

Article

Use of Information Technology for Communication and Learning in Secondary School Students with a Hearing Disability

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Abstract: Information technology (IT) is important to meet the needs of students with a hearing disability in special Thai school settings. The aim of this paper was to research the use and opinion of IT for communication and learning from students with a hearing disability in schools for the deaf. The IT in this study included information devices such as mobile phones, smartphones, and tablets. This study used the stratified random sampling method for enrolling its participants. Data collected from 192 students with a hearing disability using a self-administered questionnaires. Results found that most of these students knew about chat applications, for example, Line, Facebook, Messenger and face-to-face conversation apps. Furthermore, most of these students contacted people with hearing problems by sending messages through Facebook, Line and face-to-face applications. The main reasons why they used IT was for convenience and general conversation. A study of opinions on the use of IT by students with a hearing disability found that most of them agreed that IT equipment contributed to their participation in various activities, including conversations with their relatives and friends on social networking. Conclusion and discussions were included.

Keywords: information technology; communication; learning; students with a hearing disability

1. Introduction

Technology has become an integral part of life. At present, information technology (IT), communication, and telecommunication have evolved rapidly to converge with the media technology era. This has affected the daily life of people in various aspects, especially in terms of communication. As a result, the number of new media users in this era has increased quickly [1] through various communication and telecommunication channels. While people in general currently have access to and take advantage of new media, there also are people with disabilities, the elderly and underprivileged who still cannot fully access or utilize this technology. Such people lack the chance to develop as individuals and utilize this technology to improve their quality of life, due to economic constraints and lack of opportunities. This digital divide is a major problem in many countries, including Thailand [2,3]. Thailand's rapid and continuous move into this technological era has been used as a tool to access information faster through communication channels. In order to promote this technology, a developed information and communication technology (ICT) infrastructure is needed as well as encouragement for people to acquire knowledge and skills to use it [4].

Technology is defined as the system of tool-using behavior, which has become "part of the fabric of daily life for young children" [5]. Moreover, the Thai Office of the National Broadcasting and

Telecommunications Commission (NBTC) has said that the advancement of IT, communication and telecommunications has evolved rapidly and brought the people's way of life into the convergence technology media era. The emergence of new media plays an unwitting role in the lives of people, for example, the use of mobile phones and tablets. Nowadays, mobile phones, and especially smartphones, are used commonly in various ways. Smartphones are more than just phones by being similar to a computer. The behavior of users has integrated into using smartphones or tablets, and it is said that we have entered the post-personal computer (PC) age, because people have less use for the PC and notebook. Today, mobile phones can be used for surfing the net, taking photographs, connecting to social media online, watching movies, listening to music, watching TV, listening to the radio, reading online news, newspapers and magazines, conducting financial transactions, buying and selling, and conducting various services. This fusion of technology and media or services has come together and made daily living easier than in the past [3]. Furthermore, the value of mobile technology has not only impacted the daily lives of people without disabilities, but also those with them and their communication needs [6,7]. In addition, while technology tends to benefit people without disabilities, awareness is aimed at more accessibility for people with them, including the deaf and hard of hearing. Nevertheless, it is true that advances in mobile technology that fit the deaf and hard of hearing also benefit everyone else [8].

Educational systems have developed digital competency in an educational setting, where students with a hearing disability can acquire skills in using technology, such as discovering, storing, producing, presenting, and exchanging information. In addition to being an object of study, ICT has been gaining ground as a learning tool. Many educational systems have sought to increase the availability of computers, smartphones, iPads, tablets and Internet connections in the classroom. This equipment is an efficient tool for study, a valuable source of information, and an interesting support for teaching [9].

However, the Thai Empowerment of Persons with Disabilities Act, B.E. 2550 and Education for Persons with Disabilities Act, B.E. 2551 have defined the term "person with a disability" as someone who has limited access to daily or social activities. Such people have visual, hearing, movement, communication, mental, emotional, behavioral, intellectual, and learning disability or other impairments. There are obstacles in various areas of special needs in education that need help in enabling people with disabilities to perform their daily activities or become involved in social activities as people do in general [10,11]. Nevertheless, it has been found that many people with disabilities can succeed when given the opportunity, especially by the human rights movement and equality, to develop and promote their potential. Society needs to be more aware of the importance in developing people with disabilities, including children with special needs. It has the chance to learn and promote the education system and provide opportunities for potential development based on existing capabilities. One way of helping to develop the potential of people with disabilities is to allocate them with necessary assistive technology. It is believed that assistive technology reduces the barriers to self-help for people with disabilities and their participation in social activities [11].

After promulgation of the Thai Empowerment of Persons with Disabilities Act, B.E.2550, which is part of the Thai Ministry of Information and Communication Technology, ministerial regulations and conditions have been issued for accessing and utilizing information, communication, telecommunication services, information and communication technology, and assistive technology for communication and public services, B.E.2554, from which people with disabilities benefit through state agencies such as the Thai Ministry of Information and Communication Technology. In terms of obtaining a list of equipment and tools for use in information and communication technologies, personal computers and communication devices such as telephones, Braille printers, book reading devices, computer screen reader programs, screen magnification programs, etc., were included [12].

The meaning of ICT in this study is related to the rights of students with a hearing disability in order to utilize these devices for accessing information, communication and education. IT for communication refers to tools, devices, hardware, software or services specifically for people with disability, or its adaptation to meet the special needs of such people in order to increase, maintain and develop their

abilities and potential. IT reaches and utilizes information and communication for daily activities and independent living [12]. The age of globalization has given society borderless information and communication. Technology has brought humans into the digital society, with rapid advancement generating much innovation that facilitates comfort and convenience. It is undeniable that technology has become a part of human daily life. This is evident by people being surrounded by technological devices such as mobile phones, smartphones and tablets. With such technology, people can carry out activities with no limit of time or place and with only one device. In addition, the high level of competition in the domestic digital marketplace creates a continuous reduction of price, and this enables people with low-income to access mobile devices. A survey found that low-income families, who own a mobile device, have grown from 2% to 20%, with ownership for their children increasing from 22% to 65% [13]. This is why most people own a mobile device and carry it everywhere.

Communication is essential because it is a fundamental necessity for human survival [14]. It enables people to contact and understand each other. There are various areas of communication, such as spoken, written and sign language. People can use communication channels through the five senses (taste, smell, sound, touch and sight). However, the efficiency of communication is limited if the person receiving a message has sensory impairment, in which case children with a hearing disability cannot hear or receive media requiring a sound element [15]. Disability in listening and speaking are barriers that delay communication and increase the disability.

Moreover, modern technology originated in a period without communication media and underwent a journey to self-delivery, through development of simple media such as the postal and telecommunication systems, and it is still developing to this day. The use of advanced technology is now at a high level. In particular, communication over the telephone network has enhanced the quality of the media in terms of transmission speed, clarity, and connection to modern equipment, for example, pagers, faxes, the Internet and smartphones, which make communication in various formats more efficient, as in audio, text and pictures [16]. Therefore, communication through the Internet and mobile phones has become a part of daily living for children and young people, who rely on this technology to communicate and express their thoughts, ideas, and feelings. This applies to children with a hearing disability as much as it does to anyone else.

Although IT in communication has progressed rapidly, most of it is for people in general, who can listen. IT has not been created especially for people with a hearing disability in Thailand, and such people find it difficult to live independently. Therefore, it can be seen from the above that many such people in Thailand have problems and barriers in communicating with and contacting other people, which delays transmission of information. When these people cannot contact others, they may need to spend time and money traveling to meet them personally, or ask for help from people who can hear [16]. Furthermore, it is important that IT is used and integrated into the communication and learning process. Motivation and student dispositions influence the ability of people with disabilities to engage in interactive communication and learning, and the line between online communication and learning is becoming blurred [17].

However, communication technology has been developing rapidly and more efficiently. People with a hearing disability can adapt to some technologies by reducing their existing barriers, as follows: (1) the visual paging system is a communication device with an option of using pager codes without going through the operator; (2) the Telecommunication Device for the Deaf (TDD) is used currently in Thailand, but is not widespread because it is very expensive and requires only the English language; (3) computer with the Internet, consisting of e-mail, chat, videophone, and web to pager, from which people with a hearing disability can send private messages quickly by themselves; (4) Thailand Telecommunication Relay Services (TTRS), which is an additional service for people with a hearing disability. This service is an aid for the deaf when they want to contact hearing people by using ordinary phones. It also is responsible for transmitting spoken words, short text, or sign language through specialized communication officers that serve as intermediaries; and (5) 3G Telecommunication that comprises smartphones and tablets, and enables people with a hearing disability to communicate

through video calls or social network chat applications. These people can then communicate by text without limitation. They also can take and send photographs through Line, Facebook, Messenger, etc. Therefore, use of the 3G Telecommunication service benefits people with a hearing disability [15].

According to a report from the Household Information Technologies Use Research of Turkey Statistical Institute [18], the use of social media was the initial aim of the Internet. Most individuals use the Internet to create a profile, send messages, and share information. They also use their mobile device for connecting to the Internet at home, in the workplace, at the homes of relatives and friends, and in places such as shopping centers, restaurants, cafes and airports that provided wireless internet connection. Apart from the Internet social network, other technologies are used frequently by young individuals, who can begin to learn how to process them independently at any time or place through mobile technologies such as the Internet with general packet radio service, and 2nd, 3rd and 4th generation of wireless technologies (GPRS/3G/4G technologies) [19]. In addition, Aytekin and Sutcu [20] found that the most important reasons for using mobile devices were valued at 81.3%, 11.3% and 6.2% for communication- and interaction-focused, entertainment-focused and internet search/research-focused use, respectively. In the same research, the monthly time spending table for mobile devices was based on age, and the 15–40 age group was the leading one among others with a percentage of 26.5. This results showed that the use of mobile devices was more prevalent in the young to middle-age group.

A small research was based on documenting the impact of smartphone/mobile technology on the communication needs of children with disability. It focused on the use of IT, with a relatively small number of children with communication disability, autism spectrum disorder, or intellectual disability, to communicate in a narrow range of functions that have been fulfilled successfully by other augmentative and alternative communication (AAC) systems [21]. Furthermore, future research and development are required to ensure that children with a communication disability have access to more functionality and interconnectivity through smartphone/mobile technology [22].

Therefore, researchers are interested in studying the use of IT in communication for students with a hearing disability. Thus, the objective of this research was to explore IT for use in communication and learning by students with a hearing disability in Thailand, and the level of agreement on its use in such secondary school students was measured. This information can be used as a guide to correct or eliminate barriers and make overall communication and the learning process more convenient. It also can lead to the improvement and development of IT for meeting the needs of this group of people. This basic necessity is important in developing quality of life and an equal society in which people with a disability can live independently.

2. Materials and Methods

The aim of this research was to investigate how IT is used for the needs of students with a hearing disability. It also measured the levels of agreement in deaf high school students regarding their use of IT for communication and learning. This was quantitative research conducted with students who had studied in five schools for the deaf located in north and northeastern Thailand. The data for this paper was drawn from thematic questionnaires answered by the participants who had been students with severe (70–89 decibels) to profound (90+ decibels) hearing disability. They had studied in the 7th to 12th grade in different schools for the deaf, which were under the Office of Special Education Administration, Thai Ministry of Education, during the 2017 academic year. The stratified random sampling method was used for their selection. Each graded class in five schools for the deaf was randomized to form 30 classes in this study. The students in each class were the samples. The exclusion criteria were students with severe problems of communication, which stopped them from expressing ideas, and a refusal to participate in this study.

A total of 192 students with a hearing disability participated in this research. The respondents had studied in three schools in the northern region: Anusarnsunton School for the Deaf (formally known as Chiang Mai School for the Deaf) (20.31%), Tak School for the Deaf (20.83%) and Petchaboon School

for the Deaf (18.23%), and two in the northeastern region: Khonkaen School for the Deaf (20.83%) and Udon Thani School for the Deaf (19.80%). The students comprised 106 males and 86 females aged between 12 and 24 years (average 17.11 years). In addition, they had 2 types of hearing disability, i.e., deaf (83.33%) and hard of hearing (13.54%). Most of them (70.31%) were studying in 10th to 12th grade classes and lived on the school premises (77.08%) (Table 1).

Table 1. Overview of students with a hearing disability in schools for the deaf.

| General Information | | N | % |
|----------------------------|----------------------------------|-----|-------|
| Sex | male | 106 | 55.21 |
| | female | 86 | 44.79 |
| Age (years) | 12–13 | 12 | 6.25 |
| | 14–15 | 27 | 14.06 |
| | 16–17 | 66 | 34.38 |
| | 18–19 | 57 | 29.69 |
| | 20–21 | 17 | 8.85 |
| | 22 and up | 5 | 2.60 |
| | unknown age | 8 | 4.17 |
| School for the Deaf | Anusarnsuntorn | 39 | 20.31 |
| | Tak | 40 | 20.83 |
| | Petchaboon | 35 | 18.23 |
| | Khonkaen | 40 | 20.83 |
| | Udon Thani | 38 | 19.80 |
| Type of hearing disability | hard of hearing (70–89 decibels) | 26 | 13.54 |
| | deaf (90 decibels and up) | 160 | 83.33 |
| | unknown type | 6 | 3.13 |
| Grade class | 7th–9th | 57 | 29.69 |
| | 10th–12th | 135 | 70.31 |
| Living on school premises | Yes | 148 | 77.08 |
| | No | 44 | 22.92 |

Furthermore, the thematic questionnaire for this study was developed by the researcher and processed for content validity through suggestions from three related specialists. The questionnaire also included a section related to the general background of the students. No student names were used in the questionnaire. The IT in this study included applications and mobile devices such as smartphones and tablets. The information devices were types of assistive technology that can help students with disabilities access information for learning, for example, equipment, material or objects, as indicated in the Persons with Disabilities Education Promotion Regulation of Thailand [12].

The questionnaire was developed in the Thai language. Furthermore, a group of students used only Thai sign language for communication. Other research has successfully used Thai sign language as a response option [23]. In this study, the research on IT for communication applied to all of the above methods of processing as well as adding some techniques. These techniques were innovated, and included laying out the format for the questionnaire, selecting the language to be used in accordance with the perception of students with a hearing disability, interpreting the questionnaire into Thai sign language, and responding to the questionnaire with both written Thai and Thai sign language.

The participants were informed about the purpose of the questionnaires, as the data would be used for research purposes. Each school received permission to conduct data collection from teachers of the students. The consent form was given to all of the participants, who were scheduled by the researchers and teachers of each class and school. The analysis was in terms of descriptive statistics and included frequency, percentage, mean, and standard deviation.

3. Results

Questionnaire data were analyzed using the SPSS program, with descriptive statistical analysis provided as the predominant, quantitative component of this research. This study found that students with a hearing disability knew about Chat applications (i.e., Line, Facebook, and Messenger), with 88.54%, 84.90% and 72.40% knew face-to-face conversation apps and the Thai Telecommunication Relay Service (TTRS), respectively. In addition, these students had their own information devices. When considering information devices, it was found that students with a hearing disability owned their mobile phone or smartphone (92.19%) and notebook (45.83%). At the same time, they had IT equally involving Facebook and Messenger (95.83%), Line (92.71%) and Youtube (91.67%), while far fewer of them used Twitter (18.23%).

When considering the location for connecting to the Internet, it was found that students with a hearing disability used a mobile phone or smartphone (89.06%), while not so many connected at home (31.46%). However, the students found that the Internet speed was slow (64.58%). It also was found that these students benefitted from IT with Line (84.06%), Facebook (80.21%) and Messenger (79.17%) (Table 2).

Table 2. Overview of students with a hearing disability using information technology.

| | Statement | % |
|---|---|-------|
| Knowing about Information Technology | Email | 50.00 |
| | Personal Computer | 71.88 |
| | Notebook | 63.54 |
| | SMS through mobile phone/smartphone | 59.38 |
| | Chat Applications (i.e., Line, Facebook, Messenger) | 88.54 |
| | Face-to-face conversation applications (i.e., Video call, Video Chat) | 84.90 |
| | Thai Telecommunication Relay Service (TTRS) | 72.40 |
| | TTRS Application | 41.67 |
| | Smartboard | 40.63 |
| | Other . . . Bee Talk | 1.56 |
| Students that Own an Information Device | Personal Computer | 34.38 |
| | Notebook | 45.83 |
| | Mobile phone/Smartphone | 92.19 |
| Students that Own Information Technology Applications | Email | 44.79 |
| | Line | 92.71 |
| | Facebook | 95.83 |
| | Messenger | 95.83 |
| | Instagram | 83.85 |
| | Twitter | 18.23 |
| YouTube | 91.67 | |
| Places that Connect to the Internet | Home | 31.46 |
| | School | 76.46 |
| | Mobile Phone/Smartphone | 89.06 |
| Problems with the Internet | Slow speed of the Internet | 64.58 |
| | Internet is often unconnected | 18.75 |
| | No problem | 16.67 |
| Benefits of Information Technology | Email | 23.44 |
| | Line | 84.06 |
| | Facebook | 80.21 |
| | Messenger | 79.17 |
| | Instagram | 56.25 |
| | Twitter | 10.42 |
| YouTube | 71.88 | |

Apart from knowing about and using IT, as mentioned above, it was found that students with a hearing disability contact others who can hear via texting on Messenger (67.71%), Line (45.83%) and the mobile phone (30.20%). It was then found that the deaf and hard of hearing used IT to contact others with the same condition by texting on Messenger (68.23%) and Face-to-face conversation applications (66.67%). On the other hand, students with a hearing disability had less use for the Thai Telecommunication Relay Service (TTRS) or TTRS application (3.13%). Results showed that students with a hearing disability used IT for contacting others in the same situation. It was interesting that most means of contact had a similar percentage of use for contacting others who were hearing, deaf and hard of hearing, except for face-to-face conversation applications, which were quite different.

In addition, the results found that important reasons why all of the students used IT were because they responded to recommendations from friends (47.40%) and the need for IT in teaching and learning in the classroom, and as a source of equal learning opportunity (29.69%). It was found that these students used information devices at school (59.38%) and attractive places such as shopping malls and coffee shops (52.60%). Some of these students used IT every day (63.13%) and had used it for more than 4 years (40.10%) for general conversation (46.88%) and the convenience of contacting others (45.83%) (Table 3).

Table 3. Behavior of students with a hearing disability using information technology.

| Statement | % |
|---|-------|
| 1. Contacting others with hearing | |
| —The phone | 30.20 |
| —Email | 7.88 |
| —Sending Message Service (SMS) through a mobile device | 17.19 |
| —Texting on Line | 45.83 |
| —Texting on Messenger | 67.71 |
| —Face-to-face conversation applications (Line, Messenger, etc.) | 21.88 |
| —Thai Telecommunication Relay Service (TTRS) or TTRS application | 2.60 |
| 2. Contacting others who were deaf/hard of hearing | |
| —The phone | 20.83 |
| —Email | 8.85 |
| —Sending Message Service (SMS) through a mobile device | 15.63 |
| —Texting on Line | 46.88 |
| —Texting on Messenger | 68.23 |
| —Face-to-face conversation (Line, Messenger, etc.) | 66.67 |
| —Thai Telecommunication Relay Service (TTRS) or TTRS application | 3.13 |
| 3. The most important reasons why students use information technology | |
| —Recommendation of Friends | 47.40 |
| —Recommendation of parents | 25.00 |
| —Teachers suggestion that students assign into chatting groups | 28.13 |
| —Use in teaching and learning in the classroom | 29.69 |
| —Source of learning | 29.69 |
| 4. Place in which students often use information devices | |
| —At home | 23.33 |
| —At school | 59.38 |
| —Attractive places/Shopping malls | 52.60 |
| 5. How often did students use information technology? | |
| —Once in a while | 15.10 |
| —1–3 times a week | 17.19 |
| —4–6 times a week | 14.06 |
| —Every day | 53.65 |

Table 3. Cont.

| Statement | % |
|--|-------|
| 6. How long had students been using information technology? | |
| —Less than 1 year | 21.88 |
| —1–2 years | 19.27 |
| —3–4 years | 18.23 |
| —More than 4 years | 40.62 |
| 7. Why did students use information technology? | |
| —For the convenience of contacting others | 45.83 |
| —For receiving a message or news quickly | 33.33 |
| —For communication that can be made manually and without asking for help from others | 31.77 |
| —For finding more information for use in the classroom | 38.54 |
| —For scheduling an appointment | 38.94 |
| —For contacting for general conversation | 46.88 |
| —For sharing information files and documents | 14.58 |
| —For reducing loneliness | 36.98 |

Besides using IT as mentioned above, this study focused on the student opinion, regarding the use of IT for communication and learning and data were gathered from the questionnaire. The questionnaire ratings for opinion included the distribution of all 9 opinion statements according to two core domains: (1) Communication, and (2) Learning. The two domains were arranged, according to the number of items within each category. However, for the purpose of this study, each item was placed under only one of the two domains. A complete listing of the 9 opinion statements placed under the two domains can be found in Table 4.

Table 4. Overview of opinions and statements regarding the use of IT for communication and learning by students with a hearing disability.

| Domain | Statements | % |
|--------------------------------|---|-------|
| Communication | The communication domain helps to reduce loneliness. | 50.73 |
| | The communication domain receives a quick response when sending a message to a recipient. | 58.33 |
| | The communication domain sends and receives messages/information privately. | 56.25 |
| | The communication domain helps participation in various activities, including conversations with relatives and friends on social networks (such as Facebook, Line, Messenger, etc.) and IT devices. | 80.00 |
| | Mean (for the communication domain) | 61.33 |
| Learning | The learning domain is fast in sending and receiving information/text messages. | 56.26 |
| | The learning domain facilitates communication between the deaf and hard of hearing. | 71.88 |
| | The learning domain can be used for class and learning activity. | 61.46 |
| | The learning domain is convenient for teaching and learning (for example, discussion groups on learning activities, sharing files/information for class presentations). | 46.99 |
| | The learning domain is a knowledge resource for searching websites, and learning through online lessons on information technology devices. | 43.23 |
| Mean (for the learning domain) | | 55.96 |

This study focused on the level of agreement in secondary school students with a hearing disability regarding their use of IT for communication and learning, as shown in Table 4. The survey included four and five items of the communication and learning domain, respectively. The results of this study revealed no significant difference among the participants with a hearing disability, who rated opinion items of communication and learning. The mean total of the communication and learning domain was 61.33%, and 55.96%, respectively, with both considered to be a high level (Table 4).

In addition, when considering the opinions and statements of the communication domain, which had the highest percentage (80.00%), it was found that the students were helped in taking part in various activities, including conversations with relatives and friends on social networks by using IT devices. They also were helped in reducing loneliness (46.99%). The learning domain was the medium that facilitated communication between the deaf and hard of hearing at the highest percentage level (71.88%), while knowledge resource for searching from websites, and learning through online lessons on IT devices had the lowest (43.23%). Thus, the overall results of student opinions and statements showed that they either agreed or were neutral, and that IT or mobile applications can be used for communication and learning.

The data were computed and compiled based on each item of the following domains (Table 5). They were organized to rank the list in ascending order from highest to lowest with the top five items highlighted in bold. It was found that three of the top five items perceived by all 192 participants were under the learning domain. They concerned (1) participation in various activities (80.00%), (2) medium facilities for learning and communication between the deaf and hard of hearing (71.88%), and (3) the learning medium, which can be used for class and learning activity (61.46%).

Table 5. Overview of attitudes/opinions organized from the highest to lowest level with the top five items of IT used for communication and learning.

| Statements | Domain | % |
|---|---------------|--------------|
| 1. IT enables participation in various activities, including conversations with relatives and friends on social networks (such as Facebook, Line, Messenger, etc.) by using IT devices. | Communication | 80.00 |
| 2. IT is a learning medium that facilitates communication between the deaf and hard of hearing. | Learning | 71.88 |
| 3. IT can be used for class and learning activity. | Learning | 61.46 |
| 4. IT can respond quickly to sending messages to a recipient. | Communication | 58.33 |
| 5. IT is a learning medium that is fast in sending and receiving information/text messages. | Learning | 56.26 |
| 6. IT has privacy when sending and receiving messages/information. | Communication | 56.25 |
| 7. IT is convenient for teaching and learning, for example, group discussion about learning activities, and sharing files/information for class presentations. | Learning | 50.73 |
| 8. IT helps in reducing loneliness | Communication | 46.99 |
| 9. IT is a knowledge resource for searching websites, and learning through online lessons on IT devices. | Learning | 43.23 |

4. Discussion

The aim of this research was to gain information on the perspectives of students with a hearing disability regarding the use of IT in secondary schools for the deaf. As the number of these students in secondary education has increased, their educational needs, particularly for information and communication technology, have to be met for learning activities and the classroom. After collecting data from the 192 respondents in this study, several interesting findings were documented from descriptive information. Results indicated that students with a hearing disability utilized IT for

different purposes, including communication and learning. Although most IT was designed for people with hearing, students with a hearing disability used technologies to overcome their impairment by using their remaining faculties. They were able to read messages instead of listening, use vibrating instead of voice signals and communicate with sign language via video calling instead of talking.

The first objective was to explore the background of IT use by students with a hearing disability. The results found that most of them knew and used IT to their benefit, for example, using social media/Chat apps and face-to-face conversation apps through mobile devices (i.e., Line, Facebook, and Messenger). This result is in accordance with a survey on the strategies to improve quality of life and promote lifelong learning for people with disabilities [3], and it reported that 67.54% of their samples had access to and use of new media via devices such as mobile phones, smartphones and tablets.

At the same time, these people with a disability owned these devices, and also had accounts with IT, involving Facebook, Messenger, Line and YouTube. In addition, mobile phones and smartphones are used by students with a hearing disability mostly for Internet connection. This finding is in accordance with a study by Lersilp [15], who found that 92.30% of such students used mobile phones and smartphones to connect to the Internet, and 76.92% of them also used a notebook. This is in accordance with agreement by McNaughton and Light [21] and Kagohara et al. [24]. They stated that no efforts were made to integrate communication access for individuals requiring AAC in order that they could utilize various functions more effectively, rather than having to toggle between programs as they use apps for communication, use of the Internet, watching a movie, speech output to support face-to-face interactions, writing to address educational needs, multimedia to share experiences, the Internet to access a wide array of information, texting to promote social relationships, social media to connect with friends, and so forth.

The results mentioned above also are enhanced by a report from the National Statistical Office of Thailand [4], which emphasized that the highest proportion of accessible IT devices was a smartphone, PC and notebook. Furthermore, this finding is consistent with reports by the NBTC [3], which stated that the emergence of new media plays an unwitting role in the life people. Mobile phones can be used as more than just phones. They can be utilized for surfing the net, taking photos and using social media online. On the other hand, the TTRS box or TTRS applications in this study were not used so much by students with a hearing disability, due to very limited research or development of assistive technology being related to them in Thailand, and they could not be used as a commercial product. No entrepreneurs were interested in this technology because they considered it not worth the investment, especially in the TTRS box.

This study found that students with a hearing disability mostly used mobile phones and smartphones anywhere they could connect to the Internet. This is in accordance with a report from the National Statistical Office of Thailand [4], which stated that most people used the Internet by location through mobile phones and portable computers such as notebooks and tablets. It also found that 77.25% of people with disabilities considered the Internet slow because its service provided low speed, and it did not support the effectiveness of applications, especially communication that requires audio, video or multimedia.

However, results specified that students with a hearing disability contact those who can hear by texting on Messenger and Line as well as contacting others who are deaf and hard of hearing by texting on Messenger and face-to-face conversation applications. Lersilp [15,16] supported the argument that people with a hearing disability could not receive media that require a sound element. In Thailand, many people with a hearing disability have problems and barriers in communicating and contacting people. They therefore spend time and money traveling to meet each other, or they ask for help from people who can hear, and this becomes more of a disability. However, technology has developed continually and communication over the telephone network has advanced media technology, as well as connection through IT devices. Communication has become more efficient with various formats. Therefore, people with a hearing disability can succeed in living independently. Moreover, this result is consistent with a study by Chinawat [16], who reported that people with a hearing disability can

reach their goals of communication, which create relationships between people through long-distance communication systems.

Furthermore, students with a hearing disability could use IT every day throughout the week, which was consistent with a survey by the National Statistical Office of Thailand [4] that reported most users connect to the Internet with mobile technology 5–7 days a week. This finding is supported by Ari and Inan [25], who found that students with disabilities frequently use computers and the Internet in their daily lives and for communication and learning purposes. This is also in accordance with a journal article by Wegmann et al. [26], who reported that the usage of smartphones and online-communication applications in every-day life is not problematic in general. It is a common habit to use a smartphone while passing the time or waiting for something. A study by Tezer and Yıldız [27] found that frequency of Internet use was 1–2 h daily and mobile devices and social network were used at any time.

On the other hand, when the participants with a hearing disability were asked why they liked to use IT, they said that it was for general conversation and convenience when contacting others. That study is in accordance with one by Lersilp [15], as mentioned above, in that IT made communication more efficient by using various formats. Communication through the Internet and mobile phone technology has become a part of daily living for children and young people. This also is consistent with a study by Williams et al. [28], who stated that communication access should not be limited. It should therefore be accessed for speech output to support face-to-face interactions, writing to address educational needs, and multimedia (e.g., photos and videos) to share experiences. The Internet should be accessed rapidly to provide a wide scope of information and social media to network with others by texting and cell phones.

One of the main reasons for using IT given by students with a hearing disability was the need to use it for teaching and a source of learning in the classroom. This result is consistent with a study by Bingimlas [29], who reported that the use of new technology in the classroom is essential for providing opportunities for students to learn in an information age. By teaching skills in information and computer technology in primary schools, students are prepared to face future developments based on proper understanding. Wong et al. [30] stated that new technology can play a part in supporting face-to-face teaching and learning in the classroom.

Regarding the use of IT for communication and learning, the level of agreement on the use of IT for communication and learning in secondary school students with a hearing disability was included, with no significant difference found between the communication and learning domain. The main reasons and level of opinion for using IT are in line with a previous research by Montrieux et al. [31], who mentioned that learning with technology needs more than just making learning activities digital. It is also about creating contexts for learning that uses information technologies in integrated and meaningful ways to enhance the production of knowledge and communication, and dissemination of ideas. Similarly, studies by Ismael and Al-Badi [32] and Cooke [33] found that 92% of total participants agreed that IT had enhanced their learning and 64% indicated that it was very useful for learning. The study of Wichadee [34] also emphasized the evolution of technology to improve the teaching and learning process. Learning on-line through computers and mobile technology helps to promote autonomous learning skills for learners who can study based on their own ability and interest.

All of the data show that students with a hearing disability are more likely to access new media and more IT, but the quality and distribution of service depend on the development of media and IT devices for such people, or favorable factors that could help them access services, media and information.

5. Conclusions

The aim of this paper was to research the use of IT for communication and learning of students with a hearing disability, including the measurement level of agreement on their use of IT for communication and learning in such secondary school students. Although the Thai Ministry of Education recognizes the rights of these students to receive a suitable education, the right to obtain and access information for learning by using assistive technology has not been upheld in practice,

as required by the Persons with Disabilities Education Promotion Regulation, and Persons with Disabilities Education Act B.E.2552. In addition, the use of IT for communication and learning is very important for providing opportunities for students with a hearing disability in an information age. To study the obstacles against using IT may assist developers and related personnel, or people with a hearing disability, to overcome them and become successful IT users in the future. The aim of this paper was to study IT use for communication and learning, and measuring the level of agreement on their use of IT for communication and learning in secondary school students with a hearing disability.

The results showed that students with a hearing disability have a strong need and desire for IT for communication and learning. Even though most means of contact had a similar percentage of IT use between contacting others who were hearing, deaf and hard of hearing, face-to-face conversation applications were quite different. They revealed the challenges that exist in adopting new IT such as Line, Facebook, Messenger, and face-to-face conversation applications, etc. in their daily life and education. Regarding the reasons for using IT, many students with a hearing disability stated that it enhanced improved communication as well as making it more enjoyable. It also helped such students to communicate and learn more easily and enhance their overall communication and learning performance. Social network and information devices such as laptops, smartphones, tablets, iPads, and technical support contribute to improvement of communication and the learning process. Based on the situation and trends of IT use in students with a hearing disability, education, media literacy and utilization of new media have shown for all sectors the importance of improving the quality of life and learning of such students and children. Thus, they can live in society in the same way as other people.

A limitation of this study was its location; in only northern and northeastern Thailand, which might not be a general indicator for all areas of the country, as they have different support, barriers, and cultural factors. Future research can examine more groups of people with a hearing disability in a wider area and in greater detail as well as being aware of gender bias. In addition, researchers can acquire basic data regarding access to IT, its usage, and the need for people with a hearing disability to use it. This would be a guide for developing and adapting IT by including information devices such as smartphone applications that play a professional role in special further education. In addition, IT should enhance innovative research development that accords with the needs of students with a hearing disability.

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