 students aged 18-22 years old. among the Sichuan Vocational College of Health and Rehabilitation, Zigong City, Sichuan Province, China.

2) In the qualitative data collection, we focus on exploring knowledge and opinion about basic DHL knowledge, information searching skill, adding self-generated skill, evaluating reliability skill, determining relevance skill, information handling skill on 15 representative college students.

1.5.2 Scope of contents

The study design in this research is a cross-sectional analytic study, in the quantitative, this study will be used to assess the DHL level and determine factors related to it post the COVID-19 college students. Also, we will use the qualitative data collection to explore how to access web-based information or internet resources of COVID-19-related information, information-seeking behavior, and satisfaction with COVID-19 information searches by utilizing the focus group technique.

1.5.3 Scope of research setting

This research will be conducted at the Sichuan Vocational College of Health and Rehabilitation.

1.5.4 Scope of study period

This research project will run from September 2023 to January 2024.

1.6 Operational definition

1.6.1 Digital health literacy (DHL) skills refers to an individual's ability to acquire and understand health information and use it to maintain and promote their own health. In this study, DHL refers to five domains: 1) information searching, 2)

adding self-generated content, 3) evaluating reliability, 4) determining relevance, and 5) information handling for health information related to COVID-19 (Nutbeam D, 2008; van der Vaart, R et al, 2017).

1.6.2 Information searching skill refers to searching for and finding health information related to COVID-19 on the internet.

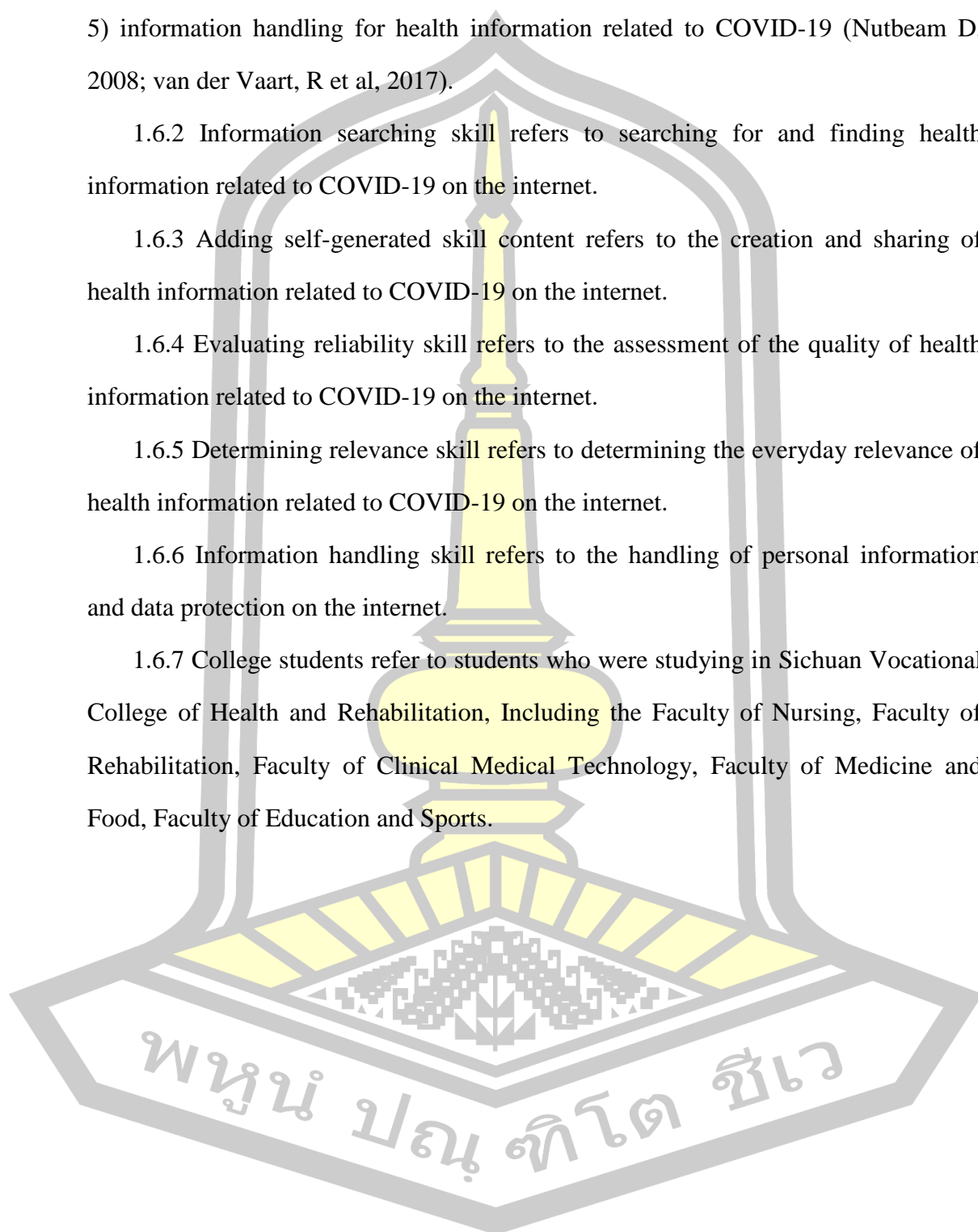
1.6.3 Adding self-generated skill content refers to the creation and sharing of health information related to COVID-19 on the internet.

1.6.4 Evaluating reliability skill refers to the assessment of the quality of health information related to COVID-19 on the internet.

1.6.5 Determining relevance skill refers to determining the everyday relevance of health information related to COVID-19 on the internet.

1.6.6 Information handling skill refers to the handling of personal information and data protection on the internet.

1.6.7 College students refer to students who were studying in Sichuan Vocational College of Health and Rehabilitation, Including the Faculty of Nursing, Faculty of Rehabilitation, Faculty of Clinical Medical Technology, Faculty of Medicine and Food, Faculty of Education and Sports.



CHAPTER II LITERATURE REVIEW

The study entitle is “Digital Health Literacy skills and its related factors in Students of Sichuan Vocational College of Health and Rehabilitation”. This study aims to the digital health literacy of vocational college students. The researcher reviewed literature, concept, theory, and relevant research as follow as:

2.1 The situation of post COVID-19 in Global and China

In post COVID-19, there have been significant changes in urban life and economic systems worldwide, which have also brought many new challenges, including China's epidemic policies and mental health challenges.

The COVID-19 forced cities to rethink their planning to better respond to the health crisis. This may include redesigning public transportation systems, improving urban layout to reduce congestion, and increasing open space and greenery to provide a safer and sustainable urban environment. The rise of digitization and remote work. Cities need to support remote work and online collaboration to adapt to new work modes. Ensure social fairness and inclusivity in cities. Urban planning needs to take into account vulnerable groups to ensure that they can also enjoy the opportunities and resources provided by the city (Florida, R et al, 2023).

COVID-19 has accelerated the digital process and enterprise digital transformation. The opportunities brought by digitization include remote office, e-commerce, automated production, and the application of intelligent technology. These trends can improve efficiency, reduce costs, and accelerate innovation. However, digitization also brings a series of challenges, including network security threats, data privacy issues, and the digital divide. Enterprises need to invest in data security and employee training to effectively address these challenges. The importance of

enterprises needing to adapt flexibly to the digital world. They must constantly innovate to adapt to market changes and customer needs (Almeida, F et al, 2020).

China has terminated the zero COVID-19 policy, although it has ended, continuous monitoring and control are still needed. China needs to balance economic recovery and epidemic control, and at the same time, China plays an important role in international cooperation because the epidemic is a global problem that requires global cooperation to solve (The Lancet Regional Health-Western Pacific, 2023).

During the epidemic, mental health issues have sharply increased, including anxiety, depression, and stress disorders. The end of policies may lead to more mental health challenges. China needs to enhance the accessibility and quality of mental health services to meet the increasing demand, which may include providing more mental health resources and professional training. Social support is crucial, including support from families and communities, as well as government intervention and policy support (Xiao, Y et al, 2023).

The world after COVID-19 faces multiple challenges and opportunities. Cities need to be re planned to provide a safer, sustainable, and inclusive living environment. Enterprises must adapt to digital transformation while paying attention to security and privacy. China terminates the zero COVID-19 policy, but sustained efforts are still needed. Mental health services also need to address new challenges. These issues not only have an impact on their respective fields, but also have a broad impact on global society and economy. The global community needs to cooperate to address these common challenges and seek innovative solutions to ensure people's health, economic, and social well-being.

2.2 The situation internet used in China

The internet has played an increasingly important role in our lives, especially during the COVID-19 pandemic. In China, the internet has been a crucial tool in the

fight against COVID-19. Digital technologies such as artificial intelligence (AI), big data, cloud computing, blockchain, and 5G have been actively used to effectively improve the efficiency of national monitoring, virus tracking, prevention, control, treatment, and resource allocation during COVID-19. The Chinese government has actively promoted the use of digital technologies to improve the country's public health system, and this has been successful in preventing and controlling the spread of COVID-19.

Social media has also played a significant role in China during the pandemic, particularly in the effective spread of COVID-19 epidemic prevention and health knowledge. Due to its broad reach and fast network transmission speed, social media has been an effective tool in disseminating information about the virus to people all over the country (Li X et al, 2020). As of June 2022, there were 1.051 billion internet users in China, with an internet penetration rate of 74.4% (CNNIC, 2022). This high level of internet usage has made it easier for public health officials to disseminate information about the pandemic and encourage people to adopt preventive measures.

In contrast, in the United States, Google web searches related to COVID-19 are primarily focused on transmission, clinical symptoms and signs, and activity adjustments, according to Google Trends (Google Trends, 2023) . A significant portion of online search results come from major health organizations or academic medical institutions, which is reassuring. However, the impact of social media in disseminating health-related information during the pandemic in the United States has been less significant than in China.

The internet has played a crucial role in the fight against COVID-19 in China, with digital technologies and social media being particularly helpful in reducing the spread of the virus. The high level of internet usage in China has facilitated the dissemination of health-related information, which has been instrumental in encouraging people to adopt preventive measures. In contrast, while the internet has

also played a role in the United States during the pandemic, the impact of social media in disseminating health-related information has been less significant.

And Chinese digital technologies and social media have been effectively utilized for monitoring, tracking, prevention, and treatment measures. The Chinese government has actively promoted the use of these technologies to improve public health outcomes. Social media has been instrumental in disseminating information and health knowledge, supported by China's high internet penetration rate. In contrast, the United States has also employed digital technologies and major health organizations for information dissemination, but the impact of social media has been relatively less significant. Overall, the internet has served as a valuable tool in the fight against COVID-19, facilitating communication and public health efforts in both China and the world States.

2.3 The situation internet used during of COVID-19 in China

The COVID-19 pandemic has had a significant impact on the world, and China has been no exception. During this time, the internet has played a crucial role in disseminating information, providing healthcare services, and monitoring the outbreak. Digital technologies such as artificial intelligence (AI), big data, cloud computing, blockchain, and 5G have been actively employed in China to improve the efficiency of virus tracking, national monitoring, prevention, control, treatment, and resource allocation during COVID-19. These technologies have allowed for the timely detection of COVID-19 cases, the tracing of the virus's spread, and the allocation of medical resources to those in need (Saher, R et al, 2021). They have also facilitated remote consultations and online appointments, which have been popular, especially in areas where offline medical treatment was challenging.

Social media has also been instrumental in the effective spread of COVID-19 epidemic prevention and health knowledge in China. With its vast reach and fast

network transmission speed, social media has played a vital role in disseminating accurate information about the virus, including prevention measures and healthcare services. According to the China Internet Network Information Center report data, as of June 2022, there were 1.051 billion internet users in China, with an internet penetration rate of 74.4% (CNNIC, 2022). This means that the internet and social media have been crucial in ensuring that accurate information about COVID-19 is accessible to the majority of the population.

The COVID-19 pandemic has highlighted the importance of the internet and digital technologies in healthcare. In China, these technologies have been critical in the fight against the pandemic, facilitating the delivery of healthcare services and improving the efficiency of virus tracking, national monitoring, prevention, control, treatment, and resource allocation. Going forward, it is likely that digital technologies and the internet will continue to play a significant role in healthcare, particularly in the context of pandemics (Li X et al, 2020).

Therefore, internet has played a crucial role in responding to the crisis in China. Digital technologies such as AI, big data, cloud computing, blockchain and 5G have been actively utilized to enhance virus tracking, national monitoring, prevention, control, treatment, and resource allocation. Social media has also played a crucial role in disseminating accurate information and promoting public awareness. China's high internet penetration rate has facilitated the widespread accessibility of COVID-19 information. The use of digital technologies and social media has proven effective in improving healthcare services and response capabilities.

2.4 Health literacy theory

The World Health Organization (WHO) defined health literacy in its 2013 "Global Health Promotion Agenda: Investment in Global Action". According to this definition, health literacy is an individual and social resource used to support people

in achieving the maximum potential for health in their daily lives. It encompasses knowledge, abilities, and behaviors, as well as people's ability to make healthy choices in various environments. Most current research on health literacy has examined its measurement, impact on health outcomes, and intervention measures aimed at addressing low health literacy issues. Health literacy is of great significance in improving health outcomes and promoting health equity, as it requires comprehensive measurement tools, interventions, and strategies to address low health literacy issues.

2.4.1 Definition of health literacy

Health literacy is defined as the ability to acquire, understand, evaluate, and apply information in health decision-making. Health literacy is not only an individual's skills and knowledge, but also their ability to access and utilize health information under various social, cultural, and environmental conditions (Nutbeam, D, 1998). Health literacy is an important goal of public health, and a comprehensive approach is needed to improve health literacy and address educational, organizational, and social factors. This is also a challenge for health education and communication in the 21st century (Nutbeam, D, 2000), and it is crucial to develop standardized and effective measures to measure health literacy, which will be used to assess health literacy levels and support intervention and policy development (Pleasant, A et al, 2011). Of course, strategies and interventions to improve health literacy in different populations and environments should consider factors such as culture, society, and background (Paakkari, L et al, 2020). Researchers have developed health promotion strategies based on the different literacy levels of the US population (Rudd, R. E et al, 2004), adopting a comprehensive approach to integrating health and health education, improving health knowledge, and enhancing individuals' ability to actively participate in health (Kickbusch, I et al, 2013).

2.4.2 Level of health literacy

The three levels of health literacy are functionality, interactivity, and critical. These three levels of health literacy provide a framework for understanding the different skills and competencies individuals need to navigate and make informed decisions about their health. It is important to note that these levels are not mutually exclusive, and individuals may demonstrate varying levels of health literacy across different contexts and situations.:

2.4.2.1 Functionality

This level of health literacy refers to basic skills and Knowledge that individuals need to understand and follow health-related information. It involves reading, writing, numeracy, and comprehension skills related to health. People with functionality health literacy can understand basic health information and instruction (Kutner, M. A 2006). Low functional health literacy can lead to an increase in hospitalization rates (Baker, D. W et al, 2002) . Strategies and methods to improve health literacy include mastering and utilizing health information, effectively interacting with the healthcare system, and enhancing self-management and self-care abilities (Berkman, N. D et al, 2010) . Some researchers believe that low health literacy in children can lead to adverse health outcomes, the issue of health literacy should be addressed in the pediatric medical environment (DeWalt, D. A et al, 2009).

2.4.2.2 Interactivity

The interactivity of health literacy requires more advanced skills and the ability to communicate and interact effectively with healthcare providers and systems. It involves navigating the healthcare system, understanding medical jargon, and actively participating in healthcare decision-making processes. Individuals with interactivity health literacy can seek and communicate health information, identify reliable sources, and engage in collaborative healthcare interactions (Pleasant, A et al, 2011).

2.4.2.3 Critical

Critical health literacy involves the ability to analyze and evaluate health information critically. It includes understanding the social, cultural, and economic factors that influence health and being able to make informed decisions and take appropriate actions based on the available information. People with critical health literacy can assess health information for credibility, bias, and relevance (Nutbeam, D 2000).

2.4.3 Measurement of health literacy

Some studies focus on developing tools and measures to assess the health knowledge level of the population. During the evolution of the concept of health literacy, it was found that a comprehensive approach was necessary (Nutbeam D, 2008). In a health literacy survey questionnaire in Europe, the (HLS-EU-Q) questionnaire was developed to measure the health literacy of the European population (Sørensen, K et al, 2012). After evaluating the health literacy skills of American adults in the United States, the results obtained better reflect the significance of these tools (Kutner, M. A, 2006).

2.4.4 Impact on health outcomes

Research has consistently shown that low health literacy has a significant impact on health outcomes. After conducting a systematic review, a strong correlation was found between low health literacy and poor health outcomes (Berkman, N. D et al, 2011, DeWalt, D. A et al, 2004), and it was found that among medical insurance management care registrants with lower levels of functional health knowledge, the risk of hospitalization was relatively high (Baker, D. W et al, 2002). So limited health knowledge is associated with adverse health outcomes (DeWalt, D. A et al, 2004).

2.4.5 Theoretical and practical significance:

The researchers also emphasized the theoretical and practical significance of health literacy, which plays an important role in shaping health outcomes (O'Connor, R et al, 2020). Another study investigated the causal relationship between health literacy

and health outcomes, emphasizing the multifaceted nature of this relationship (Paasche-Orlow, M. K et al, 2007). The close connection between health knowledge and chronic disease knowledge fully demonstrates the importance of health knowledge in enhancing individual effective health management (Gazmararian, J. A et al, 2003).

In summary, research on health knowledge emphasizes its crucial role in promoting health and well-being. Limited health knowledge is associated with adverse health outcomes, emphasizing the need to strengthen intervention measures and policies for health knowledge and skills. So, health literacy can be applying to develop of digital health literacy for understand health information and use it to maintain and promote their own health.

2.5 Digital health literacy

Digital health literacy (DHL) is an important concept that has been gaining increasing attention in healthcare in recent years. With the rise of the internet and digital technologies, DHL has become even more crucial, as it refers to a person's ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to prevent, address, or solve a health problem. According to the content of van der Vaart and Drossaert (2017) has five components:

- (1) Information searching refers to searching for and finding health information on the internet.
- (2) Adding self-generated content refers to the creation and sharing of health information on the internet.
- (3) Evaluating reliability refers to the assessment of the quality of health information on the internet.
- (4) Determining relevance refers to determining the everyday relevance of

health information on the internet.

(5) Information handling refers to the handling of personal information and data protection on the internet.

The COVID-19 pandemic has highlighted the importance of DHL, as people need to access accurate and timely information about the virus and its prevention. Several studies have investigated DHL and its associated factors among different populations. For example, researchers conducted a national cross-sectional study to assess the DHL level of college students in China during the COVID-19 pandemic and determine the factors related to their DHL level. The study found that the students' DHL level was limited, indicating the need for interventions to enhance their DHL.

In another study, researchers investigated the relationship between DHL and preventive behaviors during the early COVID-19 pandemic among the general population. The study found that DHL was positively associated with preventive behaviors, highlighting the importance of DHL in promoting health behaviors during the pandemic (Lee, J et al, 2021).

Improving DHL can lead to better health outcomes and help people make informed decisions about their health. Therefore, it is crucial to continue researching DHL and develop interventions to enhance DHL among different populations. For example, providing health education and training programs that focus on DHL, creating user-friendly health information websites and mobile applications, and encouraging the use of social media platforms to share reliable health information can all help improve DHL.

DHL is an essential concept in healthcare, particularly during the COVID-19 pandemic. Enhancing DHL can lead to better health outcomes and promote health behaviors, making it crucial for healthcare providers and policymakers to prioritize DHL research and interventions.

Therefore, the importance of DHL has become evident as people need accurate information for prevention. Studies have shown that DHL among college students was limited, highlighting the need for interventions. Additionally, higher DHL levels were associated with better preventive behaviors in the general population. To enhance DHL, interventions such as educational programs, user-friendly digital platforms, and social media can be employed. Continued research and targeted strategies are essential to improve DHL and promote positive health outcomes.

2.6 The factors related to digital health literacy

The student is a critical period for individuals to learn about health, develop healthy practices and improve digital health literacy. A review of relevant domestic and international literature reveals that the factors associated with health and digital health literacy can be show that.

2.6.1 Demographic

Research has shown that age can affect the level of digital health literacy, and young people may be more likely to master digital health tools (Tennant, B et al, 2015). An individual's education level is usually related to their level of digital health literacy, a higher level of education may make it easier for individuals to understand and apply digital health information. Cultural background and social factors, such as social support and socio-economic status, can also affect digital health literacy. Different cultures and social groups may have different views and needs on digital health (Norman, C. D et al, 2006).

2.6.2 Health knowledge

The level of individual understanding of health-related information is also one of the factors that affect digital health literacy. A richer knowledge of health may help to better understand digital health information (Norman, C. D et al, 2006).

2.7 Relevant researches

In relevant research, researchers believe that the level of digital health literacy is very important and is influenced by many factors. Based on relevant research literature, it is summarized as follows:

1) The importance of digital health literacy: Researchers have discussed the basic skills required for digital health literacy and their impact on consumer health in a digitally connected world (Norman, C. D et al, 2006). Digital health literacy is progressing, and researchers have emphasized the importance of digital health literacy in promoting health and well-being. A European survey evaluated citizens' levels of digital health literacy, Explored the concepts of informed and empowered citizens in the context of health (Santana, S et al, 2011).

2) Digital Health Literacy Assessment Tool: Researchers have developed evaluation tools to study a three group randomized trial protocol to evaluate the comparative effectiveness of different approaches in promoting community digital health literacy (Faux-Nightingale, A et al, 2022), a systematic review and meta-analysis were conducted on young people with chronic diseases using serious games to improve knowledge and self-management, and it was found that serious games have a positive effect on improving health-related outcomes (Charlier, N et al, 2016). The reliability and effectiveness of the digital health literacy scale for elderly people recruited online were tested, supporting the reliability and effectiveness of the eHEALS scale (Chung, S. Y et al, 2015), The system review explored different questionnaires used to measure digital health literacy, examined the measurement characteristics of these tools, and gained a deeper understanding of the current status of digital health literacy assessment (Schreiweis, B et al, 2021). Additionally, there was the development and validation of digital health literacy assessment tools specifically designed for the elderly, recognizing the unique needs and challenges they may face when using digital health resources (Slatyer, S et al, 2020).

3) The relationship between digital health literacy and health literacy: A study on digital health literacy among German university students found a positive correlation with user experience, health knowledge, and health behavior (Soellelner, R et al, 2014), afterwards, researchers discussed the importance of health literacy and digital health literacy, as well as the necessity of fairness in the context of digital health (Champlin, S et al, 2020). In the context of the digital divide, researchers found that, explored how the gaps in digital health literacy acquisition and skills lead to health inequality, and the necessity of addressing these gaps to promote health equity, the dimensions of health literacy and digital health literacy have different aspects and influencing factors (Neter, E et al, 2012), and health literacy can affect patients' use of online health information (O'Connor, R et al, 2019). Research has found that the higher the digital health literacy of elderly people, the better their health status (Xie, L et al, 2022).

4) The relationship between digital health literacy and demographic characteristics: There are significant differences in digital health literacy among some populations. They investigated the health and media habits of college students, as well as their perception of the quality of health information (Fraser, A. M et al, 2022). They also investigated the digital health literacy of nursing undergraduate students and found that their level of digital health knowledge is moderate, requiring further training and education (Tubaishat, A et al, 2016), A longitudinal study examined the sustained benefits of digital health knowledge and the utilization of online health information in a sample of Japanese individuals residing in healthy areas, emphasizing the long-term impact of digital health knowledge on health-related behaviors (Mitsutake, S et al, 2018), and investigating the role of leadership styles, especially transformational leadership, in digital health literacy and communication (Robbins, B et al, 2022).

5) The relationship between digital health literacy and internet literacy: Internet literacy is the relatively biggest factor affecting digital health literacy, but there is not much literature available. Some researchers have discussed the concept of online literacy in the context of health and its operations, emphasizing the importance of considering different aspects of online literacy to promote health education and participation (Huhta, A. M et al, 2018).

6) The relationship between digital health literacy and information literacy: In research on information literacy, the source of information is particularly important, especially in identifying the quality of information. Some studies have shown the impact of digital health literacy on perceived trust in online health communication channels and sources, emphasizing the role of digital health literacy in shaping individuals' trust in online health information (Paige, S. R et al, 2017) , Health information seeking and digital health literacy among patients seeking medical treatment in private and public clinics (Gutierrez, N et al, 2014).

7) The relationship between digital health literacy and disease perception literacy: When there is a high health risk in the environment or oneself, people will spontaneously search for relevant information. Some studies have examined the relationship between digital health literacy and infectious diseases, focusing on internet search behavior related to the Ebola virus, and emphasizing the importance of digital health literacy in obtaining and interpreting accurate health information during disease outbreaks (Alicino, C et al, 2015) . Discussed the digital health literacy of diabetes patients and their use of the Internet to search for health information (Jendly, M et al, 2023). A study used data from the global online survey to investigate the use of technology by patients with rare diseases, and discussed the role of digital health literacy in acquiring and using health technology to manage rare diseases (Ashtari, S et al, 2022), project response theory analysis was used to understand the digital health literacy of patients with chronic diseases, with special attention to the digital health

literacy scale. The digital health literacy of diabetes patients and their use of the Internet to search for health information were discussed.

8) The relationship between digital health literacy and personal information security literacy: When people are on the internet, how to use privacy techniques plays a significant role, which is a complex and important issue involving the processing of sensitive personal health information. The disclosure of personal identity and health information can hinder people's active participation in digital health, especially members of vulnerable groups (Li, X, 2018).

Chinese college students generally accept new things and have the advantage of easy mastery of new technologies, but they are also easily exposed to many erroneous knowledge on the internet. Studying their DHL level and influencing factors has great research significance.

2.8 Conceptual framework of the study

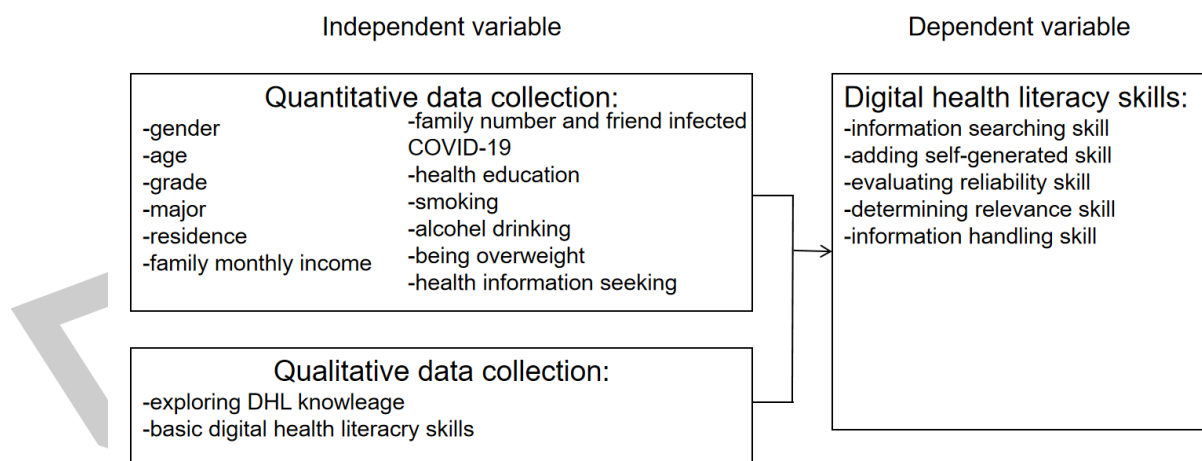


Figure 1 Conceptual framework

CHAPTER III METHODOLOGY

This is a mixed-method study in which we integrate both quantitative and qualitative studies. In the quantitative, we focus on the assessment of demographic characteristics, health information source factors, internet factors, and DHL level, as well as determining the associated factors. In the qualitative data collection, we focus on exploring knowledge and opinion about basic DHL knowledge, information searching skill, adding self-generated skill, evaluating reliability skill, determining relevance skill, information handling skill. The study procedure for this study is as follows:

3.1 Study design

The quantitative data collection, which the study will use to examine the DHL level and its associated factors among students in of Sichuan Vocational College of Health and Rehabilitation. A questionnaire survey was conducted on 1062 full-time students aged 18-25 years old. In terms of qualitative, we focus on exploring about basic DHL knowledge, information searching skill, adding self-generated skill, evaluating reliability skill, determining relevance skill, information handling skill.

3.2 Study population and samples

3.2.1 The quantitative data collection

3.2.1.1 Study population

The research subjects in this stage are students from Sichuan Vocational College of Health and Rehabilitation in Zigong City, Sichuan Province, China.

3.2.1.2 Sample

The sample size estimation was calculated using Daniel's (Daniel et al,1999) formula as follows:

$$n' = \frac{NZ_{\alpha/2}^2 P(1 - P)}{d^2(N - 1) + Z_{\alpha/2}^2 P(1 - P)}$$

n' = Sample size

N = Number of population ($N=9390$)

Z = confidence intervals (set as 95% CI, $Z=1.96$)

P = proportion of students who had low or high level of DHL at SVHR ($P=0.526$)

(Htay, M. N. N et al, 2022)

d = precision values ($d=0.03$)

When

$$n' = \frac{(9390)(1.96)^2 0.526(1-0.526)}{(0.03)^2(9390-1) + (1.96)^2(0.526)(1-0.526)}$$

$$n' = 955.98 \approx 956$$

The formula to calculate the dropout rate as 10%.

$$N_1 = \frac{n}{1 - d}$$

d = dropout rate ($d=0.1$)

n = Number of population ($n=956$)

N_1 = Sample size

When

$$N_1 = 956 / 1 - 0.1$$

$$N_1 = 1062$$

Therefore, the minimum credible sample size for medical students is 1062.

3.2.1.3 Inclusion criteria

1) Students who were freshman, sophomores, or juniors (students who aged rang 18-22 years old)

2) Can use smart phone and have Wechat app on the phone

3) Able to read and understand Chinese mandarin independently

4) Willing to participate

3.2.1.4 Exclusion criteria

1) Student who refused to answer the questionnaire

2) Student who provided an incomplete response

3.2.1.5 Sampling

Using multi-stage random sampling method, students are selected according to certain characteristics and proportions, as follows:

Stage I: Classify 9390 students according to their respective faculties.

Stage II: Once again, classify the students of the faculty according to their grades.

Stage III: lottery method was used to 11.3% (based on the ratio of 1062/9390).

Finally, a sample of 1062 students was selected for analysis (**Table 1**).

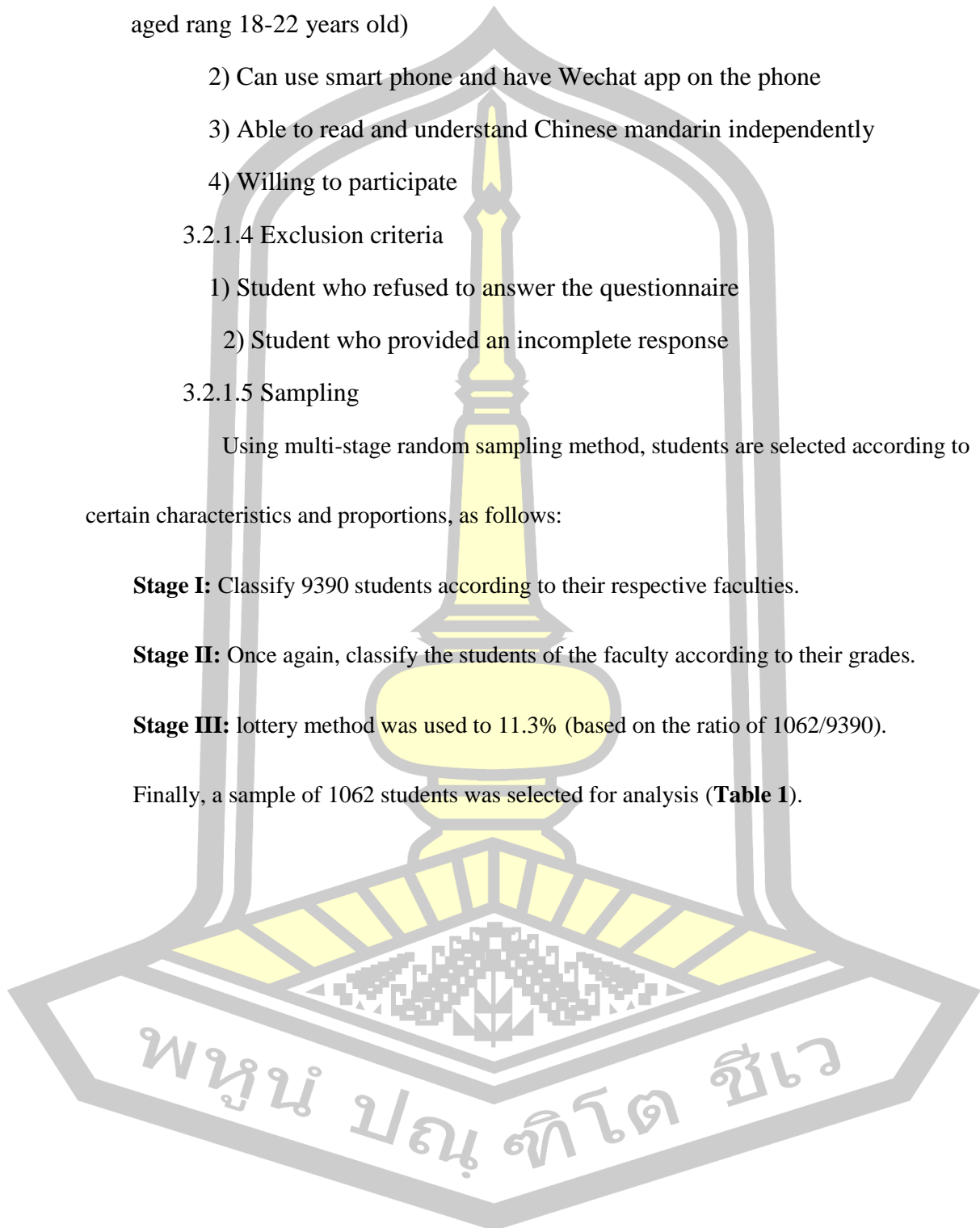
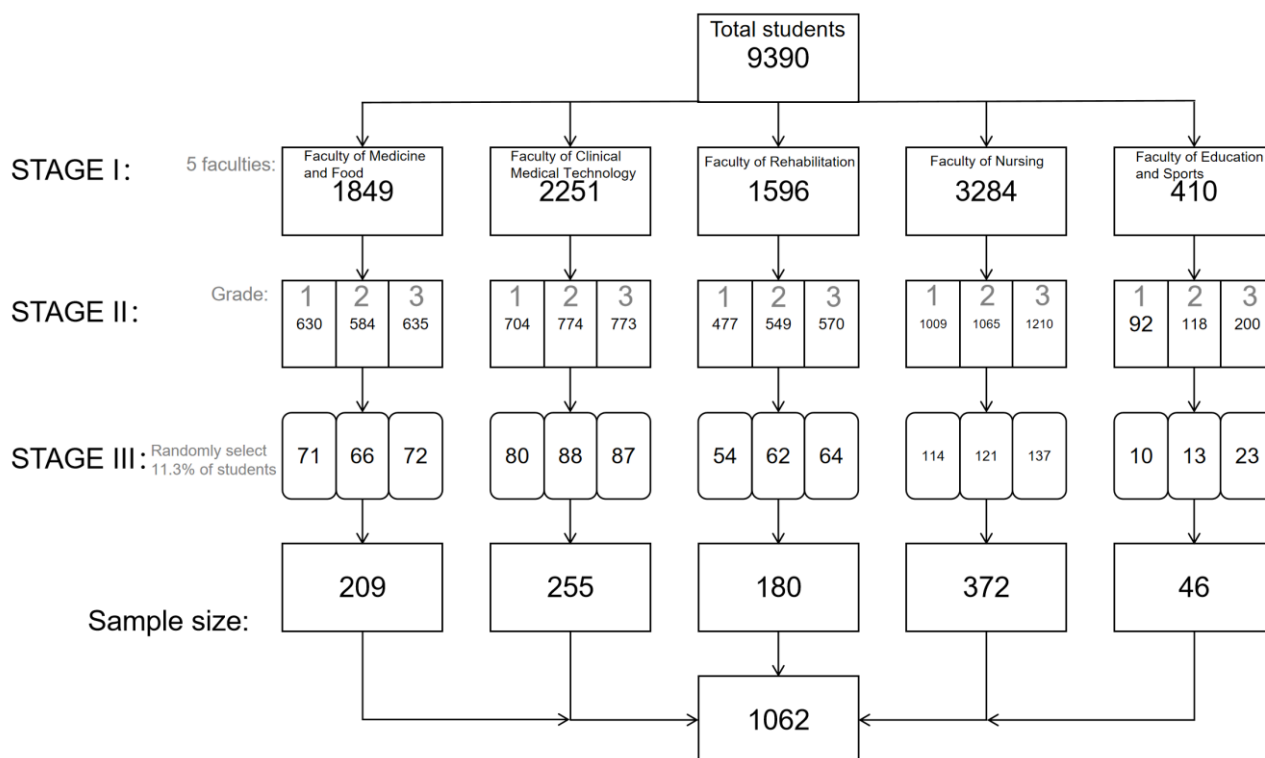


Table 1 Multi-stage random sampling

3.2.2 The qualitative method

The target group includes the key informants who can give information about how to access web-based information or internet resources of COVID-19-related information, information-seeking behavior, and satisfaction with COVID-19 information searches by utilizing the focus group technique. The key informants or stakeholders include 15 representative college students.

Inclusion criteria

- 1) The volunteers are students who are full-time students.
- 2) Willing to participate.

Exclusion criteria

- 1) Participants who do not live in a research setting during research conduct
- 2) Participants who want to cancel their research participation during research conduct
- 3) The participants who have a sudden illness

3.3 Research instruments and the evaluation of research instruments quality

3.3.1 Quantitative instruments

The self-administered questionnaire was developed on the basis of literature review that consists of three parts:

Part I--Demographic characteristics and Health information sources factors

The exposure variables were 12 demographic characteristics: age, gender, year of study, major, residence, family monthly income, having had family members or friends infected with COVID-19, health education, smoking, alcohol drinking, being overweight, and health information seeking.

The year of study was classified into freshmen, sophomore, and junior. The major was divided into nursing, rehabilitation, medicine and food, education and sports, and clinical medical technology. Having had family members or friends infected with COVID-19, health education, smoking, alcohol drinking, and being overweight were binary (yes/no). Our questionnaire asked about the health information seeking from different sources, rated from 1 (never) to 5 (always).

Part II-- Digital Health Literacy Scale

A self-reported DHL questionnaire was developed based on van der Vaart et al.⁸ This questionnaire comprised 25 items measuring five subdomains: (1) searching information, (2) adding self-generated content, (3) evaluating reliability, (4) determining relevance, and (5) handling information (Cronbach' s $\alpha = 0.91$). The total DHL score was the sum of the scores for all items (ranging from 5 to 125). A median score of <70 was considered inadequate (low level), whereas a median score of ≥ 70 was considered adequate (high level). For each domain, a score of at least 16 was required to be considered adequate.

3.3.2 Qualitative instruments

The researcher will prepare the guidelines for questions that will be used in the focus group technique how to access web-based information or internet resources

of COVID-19-related information, information-seeking behavior and satisfaction with COVID-19 information searches.

3.4 Data collection

The research team consisted of three members, and the tool used for data collection was Questionnaire Star, a software with powerful features to design questionnaires, collect questionnaires, and perform simple data statistics. The method of implementation was as follows: first, the entries of the collection scale or survey were poured into Questionnaire Star; next, the entries were edited to form a usable questionnaire; and finally, the completed questionnaire was produced with a QR code, which was given to the subjects who filled it out. The data is collected in two steps.

Step 1: Before distributing the questionnaires, 3 panel members were trained and informed of informed consent, precautions, and handling of unexpected situations before the questionnaires were filled out, and 2 members were selected to distribute the questionnaires.

Step 2: For the collected questionnaires, one other member was asked to check the completeness of the questionnaires, and if any questionable questionnaires were found, a third person was asked to come together for consultation and finalization.

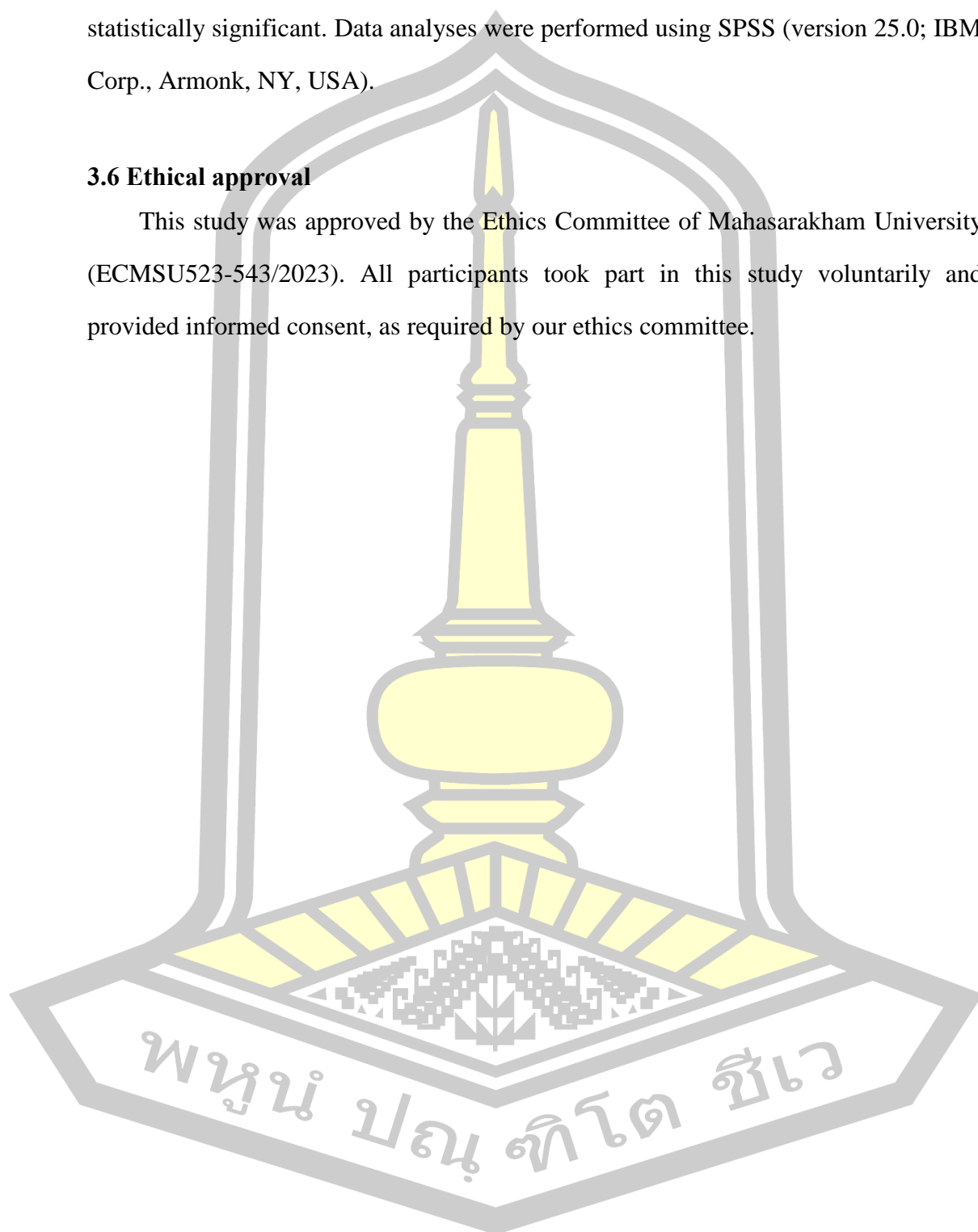
3.5 Data analysis

The studied variables are presented using descriptive statistics, including the frequency and percentage, except for age, which is reported as the median, and health information seeking, which is reported as the mean \pm standard deviation (SD). The normality of their distribution was assessed using the Kolmogorov–Smirnov test; our data were not normally distributed. The DHL scores were computed; those above the median were classified as high, and those below the median were classified as low. The associations between participants' characteristics and DHL were examined using chi-squared tests. Multivariate logistic regression was used to identify associations

while controlling for the effects of other variables. A $p < 0.05$ was considered statistically significant. Data analyses were performed using SPSS (version 25.0; IBM Corp., Armonk, NY, USA).

3.6 Ethical approval

This study was approved by the Ethics Committee of Maharakham University (ECMSU523-543/2023). All participants took part in this study voluntarily and provided informed consent, as required by our ethics committee.



CHAPTER IV RESULTS

This study used both quantitative and qualitative methods to evaluate the DHL level of students at Sichuan Vocational College of Health and Rehabilitation, and conducted a cross-sectional analysis of relevant factors to explore the factors that affect their DHL level. The research results are as follows:

4.1 Quantitative Results

4.1.1 Basic Information

4.1.1.1 The Demographic characteristic

The demographic characteristics of the 1062 samples show that there are more females than males (82.9%), with the majority of students aged 20 years old (35.5%) and 19 years old (32.9%). The grade distribution is relatively even, with slightly more freshmen (36%). In terms of major, nursing has the highest number of students (35%), followed by clinical medical technology (24%). For further details, please refer to Table 2.

Table 2 Demographic characteristic (n=1062)

Variable	Number	%
Gender		
Male	182	17.1
Female	880	82.9
Age		
18	113	10.6
19	349	32.9
20	377	35.5
21	218	20.5
22	2	0.2

Variable	Number	%
24	2	0.2
25	1	0.1
Mean: 20.06, SD: ± 1.03		
Grade		
Freshman	383	36.0
Sophomore	350	33.0
Junior	329	31.0
Major		
Nursing	372	35.0
Rehabilitation	180	17.0
Clinical Medical Technology	255	24.0
Medicine and Food	209	19.7
Education and Sports	46	4.3

4.1.1.2 Family background, educational environment, and behavioral habits

The number of students with rural household registration far exceeds that of urban household registration (78.2%). In terms of monthly household income, only a few families exceed 10,000 (12.3%), with 5,000-9,999 being the highest (46.4%), followed by below 5,000 (41.3%). During the COVID-19 pandemic, a large number of students had family members or friends diagnosed with infections (78.9%), and a large number received relevant education (89.7%). Among them, over 90% of students do not smoke (95%) or drink alcohol (94.4%), and being overweight is rare, with the majority of students having a normal weight (96%). For further details, please refer to Table 3.

Table 3 Family background, educational environment, and behavioral habits

Variable	Number	%
Registered residence		
Urban	232	21.8
Rural	830	78.2
Family monthly income		
<5000	439	41.3
5000-9999	492	46.4
>10000	131	12.3
Family member or friend infected with coronavirus		
Yes	838	78.9
No	224	21.1
College health education in coronavirus		
Yes	953	89.7
No	109	10.3
Habits and customs(Smoking)		
Yes	53	5.0
No	1009	95.0
Habits and customs(Drinking)		
Yes	60	5.6
No	1002	94.4
Health status (Being overweight)		
Yes	43	4.0
No	1019	96

4.1.1.3 Scale of health information seeking and related topics on the internet

Table 4 mainly discusses the scale of students' health information seeking and related topics on the Internet. Most students often use search engines (Baidu, Bing, Sougou) (n=423, 39.8%). When using websites of public bodies (NCOC, provincial

health departments), the most common choice is "Rarely" (n=395, 37.2%). Sometimes, Wikipedia and other online encyclopedias are used (n=505, 47.5%). Most students choose "Often" for social media (Douyin, Weibo, Weixin) (n=635, 59.8%). Sometimes BiliBili is used (n=364, 34.3%). Sometimes health topic blogs are used (n=404, 38%). The most common option for guidebook communities is "Rarely" (n=526, 49.5%). Health portals also chose "Rarely" as the most common option (n=511, 48.1%). Websites of doctors/pharmaceutical companies were still chosen "Rarely" (n=635, 59.8%). Most news portals also chose "Rarely" (n=510, 48%).

Table 4 Scale of health information seeking and related topics on the internet

Characteristics	Often	Sometimes	Rarely	Never	Don't Know
	N(%)	N(%)	N(%)	N(%)	N(%)
Search engines (Baidu, Bing, Sougou)	423(39.8)	397(37.4)	204(19.2)	38(3.6)	0(0.0)
Websites of public bodies (NCOG, provincial health departments)	196(18.4)	390(36.7)	395(37.2)	39(3.7)	42(4.0)
Wikipedia and other online encyclopedias	199(18.7)	505(47.5)	280(26.4)	37(3.5)	41(3.9)
Social media (Douyin, Weibo, Weixin)	635(59.8)	252(23.7)	124(11.7)	51(4.8)	0(0.0)
BiliBili	213(20.0)	364(34.3)	344(32.4)	101(9.5)	40(3.8)
Blogs on health topics	127(12.0)	404(38.0)	398(37.5)	97(9.1)	36(3.4)
Guidebook communities	96(9.0)	306(28.8)	526(49.5)	90(8.5)	44(4.2)
Health portals	100(9.4)	312(29.4)	511(48.1)	93(8.8)	46(4.3)
Websites of doctors/pharmaceutical Companies	88(8.3)	300(28.2)	532(50.1)	101(9.5)	41(3.9)
News portal (e.g., newspapers, TV stations)	105(9.9)	322(30.3)	510(48.0)	90(8.5)	35(3.3)

4.1.2 DHL skills

4.1.2.1 Information searching skill

Table 5 mainly discusses students' information searching skill. Students usually use smartphones/computers to search for health information on the Internet (n=470, 42.7%). They are usually able to easily search for the required health information from the Internet (n=467, 44%). Sometimes they consult doctors/hospitals on the Internet for health information (n=418, 39.4%). Sometimes they check the health information push notifications they have subscribed to on the Internet (n=395, 37.2%). Sometimes health-related applications are used to obtain information (n=465, 43.8%).

Table 5 Information searching skill (n=1062)

No	Content	Options				
		Never	Occasionally	Sometimes	Usually	Always
		N(%)	N(%)	N(%)	N(%)	N(%)
1	I use my smartphone/computer to search for health information on the internet.	0(0.0)	54(5.0)	453(42.7)	470(44.3)	85(8.0)
2	I can easily search the required health information from the internet.	47(4.4)	38(3.6)	343(32.3)	467(44.0)	167(15.7)
3	I can consult doctors/hospitals for health information on the internet.	86(8.1)	374(35.2)	418(39.4)	91(8.6)	93(8.7)
4	I can check the health information push subscribed on the internet.	79(7.5)	390(36.7)	395(37.2)	117(11.0)	81(7.6)
5	I use the application software about health to obtain information.	68(6.4)	213(20.1)	465(43.8)	234(22.0)	82(7.7)

4.1.2.2 Adding self-generated skill

Table 6 mainly explores students' adding self-generated skill. Sometimes, discussing health information with others on social media is the most common (n=322, 30.3%). Sometimes sharing health information on the Internet (n=381, 35.9%). Sometimes collecting links to health information on the Internet (n=475, 44.7%). Sometimes commenting on posts related to health information on the Internet (n=381, 35.9%). Occasionally discussing health information with others on social media (n=315, 29.7%).

Table 6 Adding self-generated skill (n=1062)

No	Content	Options				
		Never	Occasionally	Sometimes	Usually	Always
		N(%)	N(%)	N(%)	N(%)	N(%)
1	I can publish various forms of health information on the internet.	301(28.3)	297(28.0)	322(30.3)	89(8.4)	53(5.0)
2	I can share the health information on the internet.	369(34.7)	179(16.9)	381(35.9)	86(8.1)	47(4.4)
3	I can collect links to health information on the internet.	166(15.6)	295(27.8)	475(44.7)	94(8.9)	32(3.0)
4	I can comment on posts related to health information on the internet.	170(16.0)	372(35.0)	381(35.9)	98(9.2)	41(3.9)
5	I can discuss health information with others on social media.	292(27.5)	314(29.6)	315(29.7)	92(8.6)	49(4.6)

4.1.2.3 Evaluating reliability skill

Table 7 mainly explores students' evaluating reliability skill. Sometimes students can distinguish whether some health information on the Internet has commercial interests (n=430, 40.5%). Sometimes they can identify health information

officially provided on the Internet (n=427, 40.2%). Sometimes they can verify the facts of the same health problem from many aspects of the Internet (n=452, 42.6%). Most students sometimes believe that some popular health information on the Internet is of high quality (n=501, 47.2%). And most students sometimes believe that health information with data/charts on the Internet is more accurate (n=528, 49.7%).

Table 7 Evaluating reliability skill (n=1062)

No	Content	Options				
		Never	Occasionally	Sometimes	Usually	Always
		N(%)	N(%)	N(%)	N(%)	N(%)
1	I can distinguish whether some health information on the internet has commercial interests.	236(22.2)	213(20)	430(40.5)	142(13.4)	41(3.9)
2	I can identify the health information officially provided on the internet.	84(7.9)	264(24.9)	427(40.2)	241(22.7)	46(4.3)
3	On the same health issue, I can verify the true from many aspects of the internet	83(7.8)	235(22.1)	452(42.6)	245(23.1)	47(4.4)
4	I believe some popular health information on the internet is of high quality.	111(10.5)	300(28.2)	501(47.2)	104(9.8)	46(4.3)
5	I believe health information with data/charts on the internet is more accurate.	112(10.6)	279(26.3)	528(49.7)	96(9.0)	47(4.4)

4.1.2.4 Determining relevance skill

Table 8 mainly explores students' determining relevance skill. When obtaining health information on the Internet that can help treat diseases such as COVID-19, the proportion of students who choose "sometimes" is the highest (n=493,

46.4%). When confirming the infection status of COVID-19 or other diseases on the Internet, most students also choose "sometimes" (n=477, 44.9%). The highest proportion of health information obtained on the Internet that can help prevent diseases such as COVID-19 is "sometimes" (n=477, 44.9%). Learning how to reduce the impact of the epidemic on daily life from the Internet, most students choose "sometimes" (n=512, 48.2%). Sometimes viewing the impact on daily life after the outbreak of COVID-19 from the Internet (n=467, 44%).

Table 8 Determining relevance skill (n=1062)

No	Content	Options				
		Never	Occasionally	Sometimes	Usually	Always
		N(%)	N(%)	N(%)	N(%)	N(%)
1	I check the impact of post COVID-19 on daily life from the internet.	41(3.9)	229(21.6)	493(46.4)	252(23.7)	47(4.4)
2	I learned from the internet how to reduce the impact of the epidemic on daily life.	39(3.7)	251(23.6)	477(44.9)	257(24.2)	38(3.6)
3	The health information I get on the internet can help me prevent COVID-19 or other.	33(3.1)	249(23.5)	477(44.9)	258(24.3)	45(4.2)
4	I determined the infection of COVID-19 or other on the internet.	35(3.3)	239(22.5)	512(48.2)	242(22.8)	34(3.2)
5	The health information I get on the internet can help me treat COVID-19 or other.	31(2.9)	257(24.2)	467(44.0)	256(24.1)	51(4.8)

4.1.2.5 Information handling skills

Table 9 mainly explores students' information handling skill. When using some functions on the Internet that involve personal information, the proportion of students who choose "sometimes" is the highest (n=447, 42.1%). When they choose

to believe that the disclosure of personal information on the Internet has no impact, most people choose "never" (n=448, 42.2%). Sometimes real photos/videos can be shared on the Internet (n=489, 46%). Occasionally, real information can be filled in on the Internet (n=437, 41.2%). Sometimes they can encrypt their personal information data stored on the Internet (n=333, 31.4%).

Table 9 Information handling skill (n=1062)

No	Content	Options				
		Never	Occasionally	Sometimes	Usually	Always
		N(%)	N(%)	N(%)	N(%)	N(%)
1	When I use some functions on the internet, will involve personal information.	40(3.8)	262(24.7)	447(42.1)	255(24.0)	58(5.4)
2	I believe that the disclosure of personal information on the internet has no impact.	448(42.2)	214(20.1)	307(28.9)	56(5.3)	37(3.5)
3	I can share some real photos/videos on the internet.	177(16.7)	300(28.2)	489(46.0)	57(5.4)	39(3.7)
4	I can fill in the true information on the internet.	112(10.5)	437(41.2)	428(40.3)	47(4.4)	38(3.6)
5	I can encrypt my stored personal information data on the internet.	43(4.0)	276(26.0)	333(31.4)	226(21.3)	184(17.3)

4.1.2.6 Mean and SD of DHL

Table 10 shows that the two items in information searching skill scored the highest, (3.63±0.94) and (3.55±0.71). Determining relevance skill scored above the average for all items, while evaluating reliability skill and information handling skill scored above the average for some items. However, skill 2 scored low for all items.

Table 10 Mean and SD of DHL

No	DHL contents	Mean±SD	Rank
1	I use my smartphone/computer to search for health information on the internet.	3.55±0.71	2
2	I can easily search the required health information from the internet.	3.63±0.94	1
3	I can consult doctors/hospitals for health information on the internet.	2.75±1.02	14
4	I can check the health information push subscribed on the internet.	2.75±1.01	13
5	I use the application software about health to obtain information.	3.05±0.99	4
6	I can publish various forms of health information on the internet.	2.34±1.12	22
7	I can share the health information on the internet.	2.31±1.16	24
8	I can collect links to health information on the internet.	2.56±0.96	18
9	I can comment on posts related to health information on the internet.	2.50±0.99	20
10	I can discuss health information with others on social media.	2.33±1.11	23
11	I can distinguish whether some health information on the internet has commercial interests.	2.57±1.09	17
12	I can identify the health information officially provided on the internet.	2.91±0.98	12
13	On the same health issue, I can verify the true from many aspects of the internet	2.94±0.97	11
14	I believe some popular health information on the internet is of high quality.	2.69±0.94	16
15	I believe health information with data/charts on the internet is more accurate.	2.71±0.93	15
16	I check the impact of post COVID-19 on daily life from the internet.	3.03±0.89	6
17	I learned from the internet how to reduce the impact of the epidemic on daily life.	3.00±0.88	9

No	DHL contents	Mean±SD	Rank
18	The health information I get on the internet can help me prevent COVID-19 or other.	3.03±0.88	7
19	I determined the infection of COVID-19 or other on the internet.	3.00±0.84	10
20	The health information I get on the internet can help me treat COVID-19 or other.	3.04±0.89	5
21	When I use some functions on the internet, will involve personal information.	3.03±0.92	8
22	I believe that the disclosure of personal information on the internet has no impact.	2.08±1.11	25
23	I can share some real photos/videos on the internet.	2.51±0.95	19
24	I can fill in the true information on the internet.	2.49±0.87	21
25	I can encrypt my stored personal information data on the internet.	3.22±1.13	3

4.1.3 Factors influencing DHL skills

As shown in Table 11, a total of 1062 vocational college students were enrolled in the study, with an average age of 19.68 ± 0.96 years, including 182 (17.10%) males and 880 (82.90%) females. Specifically, 36.00% of the participants were freshmen, and 35.10% majored in nursing. In addition, 78.20% of the participants came from rural areas, 87.90% had a family member or friend infected with COVID-19, and 89.70% had taken a health education course at the college. The median total DHL score was 70, while the five domain skills of DHL had median scores of 16, 12, 14, 15, and 13 points, respectively. Moreover, 52.26% of the medical vocational college students had a high level of total DHL. We found that grade ($p = 0.000$), major ($p = 0.002$), family member infected with COVID-19 ($p = 0.001$), and health education ($p = 0.000$) significantly varied in total DHL level.

Table 11 Demographic characteristic with distribution of DHL level)n=1062(

Variable	All	Total DHL		p-value
	N )%(	Low)n=507(	High)n=555(
Gender				0.871
Male	182)17.10(	88)17.40(	94)16.90(
Female	880)82.90(	419)82.60(	461)83.10(
Grade				<0.001
Freshmen	383)36.00(	158)31.20(	225)40.50(
Sophomore	350)33.00(	160)31.60(	190)34.20(
Junior	329)31.00(	189)37.30(	140)25.20(
Major				0.002
Nursing	372)35.10(	189)37.30(	183)33.00(
Rehabilitation	180)16.90(	93)18.30(	87)15.70(
Medicine and Food Education and Sports	209)19.70(	109)21.50(	100)18.00(
Clinical Medical Technology	301)28.30(	116)22.90(	185)33.30(
Residence				0.766
Urban	232)21.80(	113)22.30(	119)21.40(
Rural	830)78.20(	394)77.70(	436)78.60(
Family monthly income				0.332
<5000 yuan	439)41.30(	221)43.60(	218)39.30(
5000 -9999 yuan	492)46.30(	228)45.00(	264)47.60(
≥10000 yuan	131)12.30(	58)11.40(	73)13.20(
Family member or friend infected COVID-19				0.001
Yes	838)87.90(	378)74.60(	460)82.90(
No	224)21.10(	219)25.40(	95)17.10(
Health education				<0.001
Yes	953)89.70(	437)86.20(	516)93.00(
No	109)10.30(	70)13.80(	39)7.00(
Smoking				0.482
Yes	53)5.00(	28)5.50(	25)4.50(
No	1009)95.00(	479)94.50(	530)95.50(
Alcohol drinking				0.791
Yes	60)5.60(	30)5.90(	30)5.40(
No	1002)94.40(	477)94.10(	525)94.60(
Being overweight				0.756
Yes	43)4.00(	22)4.30(	21)3.80(
No	1019)96.00(	485)95.70(	534)96.20(

In addition, this study explored the frequency of searching for health information and related topics on the Internet from various sources (Table 12). The results reported that a critical mean scale of students often sought information through social media (Douyin, Weibo, Weixin; 4.39 ± 0.87), search engines (Baidu, Bing, Sougou; 4.13 ± 0.85), and Wikipedia and other online encyclopedias (3.74 ± 0.93). Additionally, differences in total DHL level were observed across the scale of health information seeking ($p = 0.000$) (data not shown). Across the levels of DHL, students with a mean scale of 3.67 ± 0.37 of health information seeking had high levels of DHL, while those with 3.55 ± 0.36 had low levels of DHL

Table 12 Scale of health information seeking and related topics on the internet

Characteristics	Mean \pm SD
Search engines (Baidu, Bing, Sougou)	4.13 ± 0.85
Websites of public bodies (NCOC, provincial health departments)	3.62 ± 0.96
Wikipedia and other online encyclopedias	3.74 ± 0.93
Social media (Douyin, Weibo, Weixin)	4.39 ± 0.87
BiliBili	3.57 ± 1.03
Blogs on health topics	3.46 ± 0.94
Guidebook communities	3.30 ± 0.90
Health portals	3.31 ± 0.92
Websites of doctors/pharmaceutical companies	3.28 ± 0.89
News portal (e.g., newspapers, TV stations)	3.35 ± 0.89

As shown in Table 13, we revealed that the odds ratios for factors associated with DHL after adjusting for confounding variables. Higher scores of total DHL were associated with age (ORadj = 0.83, 95% CI = 0.70 – 0.99), students at the sophomore (ORadj = 2.68, 95% CI = 1.79 – 4.00) or junior (ORadj = 1.82, 95% CI = 1.31 – 2.53) level, and those students majoring in Nursing (ORadj = 0.63, 95% CI = 0.45 – 0.87), Rehabilitation (ORadj = 0.64, 95% CI = 0.43 – 0.94), and Medicine and Food, and Education and Sports (ORadj = 0.60, 95% CI = 0.41 – 0.86), those who had no family member infected with COVID-19 (ORadj = 1.64, 95% CI = 1.20 – 2.24), did not receive health education (ORadj = 2.00, 95% CI = 1.29 – 3.07), and had a higher frequency of health information seeking (ORadj = 2.53, 95% CI = 1.76 – 3.63).

Regarding the subscales of DHL, the results indicate that grade, major, family member or friend infected with COVID-19, health education, and scale of health information seeking were found to be significantly associated with information searching, adding self-generated content, evaluating reliability, determining relevance, and information handling subscales. Interestingly, only students' average age was less likely to report a high level of information searching (ORadj = 0.82, 95% CI = 0.69 – 0.97), adding self-generated content (ORadj = 0.84, 95% CI = 0.71 – 0.99), determining relevance (ORadj = 0.82, 95% CI = 0.69 – 0.98), and information handling (ORadj = 0.83, 95% CI = 0.70 – 0.99) subscales of DHL.

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Table 13 Multiple logistic regression analysis for the overall DHL level and five sub-scales of the participants

Variable	Total DHL			Searching information			Adding self-generated content			Evaluating reliability			Determining relevance			Handling information		
	ORadj j	95%CI	p-value	ORadj j	95%CI	p-value	ORadj j	95%CI	p-value	ORadj j	95%CI	p-value	ORadj j	95%CI	p-value	ORadj j	95%CI	p-value
Age	0.83	0.70–0.99	0.037*	0.82	0.69–0.97	0.023*	0.84	0.71–0.99	0.048*	-	-	-	0.82	0.69–0.98	0.030*	0.83	0.70–0.99	0.033*
Year of study (Freshmen)	Ref.																	
Sophomore	2.68	1.79–4.00	<0.001**	2.57	1.72–3.84	<0.001**	2.61	1.75–3.89	<0.001**	2.32	1.56–3.46	<0.001**	2.61	1.75–3.89	<0.001**	2.72	1.82–4.06	<0.001**
Junior	1.82	1.31–2.53	<0.001**	1.83	1.31–2.54	<0.001**	1.81	1.30–2.51	<0.001**	1.74	1.25–2.42	<0.001**	1.84	1.32–2.55	<0.001**	1.84	1.32–2.55	<0.001**
Major (Clinical medical technology)	Ref.																	
Nursing	0.63	0.45–0.87	0.006*	0.65	0.47–0.91	0.011*	0.64	0.46–0.89	0.008*	0.63	0.46–0.88	0.006*	0.68	0.48–0.93	0.016*	0.66	0.47–0.92	0.014*
Rehabilitation	0.64	0.43–0.94	0.023*	0.63	0.43–0.93	0.021*	0.63	0.43–0.92	0.018*	0.62	0.42–0.92	0.016*	0.65	0.44–0.95	0.028*	0.64	0.43–0.94	0.023*
Medicine and food or education and sports	0.60	0.41–0.86	<0.001**	0.60	0.41–0.87	0.007*	0.63	0.44–0.91	0.014*	0.61	0.42–0.88	0.008*	0.61	0.42–0.89	0.009*	0.62	0.43–0.90	0.012*
Family member infected with COVID-19 (Yes)	Ref.																	
No	1.64	1.20–2.24	0.022*	1.62	1.18–2.21	0.003*	1.61	1.18–2.20	0.003*	1.60	1.17–2.18	0.003*	1.59	1.17–2.17	0.003*	1.68	1.23–2.30	0.001*
Health education (Yes)	Ref.																	
No	2.00	1.29–3.07	0.002*	2.34	1.51–3.63	<0.001**	2.10	1.36–3.24	0.001*	2.59	1.65–4.01	0.001*	1.94	1.26–2.99	0.003*	1.95	1.26–3.00	0.003*
Health information seeking	2.53	1.76–3.63	<0.001**	2.48	1.76–3.55	<0.001**	2.43	1.70–3.48	<0.001**	2.47	1.72–3.54	<0.001**	2.46	1.72–3.52	<0.001**	2.59	1.80–3.72	<0.001**

4.2 Qualitative Results

The qualitative study involved 15 participants and conducted in-depth interviews to qualitatively analyze the DHL of 15 college students from our university. This analysis specifically explores their demographic characteristics in qualitative data to explore knowledge and opinions about basic DHL knowledge, information searching skill, adding self-generated skill, evaluating reliability skill, determining relevance skill, and information handling skill.

4.2.1 Demographic Characteristics for Qualitative Data

This study selected 15 college students of different grades and majors from Sichuan Vocational College of Health and Rehabilitation as interviewees. This sample is considered representative and diverse. There are 11 participants under the age of 20, accounting for 73.3%. The proportion of girls is very large, accounting for 83.3%. The number of first-grade students is 8, accounting for 53.3%, while the number of third-grade students is only 1, accounting for 6.7%. There are 12 rural residents, accounting for 80.0%. See Table 14 for details.

Table 14 Demographic characteristic for qualitative data (n=15)

Variable	N (%)
Age	
<20	11 (73.3)
≥20	4 (26.7)
Grade	
Freshmen	8 (53.3)
Sophomore	6 (40.0)
Junior	1 (6.7)
Family member or friend infected COVID-19	
Yes	15 (100.0)
No	0 (0.0)
Health education	
Yes	15 (100.0)
No	0 (0.0)
Health information seeking	
Yes	15 (100.0)
No	0 (0.0)

4.2.2 In depth interview on DHL

4.2.2.1 interview data

Participants responded to basic DHL knowledge, information searching skill, adding self-generated skill, evaluating reliability skill, determining relevance skill, information handling skill, and related topics during the interview. Participants were numbered 1-15, and Table 15 shows the relevant content of the interview.

Table 15 Topics and responded (n=15)

Topic	Question	Response
Basic DHL knowledge	Basic knowledge of DHL?	<p>Ability to identify, understand, and interpret digital health information. This requires individuals to have basic computer skills and Internet use ability, so that they can access and browse online health resources.(4)</p> <p>Individuals need to be able to evaluate the sources of health information, identify authoritative and reliable health information. This involves understanding website authentication, author qualifications, publishing institutions, as well as assessing the frequency and accuracy of information updates. (9)</p> <p>Master effective information retrieval skills, be able to use search engines and databases to find the desired health information, and be able to optimize search results using keywords and Boolean logic. (10)</p> <p>Understand and use various digital tools to maintain health, such as health monitoring applications, online medical consultation platforms, electronic health records, etc. (1)</p>
	What are the important factors of DHL?	<p>Education and training are important factors in improvingDHL. Through education, one can learn how to safely and effectively use digital resources to support health decisions. (5)</p> <p>Technical accessibility is an important factor, whether the hardware and software resources for accessing the Internet and digital devices are available. Without these resources, improving DHLwill be very difficult . (9)</p> <p>Information literacy is the core ofDHL, the</p>

Topic	Question	Response
		<p>ability to identify, evaluate, retrieve, and use information. Be able to think critically about information and make wise health decisions. (4)</p> <p>Privacy and security awareness are crucial in the field of digital health. To understand how to protect one's health data from abuse and ensure the security of personal information. (14)</p> <p>Cultural and social factors can also affectDHL, trust in health information, social acceptance of digital tools, and community sharing and discussion of health information. (12)</p>
Information searching skill	1. Would you actively seek health information online, or only search when needed?	<p>"I will actively seek health information online to maintain updates on health knowledge and prevent potential health problems.)1(</p> <p>"I usually actively seek health information online to stay up-to-date with the latest health knowledge ,not just to search when needed(12)</p> <p>"I tend to search for health information only when needed to ensure its relevance and timeliness.)5(</p> <p>"I only search for relevant information when encountering specific health issues ,so that I can solve problems more targetedly. (14)</p>
	2. How do you balance health information from different channels on the internet to avoid information overload?	<p>"I avoid information overload by selecting several authoritative health information channels and regularly checking them.(3)</p> <p>"To avoid information overload ,I will prioritize information sources ,pay attention to information published by authoritative institutions, and regularly organize and review the collected information.)5(</p> <p>"I will use subscription and information aggregation tools to centrally manage health information from different channels and reduce information overload.)12(</p> <p>"I set information filtering criteria ,such as only focusing on content published by certified medical experts and institutions .(11)</p>

Topic	Question	Response
		<p>"In order to balance health information from different channels ,I will prioritize obtaining health information from formal channels such as the government, health administrative departments, health professional institutions, and official media, and judge its scientific and authoritative nature. I will not easily believe or blindly follow it.)9(</p>
Adding self-generated skill	<p>3. What do you think of the level ofDHLamong people around you?</p>	<p>"I think people around me have varying levels of DHL .Some are able to make good use of online resources ,while others require more guidance.)8(</p> <p>"I have observed significant differences in the level of mastery of DHL among people around me ,which may be related to their educational background and information acquisition channels(3)</p> <p>"They exhibit significant individual differences inDHL, which may be related to their age and technological acceptance.)5(</p>
	<p>4. Do you share your health data with others online?</p>	<p>I will not share my health data with others online unless it is necessary for medical consultation.)11(</p> <p>I will not casually share my health data online, only with doctors when I need professional medical consultation.)14(</p> <p>I rarely share my health data online unless it's for the purpose of participating in scientific research. (7)</p> <p>I am cautious about sharing health data online, unless it is for the purpose of obtaining professional medical advice and ensuring the security of data transmission.)10(</p> <p>I will selectively share my health data with trusted people online, such as family members or healthcare professionals, so that they can better understand my health status.)5(</p>
Evaluating reliability skill	<p>5. How do you usually judge the reliability of a</p>	<p>I judge the reliability of the information source by checking its official website authentication, author qualifications, and cited scientific</p>

Topic	Question	Response
	health information source on the internet?	<p>literature.)4(</p> <p>I judge the reliability of health information sources on the internet by checking the website's domain name, publishing organization, and update frequency of information.)2(</p> <p>I usually check the reputation of the publishing institution, the sources of information citations, and whether there is peer review.)14(</p> <p>I will check the timestamp of the information release and whether there are any references or recommendations from other authoritative institutions to evaluate its reliability.)3(</p>
	6. How do you handle false information when searching for health information online?	<p>When encountering false information, I will ignore and seek other more reliable sources, and may report it to relevant platforms.)10(</p> <p>I will try to verify the authenticity of information from multiple reliable sources and avoid spreading unverified information.)9(</p> <p>When encountering suspected information, I will verify the authenticity of the information through cross validation and fact checking websites.)2(</p> <p>In the face of false information, I will try to find evidence to the contrary and remind others on social media to pay attention to the authenticity of the information.)5(</p>
Determining relevance skill	7. How do you ensure that your health information is up-to-date through the internet?	<p>I ensure the latest information by subscribing to health-related newsletters and regularly visiting authoritative health websites.)7(</p> <p>I will regularly check for updates from the medical and health organizations that I follow.)9(</p> <p>I will obtain updates through medical journals and health blogs.)12(</p> <p>I often check the news on social media.)2(</p>
	8. How do you view the	I believe that online health tools can serve as auxiliary tools for health management, helping

Topic	Question	Response
	connection between online health tools and your own life?	<p>me better monitor and improve my health status.)10(</p> <p>I believe that health tools on the internet are closely related to my daily life, as they help me monitor my health status and make better health decisions.)4(</p> <p>I believe that online health tools can improve the efficiency of health management, but they should serve as a supplement to traditional medical consultation rather than a replacement.)6(</p>
Information handling skill	9. How to deal with privacy or data security issues when using health tools online?	<p>When using online health tools, I carefully read the privacy policy and choose services that provide strong encryption and data protection.)5(</p> <p>I will prioritize health tools that explicitly promise to protect user privacy and data security, and regularly update my privacy settings.)14(</p>
	10. What if one needs to provide some personal information to obtain health information online?	<p>For situations where personal information is required, I will evaluate the value of the information and the trustworthiness of the provider, and only provide it if I am confident in the security of the information.)2(</p> <p>I believe that providing personal information to obtain health information is acceptable, as long as this information is used to improve health services and there are clear privacy protection measures in place.)4(</p> <p>I think it is necessary to provide personal information when obtaining health information, but the premise is that this information will be strictly kept confidential and only used to provide better health services.)9(</p>
Opinions	How do you think schools should improve students' DHL?	<p>Schools can incorporate DHL into their curriculum system by offering specialized courses or incorporating relevant content on DHL into existing courses , such as information recognition, assessment, and usage skills, as well as knowledge on network security and privacy protection. (4)</p>

Topic	Question	Response
		<p>Organize practical activities such as health information retrieval competitions, health knowledge quizzes, and health information debunking activities to enhance students' DHL and strengthen their ability to identify and process health information through practical operations. (13)</p> <p>Train teachers onDHLto ensure they have the ability to guide students in the proper use of digital health resources and effectively integrate DHLeducation into their teaching .(3)</p> <p>Through campus broadcasting, posters, campus websites and other channels, promote digital health knowledge, create a campus cultural atmosphere that valuesDHL, and encourage students to actively learn and practice. (10)</p> <p>Collaborate with medical institutions, public health organizations, and other organizations to invite experts to campus to hold lectures and workshops, providing students with professional digital health guidance and the latest health information. (6)</p>

Through Table 15, the high-frequency vocabulary and quantity in Topic 1 Basic DHL Knowledge are:Information (12 times), Health (10 times), Ability (4 times), Digital (3 times), Identify (3 times)

The high-frequency vocabulary and quantity in Topic 2 Information Searching Skill are:Information (12 times), Health (10 times), Online (8 times), Search (6 times), Actively (5 times)

The high-frequency vocabulary and quantity in Topic 3 Adding Self-Generated Skill are:People (6 times), Level (5 times), DHL (5 times), Around (4 times), Think (4 times)

The high-frequency vocabulary and quantity in Topic 4 Evaluating Reliability

Skill are: Information (12 times), Health (10 times), Source (6 times), Reliability (5 times), Judge (5 times)

The high-frequency vocabulary and quantity in Topic 5 Determining Relevance Skill are: Information (12 times), Health (10 times), Update (6 times), Ensure (5 times), Internet (5 times)

The high-frequency vocabulary and quantity in Topic 6 Information Handling Skill are: Privacy (6 times), Data (5 times), Security (5 times), Tool (4 times), Online (4 times)

The high-frequency vocabulary and quantity in Topic 7 Opinions are: School (6 times), DHL (5 times), Improvement (5 times), Student (4 times), Think (4 times)

Through high-frequency vocabulary analysis, the following commonalities can be found: 'Information' and 'health' are high-frequency words in all question responses, indicating that the core of Digital Health Literacy (DHL) lies in how to process and use health information.

The frequent occurrence of words such as "ability," "skill," and "tool" indicates that the answers emphasize an individual's ability and skills to process health information in a digital environment.

The frequent occurrence of "privacy" and "security" in the response to information processing skills indicates that privacy and data security are important considerations when using digital health tools.

The frequent appearance of "school" and "student" in opinion-based responses indicates that schools play an important role in improving students' digital health literacy.

CHAPTER V

CONCLUSION, DISCUSSION, AND RECOMMENDATION

This chapter will introduce the conclusions drawn and discuss them, and finally provide relevant suggestions:

5.1 Conclusion

Research has found that there are differences in DHL among students at Sichuan Vocational College of Health and Rehabilitation, with 52.26% of students considered to have a high level of DHL. The median scores for DHL's five domain skills (information search, adding self-generated content, assessing reliability, determining relevance, and information processing) are 16, 12, 14, 15, and 13 points, respectively.

Female students account for a relatively high proportion (82.9%), mainly concentrated in the ages of 19 and 20. Nursing students have the highest proportion (35%), followed by clinical medical technology majors (24%). The majority of students come from rural backgrounds (78.2%), with the highest number of students from families with monthly incomes between 5000 and 9999 yuan (46.4%). The proportion of family members or friends infected with COVID-19 is high (78.9%), and the vast majority of students do not smoke (95%) or drink alcohol (94.4%).

5.1.1 DHL Situation

Students usually use smartphones/computers to search for health information on the Internet, and 42.7% of them often do so. Sometimes, they discuss health information on social media, share health information, collect health information links, and comment on health information-related posts on the Internet. Sometimes, students can distinguish whether health information on the Internet has commercial interests, identify the health information provided by officials, and verify the facts of the same health problem from multiple aspects. When students use the Internet function, they sometimes involve personal information, but most students think that the disclosure of personal information on the Internet has no impact.

5.1.2 Factors Related to DHL

In this study, we observed an interesting phenomenon: there is a positive correlation between the student population without family members infected with COVID-19 and frequent health information-seeking behavior. This discovery may point to several important factors and potential mechanisms affecting DHL.

Firstly, students without family members infected with COVID-19 may place greater emphasis on obtaining and processing health information. They may be more proactive in searching for information about preventive measures, vaccination, disease transmission routes, and health habits. This positive information-seeking behavior may enable them to better understand how to protect themselves and family members from COVID-19 infection, thereby reducing the risk of infection.

These students may have strong health information literacy skills, including assessing the reliability of information, determining the relevance of information, and effectively processing information. These skills enable them to filter scientific and accurate protective measures from a large amount of health information and apply them to daily life, such as maintaining social distancing, wearing masks, and washing hands frequently.

In addition, frequent seeking of health information may also be related to an individual's awareness of health and prevention. These students may be more concerned about personal and public health issues, and therefore more inclined to take preventive measures. This attitude may also be reflected in their family members, thereby reducing the risk of infection for the entire family.

This positive correlation may also reflect a broader social dynamic, namely that during the pandemic, those who are able to effectively access and utilize health information are more likely to take effective protective measures, thereby reducing the spread of COVID-19. This emphasizes the importance of improving public health information literacy, especially during global public health crises.

In summary, the findings of this study emphasize the role of health information literacy in preventing the spread of COVID-19, as well as the importance of

enhancing individual and community health information-seeking behavior. Improving DHL through education and public health interventions can not only enhance individuals' ability to protect their health, but also reduce the spread of diseases at a broader societal level.

5.2 Discussion

This was the first study to investigate the factors that influenced DHL in vocational college medical students after the COVID-19 pandemic in Sichuan, China. This study found that most students had a high overall DHL level. Year of study, major, having had a family member or friend infected with COVID-19, health education, and health information seeking were independent factors influencing overall DHL and DHL sub-classes (searching information, adding self-generated content, evaluating reliability, determining relevance, and handling information). Thus, our results are meaningful for awareness of future pandemics.

We found that the overall DHL of most medical college students was high. This agrees with Tran (Tran HTT, et al., 2022), who reported high DHL scores for medical students. However, other studies reported that nursing and medical students had low DHL scores (Eun-Kyoung Lee O, et al., 2020; Nguyen LH, et al., 2020). Therefore, medical students need to develop appropriate DHL skills. As future healthcare providers, they have to be considered a reliable health information source and educate their patients on health issues. Additionally, some research suggests that eHealth literacy skills should be integrated into the curriculum of medical and health science students (Park H, et al., 2015; Tubaishat A, et al., 2016). During the COVID-19 pandemic, the Chinese government used social media and internet news channels to relay COVID-19-related knowledge and encourage health behaviors (Niu Z, et al., 2020; Nguyen HT, et al., 2020). It was indicated that higher levels of health literacy were related to lower awareness of COVID-19. A substantial proportion of our participants had low DHL skills (47.74%); therefore, adjusted interventions are needed to raise their DHL level. DHL is key to managing healthcare resources and is thus crucial for medical and healthcare personnel (Dheda K, et al., 2019).

The current study found that DHL first increased with the year of study and then decreased. This result implies that college education lacks instruction on DHL. Previous studies have indicated that the digital aspect is vital for healthcare workers as these workers may influence their patients' digital literacy and eHealth Literacy (Kayser L, et al., 2018; van Houwelingen CT, et al., 2016). In addition, different majors resulted in different overall DHL scores, the reasons for which are unclear and should be investigated. We also found that the overall DHL scores of students who had family members or friends infected with COVID-19 were higher than those who did not have people close to them infected. Moreover, students who received health education had higher scores than those who lacked health education.

The multiple logistic regression analysis revealed that the year of study, major, having had a family member infected with COVID-19, health education, and health information seeking influenced the overall DHL and searching information, adding self-generated content, evaluating reliability, determining relevance, and handling information sub-classes. Nevertheless, our results disagree with previous studies regarding the year of study (Zhang Y, et al., 2016; Estrela M, et al., 2023). Previous reports have shown that the year of study significantly increased DHL (Estrela M, et al., 2023). However, we found that DHL increased with the year of study but then decreased, suggesting that this is a risk factor for overall DHL and the sub-classes. This implies that the college curriculum in question lacks instruction on digital information. Indeed, some studies have highlighted that younger people are more likely to use mobile health apps than older individuals (Ameri F, et al., 2021). The majors included in the survey were nursing, rehabilitation, medicine and food, education and sports, and clinical medical technology. Students of clinical medical technology had a higher overall DHL level than other majors. This may be due to this major's curriculum, resulting in students with a better understanding of DHL and the sub-scales. Thus, major is a protective factor, especially for nursing students. Furthermore, having had a family member or friend infected with COVID-19 was positively correlated with overall DHL and all sub-scales (especially handling information), which may be due to having experienced an infection in a loved one because the Chinese government implemented family isolation measures throughout

the pandemic. Moreover, the Chinese government published information and guidelines for the control and prevention of COVID-19 (Li S, et al., 2021; Bol N, et al., 2018). A study conducted in Japan identified family members as information sources (Inoue M, et al., 2022), indicating the importance of having a family with an enhanced DHL level, especially for handling information. In addition, the positive association between DHL and health education has been confirmed by several studies (Rosário R, et al., 2023; Kim J, et al., 2023), including the current one. This illustrates that, even during the pandemic, health education is related to healthy behaviors through DHL. Indeed, eHealth literacy encouraged individuals to search for information about health, follow healthy behaviors, influence public behavior, and ultimately stop the pandemic (Ameri F, et al., 2021). We found that health information seeking was closely related to DHL, particularly in the handling information sub-scale. Information handling refers to managing data, which is vital for medical students because they can make assessments and accurate judgments about health information (Schulenkorf T, et al., 2021). Interestingly, most of our participants relied on social media (Douyin, Weibo, and Weixin) to obtain health information. Thus, DHL is crucial for strengthening the ability to find, understand, and evaluate health information from electronic platforms if other pandemics occur in the future. However, we obtained different results regarding the evaluating reliability sub-scale. We found that the student age was not related to their evaluation of reliability, disagreeing with previous studies (Dadaczynski K, et al., 2021; Chun H, et al., 2022; Morton E, et al., 2021) that reported a negative association between age and DHL (Dadaczynski K, et al., 2021; Morton E, et al., 2021), which argued that students with higher DHL levels in the evaluating information reliability sub-scale accessed the official websites of public bodies and agencies more often and turned less frequently to sources such as support communities, including forums and social media. By contrast, our vocational college medical students generally accessed information through social media (Douyin, Weibo, and Weixin). Hence, it is crucial to implement intervention strategies that will improve DHL, focused on social media.

Finally, because this study was conducted after the COVID-19 pandemic in China, important sources for searching information have been identified and the

experiences of the pandemic may serve as guidelines for enhancing DHL and promoting preventive behaviors in the case of future pandemics.

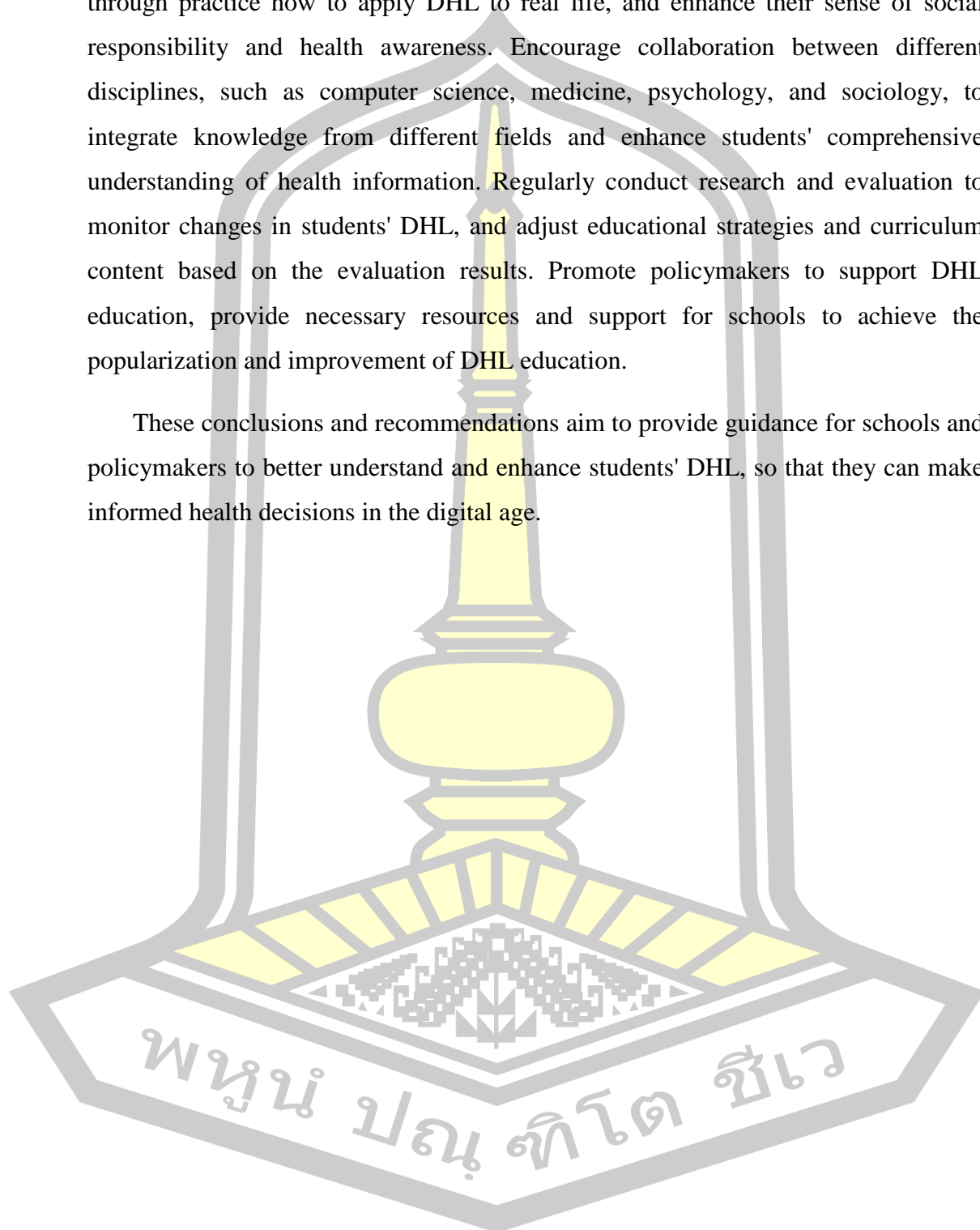
In conclusion, only about half (52.26%) of the participating students had a high overall DHL. More advanced students, those majoring in clinical medical technology, those having had a family member or friend infected with COVID-19, those receiving health education, and those exhibiting interest in health information seeking had a higher overall DHL level and higher scores in the five sub-scales. The sample, although weighted, is not representative of all vocational college medical students in Sichuan, China. This was not a longitudinal study and thus could not confirm a causal association between independent and dependent factors.

5.3 Recommendations

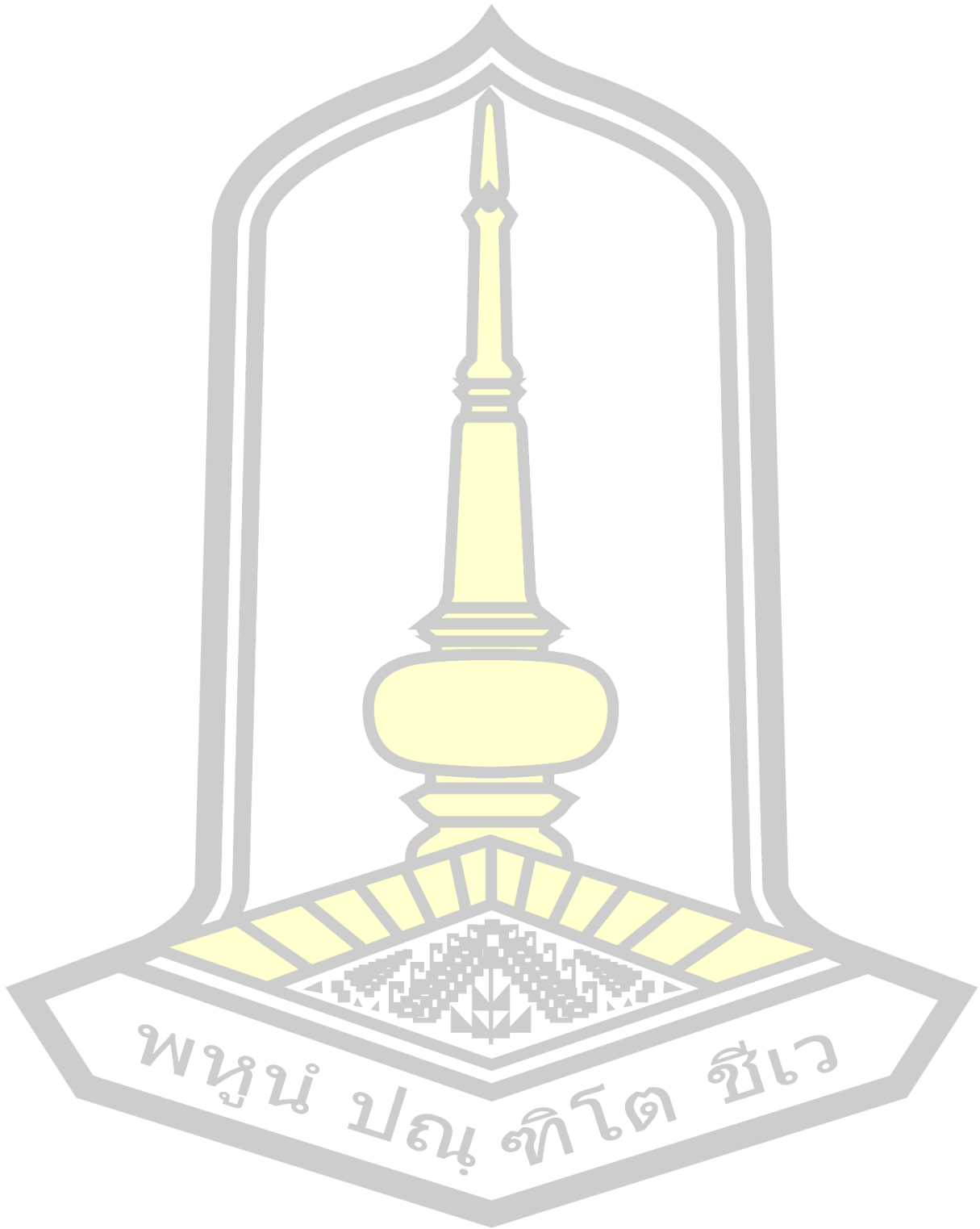
Schools should incorporate DHL into their curriculum system and provide specialized courses and training to enhance students' skills in information recognition, assessment, and utilization. Organize practical activities such as health information retrieval competitions and health knowledge quizzes to enhance students' practical skills and DHL. Train teachers on DHL to ensure they can effectively guide students in using digital health resources, promote digital health knowledge through campus broadcasts, posters, websites, and other channels, and create a campus cultural atmosphere that values DHL. Collaborate with medical institutions and public health organizations to invite experts to campus to hold lectures and workshops, providing professional digital health guidance for students. Strengthen education and training on student privacy protection and data security, and enhance their self-protection awareness when using digital health tools. Schools should strengthen information literacy education, teaching students how to distinguish the authenticity of information, how to evaluate the reliability of information, and how to safely handle personal information. Improve students' accessibility to digital technology and ensure that all students have equal access to digital resources and tools to support their development of DHL. Develop courses specifically targeting health information literacy, teaching students how to effectively search, evaluate, and use health information, as well as how to protect themselves from the influence of false

information. Encourage students to participate in community health projects, learn through practice how to apply DHL to real life, and enhance their sense of social responsibility and health awareness. Encourage collaboration between different disciplines, such as computer science, medicine, psychology, and sociology, to integrate knowledge from different fields and enhance students' comprehensive understanding of health information. Regularly conduct research and evaluation to monitor changes in students' DHL, and adjust educational strategies and curriculum content based on the evaluation results. Promote policymakers to support DHL education, provide necessary resources and support for schools to achieve the popularization and improvement of DHL education.

These conclusions and recommendations aim to provide guidance for schools and policymakers to better understand and enhance students' DHL, so that they can make informed health decisions in the digital age.



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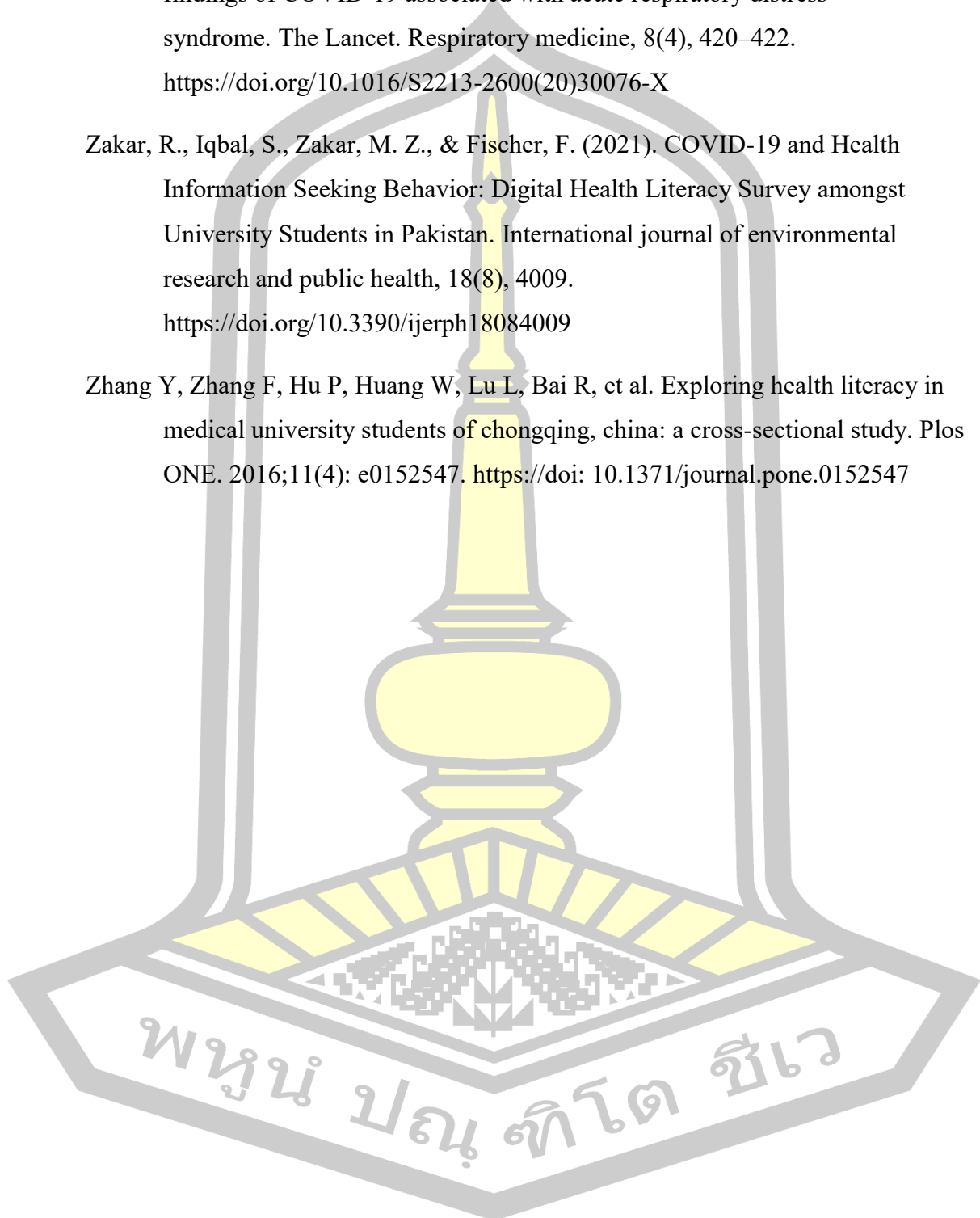
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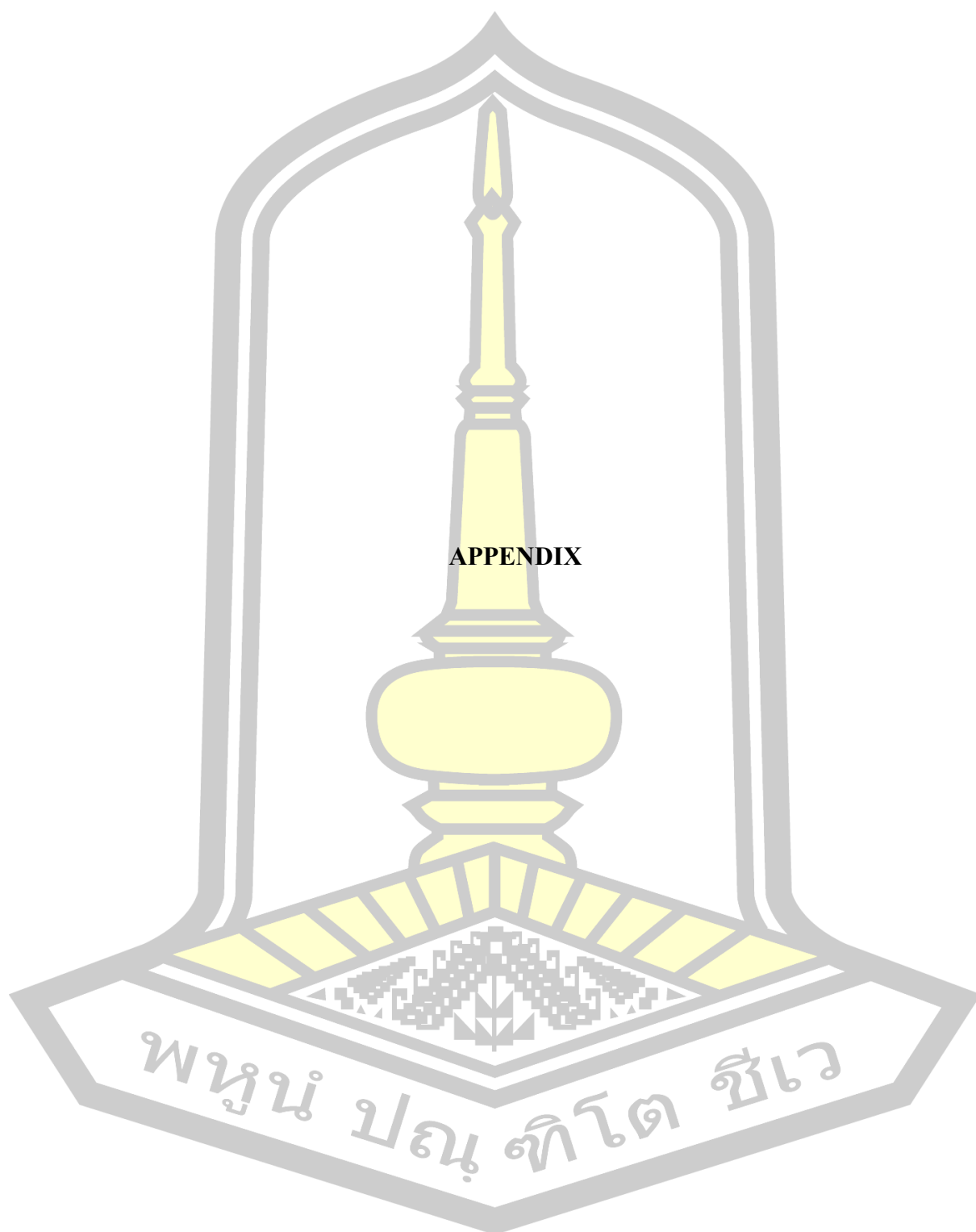
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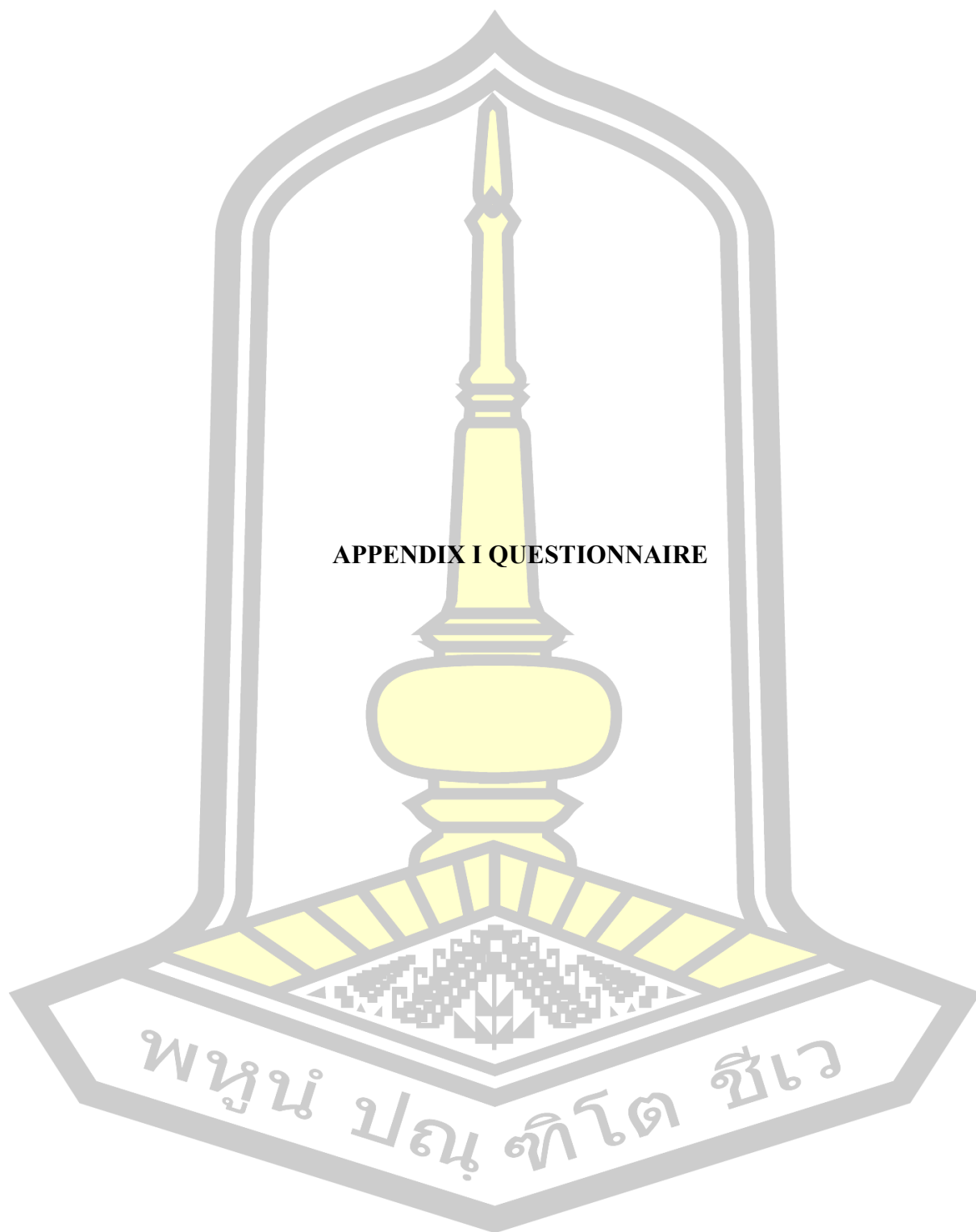
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APPENDIX

พหุบัณฑิตยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย



APPENDIX I QUESTIONNAIRE

พหุบัณฑิตจตุรวิธาน

QUESTIONNAIRE

Title: Digital health literacy skills in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation

Date:

Part 1: Demographic data

Sex: male [] female []

Date of birth:

Year of college: 1 [] 2 [] 3 [] 4 []

Study major: Faculty of Nursing [] Faculty of Rehabilitation [] Faculty of Clinical Medical Technology [] Faculty of Medicine and Food [] Faculty of Education and Sports []

Registered residence: Urban [] Rural []

Family monthly income: <5000 [] 5000-9999 [] >10000 []

Family member or friend infected with corona virus: Yes [] No []

College health education in corona virus : Yes [] No []

Habits and customs: Smoking [] Drinking [] No []

Health status: Being overweight [] Having diagnosed lung disease [] No []

Part 2: Digital health literacy

1. Searching and finding health information on the internet is the question item No.1-5

2. Creating and sharing of health information on the internet is the question item No.6-10

3. Assessment of the quality of health information on the internet is the question item No.11-15

4. Determining the everyday relevance of health information on the internet is the question item No.16-20

5. Handling of personal information and data protection on the internet is the question item No.21-25

No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
1	I use my smartphone/computer to search for health information on the Internet.					
2	I can easily search the required health information from the Internet.					
3	I can consult doctors/hospitals for health information on the Internet.					
4	I can check the health information push subscribed on the Internet.					
5	I use the application software about health to obtain information.					
6	I can publish various forms of health information on the Internet.					
7	I can share the health information on the Internet.					
8	I can collect links to health information on the Internet.					
9	I can comment on posts related to health information on the Internet.					
10	I can discuss health information with others on social media.					
11	I can distinguish whether some health information on the Internet has commercial					

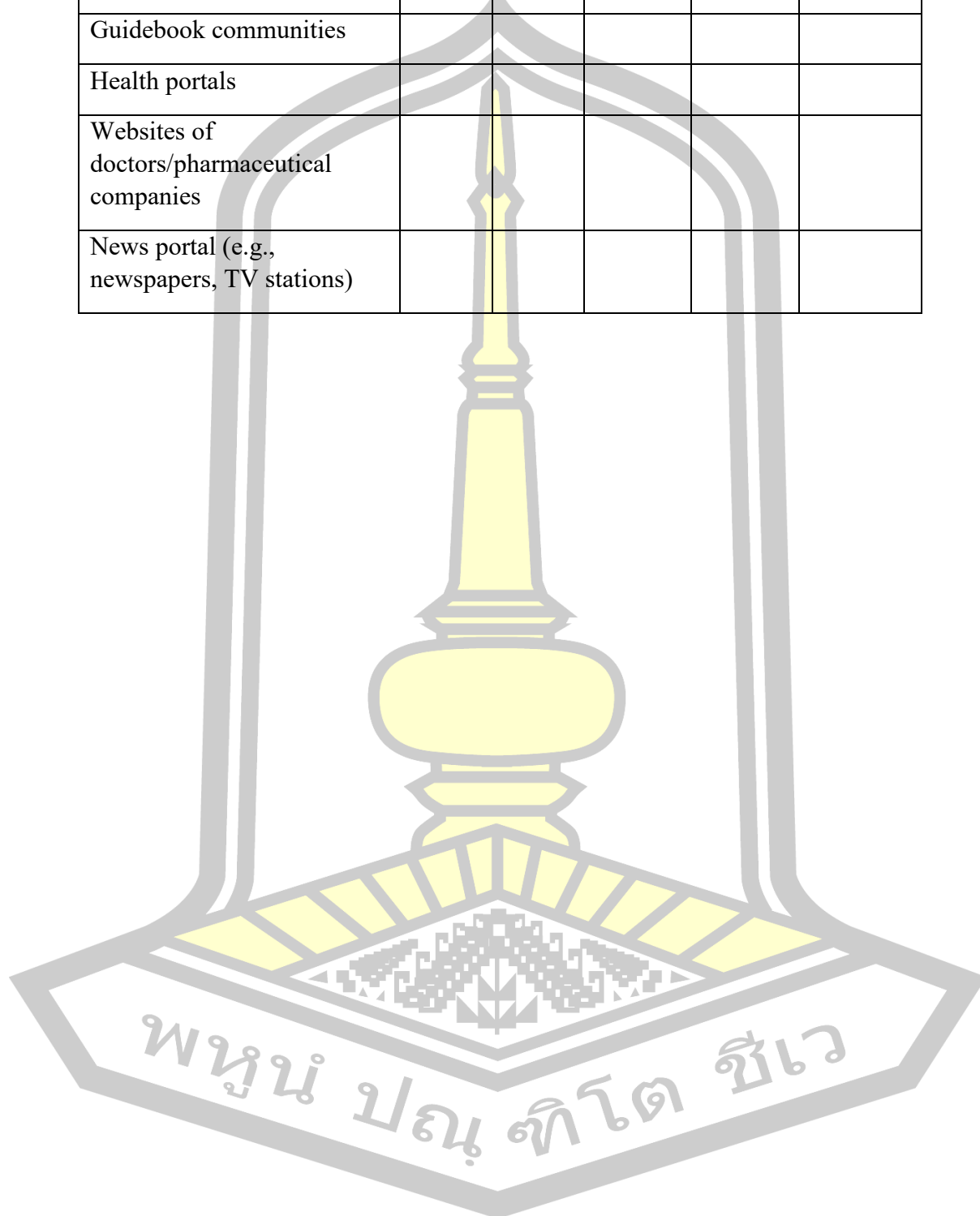
No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
	interests.					
12	I can identify the health information officially provided on the Internet.					
13	On the same health issue, I can verify the true from many aspects of the Internet					
14	I believe some popular health information on the Internet is of high quality.					
15	I believe health information with data/charts on the Internet is more accurate.					
16	I check the impact of post COVID-19 on daily life from the Internet.					
17	I learned from the Internet how to reduce the impact of the epidemic on daily life.					
18	The health information I get on the Internet can help me prevent COVID-19 or other.					
19	I determined the infection of COVID-19 or other on the Internet.					
20	The health information I get on the Internet can help me treat COVID-19 or other.					

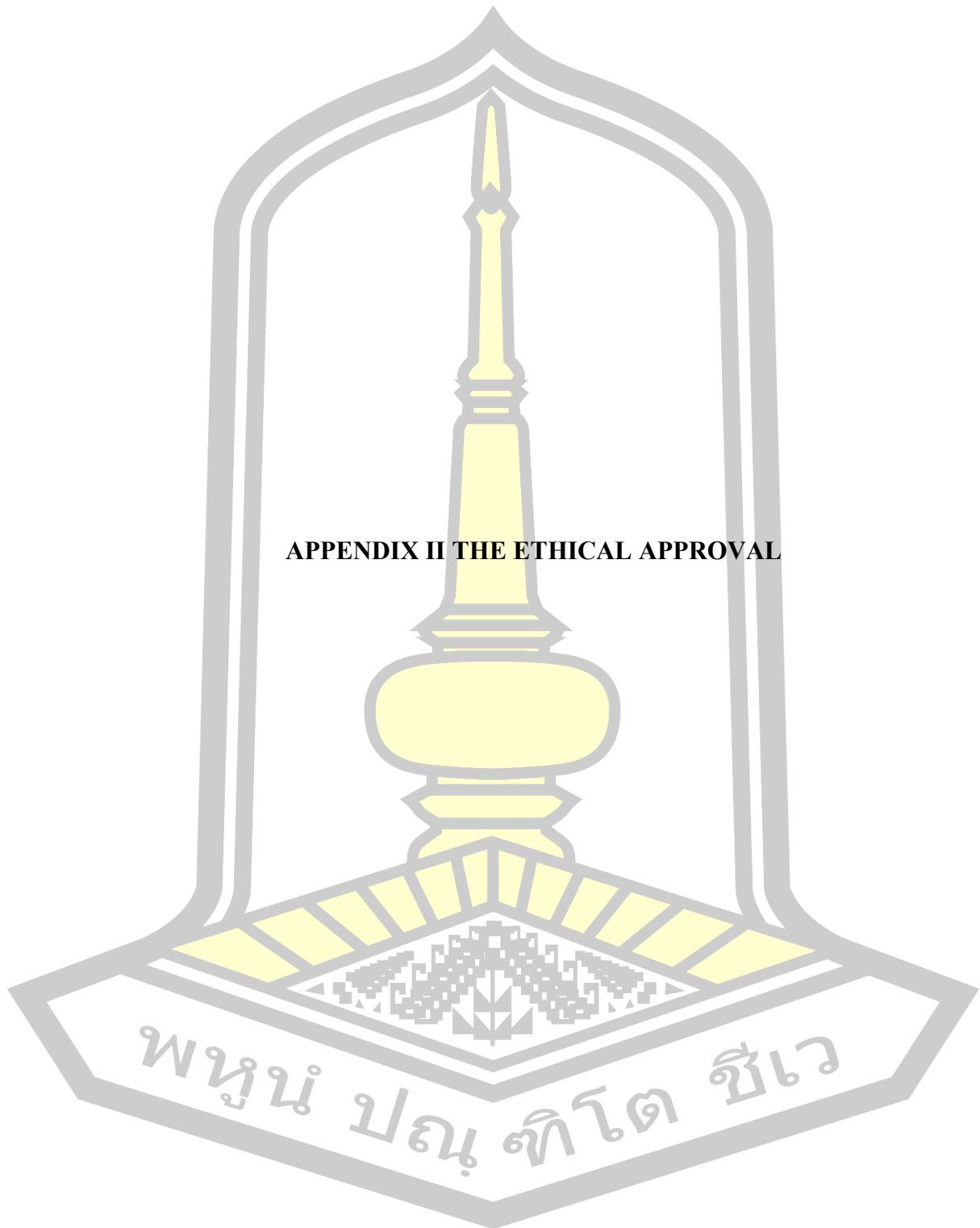
No	Content	Answering Options				
		Never (1)	Occasionally (2)	Sometimes (3)	Usually (4)	Always (5)
21	When I use some functions on the Internet, will involve personal information.					
22	I believe that the disclosure of personal information on the Internet has no impact.					
23	I can share some real photos/videos on the Internet.					
24	I can fill in the true information on the Internet.					
25	I can encrypt my stored personal information data on the Internet.					

Part 3 Scale of health information seeking and related topics on the internet.

Characteristics	Often	Some times	Rarely	Never	Don 't Know
Search engines (Baidu, Bing, Sougou)					
Websites of public bodies (NCOC, provincial health departments)					
Wikipedia and other online encyclopedias					
Social media (Douyin, Weibo, Weixin)					
BiliBili					
Blogs on health topics					

Characteristics	Often	Some times	Rarely	Never	Don 't Know
Guidebook communities					
Health portals					
Websites of doctors/pharmaceutical companies					
News portal (e.g., newspapers, TV stations)					





APPENDIX II THE ETHICAL APPROVAL



MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR
RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 523-543/2023

Title : Digital health literacy status in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation.

Principal Investigator : Mr. Tu Hao

Responsible Department : Faculty of Public Health

Research site : Sichuan Vocational College of Health and Rehabilitation

Review Method : Expedited Review

Date of Manufacture : 6 December 2023

expire : 5 December 2024

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.



(Asst. Prof. Ratre Sawangjit)

Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

๕/๕/๒๑
ECMSU01-05.03 Update 2021

Research Subject Information Sheet for Questionnaire
(For Participants aged 18 years and older)

Dear, All Participants

My name is Mr. Tu Hao, the master degree student of Public Health program, Faculty of Public Health, Mahasarakham University. I am conducting the research entitle: "Digital health literacy status in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation". This study focuses on assessing the Digital health literacy level of the students of the Sichuan Vocational College of Health and Rehabilitation in Zigong, Sichuan Province, China, the post COVID-19 and the related factors affecting DHL. The results of this study, so as to effectively improve the Digital health literacy level of college students in the future. In this study, we integrate both quantitative and qualitative data collection. In the quantitative, we focus on investigating demographic characteristics, health information source factors, internet factors, and Digital health literacy level, as well as the relevant factors affecting Digital health literacy the post COVID-19 pandemic. The population in this phase is 1062 students aged 18-22 years old. among the Sichuan Vocational College of Health and Rehabilitation, Zigong City, Sichuan Province, China. In the qualitative data collection, we focus on exploring how to access web-based information or internet resources of COVID-19-related information, information-seeking behavior and satisfaction with COVID-19 information searches include 8-10 representative college students.

Your participation in this study is voluntary. Whether to participate in this study is up to you. If you decide to participate in the first stage of this study, I would like you to answer the questionnaire. This self filled questionnaire consists of three parts, consisting of 36 items, and the response time is approximately 15-25 minutes. After you have answered all the questions, please send them back to the research team. Please take the time to carefully answer the questionnaire or ask the researchers if there are any unclear areas or if you have any questions. In addition, you have the right to withdraw at any time without prior notice.

If you feel uncomfortable or undesired with some questions, you have the right to refuse to answer questions. Also, you have the right to withdraw from this program at any time without prior notice. In additional, the refusal or withdrawal from this project will involve no affect your learning, now or in the future.

The data will be kept and not publicly disclosed on an individual person. All data will be identified only by a code, with personal details kept in a locked file or secure computer with access only by the immediate research team. The results will only present in terms of overall and these data will be destroyed at the end of the study. In this research, you do not receive compensation and will not be charged anything.

If you have any questions about the research, or if you would like more information, please contact Mr. Tu Hao, Faculty of Public Health, Mahasarakham University. Tel. (mobile phone): (+86) 18681333200, E-mail: 78836424@qq.com

If you are not treated as described or want to know your rights while participating in this research. You can contact the Review Ethics Broads of Mahasarakham University, Division of research facilitation and dissemination, Mahasarakham University. Tel. 043-754416 (internal number 1755)

Best Regards,

()
Researcher



ECMSU01-06.03

Informed Consent Form
(For Participants aged 18 years and older)

Name-Surname (Mr./Mrs./Ms.).....Age.....(years)
Address: House No.Village No.....Sub-district.....
District.....Province.....

I read the research subject information sheet and obtain the description of this study by Mr. Tu Hao about the voluntary of "Digital health literacy status in the post COVID-19 pandemic and its related factors in students of Sichuan Vocational College of Health and Rehabilitation". These information including the rational and purpose of the study and list all procedures that I have to act and be treated, list the benefits that I will receive from the research and risks that may occur from participating in the research, also the guidelines for prevention and correction in case of danger by reading/listening to the description of the message from research subject information sheet for questionnaire. Moreover, I have also received an explanation and response from the research project leader already.

As well as an assurance from the researcher that my data will be kept confidential, will not be anonymous, and the results will presented in an overview or summary to academic benefit.

"The participation in this study, I participate voluntarily" and I am free to withdraw at any time, without giving a reason and without cost, and no affect to my learning, now or in the future.

I have read and I understand the provided information from research subject information sheet and informed consent form. I voluntarily agree to take part in this study and give my signature already.

Sign..... Participant
(.....)

Date.....

Sign..... Witness (in case of reading the explanation to the volunteers)
(.....)

Date.....

Sign..... Investigator/person taking the consent
(.....)

Date.....



BIOGRAPHY

NAME	Mr.Hao Tu
DATE OF BIRTH	14/02/1988
PLACE OF BIRTH	Zigong City
ADDRESS	No. 5, 2nd Floor, Unit 2, Building 9, No. 52 Tongda South Street, Ziliujing District, Zigong City, Sichuan Province
POSITION	Engineer
PLACE OF WORK	Vocational College of Health and Rehabilitation
EDUCATION	2014 Bachelor's degree, Sichuan Normal University, majoring in Information Systems and Information Management 2025 Master's degree of Public Health, Faculty of Public Health, Mahasarakham University.
Research output	[1] Luo Yuke, Tu Hao. Exploration of the Application of Information Technology in the Practical Teaching of Medical Aesthetics Technology [J]. Shanhaijing: Frontiers of Education, 2020, 000 (019): P.1-2 [2] Cai Banggui, Li Youwen&Tu Hao (2021). Design and Implementation of Electronic Control System Based on One Card Mobile Terminal China New Communications (10), 54-55. doi: CNKI: SUN: TXWL.0.2021-10-026 [3] Tu Hao. Factors Influencing Shared Printer Connection [J]. Digital Imaging Era, 2021 (6): 111 [4] Tu Hao. Research on Strategies for Network Informationization Teaching in Universities [J] Changjiang Series, 2023 (2): 162-164 [5] Luo Yuke, Tu Hao, Xu Ling&Zhang Yan. A Double headed Makeup Spray Gun. CN202222287191.7, 2023-01-24

พหุบัณฑิต ชีวะ