

Article

# Access to Information for Learning by Using Assistive Technology for Undergraduate Students with Disabilities in Northern Thailand

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**Abstract:** The purpose of this study was to survey access to information for learning on the types of assistive technology used by undergraduate students with disabilities in Northern Thailand. The types of assistive technology in this study included assistive devices and educational services. Data were collected from a questionnaire developed as a rating scale checklist that was completed by 140 undergraduate students with disabilities. Results of this study found that all types of educational services provided more to undergraduate students with disabilities than almost all kinds of assistive technology. Additionally, the students utilized assistive devices and accessed educational services for different reasons, and most students with visual disabilities were given either assistive devices or educational services. In terms of use, results found that students with hearing disabilities used assistive technology the most, whereas findings concerning needs showed that all of the students with disabilities demanded almost all types of assistive technology.

**Keywords:** access to information; learning; educational service; assistive technology; students with disabilities; higher education

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## 1. Introduction

Human rights and equality are being promoted for persons with disabilities; therefore, opportunities for such students to study in a higher system of education are increasing. Providing assistive technology can support and enhance the potential of persons with disabilities, who face barriers to access of information for learning and participating with their peers in universities. In fact, access to these mechanisms is a way to enhance more opportunities for this group of people [1].

The Thai Ministry of Education issued a Ministerial Regulation in 2007 on the provision of assistive technology, media, services, and other related support for students with disabilities, which regulated the meaning of assistive technology and the rights of students with disabilities to obtain it [2]. Assistive technology is a generic term that includes assistive, adaptive, and rehabilitative devices, and comprises virtually everything that might be used to compensate for the lack of certain abilities. It ranges from low-tech devices such as crutches or special grips for a pen, and more advanced items such as hearing aids and glasses, to high-tech devices such as computers with specialized software for helping dyslexics to read. Depending on the nature of its use and application, assistive technology devices can be used by students with disabilities on their own or with assistance, in and outside the learning setup. Touch control devices, alternative keyboards and mouse, speech-to-text word recognition tools, word prediction programs, word processors, grammar checkers, scanners, compact disc recording drives, and spell checkers are some examples of assistive technology [3]. However, while assistive technology is an assistive device, educational services are also a type of assistive technology. In the same way, educational services assist students with disabilities throughout Thailand, according to their

individual needs for increasing and enhancing their potential by, for example, the provision of a sign language interpreting service for deaf students and reading services for those who are blind or with a learning disability. These technologies are not only designed for persons with disabilities, but also adaptable or modifiable from mainstream methods. Therefore, they have the objectives of increasing, enhancing, maintaining, and developing the ability and potential of students with disabilities so that they are able to access information and activities in the same way as students without disabilities.

Moreover, the Persons with Disabilities Education Promotion Regulation, under The Persons with Disabilities Education Act B.E.2552, requires each university in Thailand to maintain a Disability Support Service (DSS) for assisting students with disabilities in higher education. This regulation indicates the awareness of related policy-makers of the need for higher education for undergraduate students with disabilities. It is also intended to empower students with disabilities to access information and other resources at all levels in order to enhance their quality of life and independent living by improving the Thai education system [4].

However, most students with disabilities have the legal right to access assistive technology, but they have had problems in receiving and using them due to barriers of internal and external factors. While students with disabilities do have benefit from assistive technology, it is not based on their right to receive them [5]. Their acceptance is also required in trying and adapting to the assistive technology they receive. Students should have the willingness to practice and obtain expertise in order to gain full benefit and eliminate existing barriers. This includes the process of modeling access to information for learning by using assistive technology, which should be covered by a budget for providing and maintaining them, preparing or replacing accessories, providing funding for personnel evaluation, training, and using the technology [6].

Assistive technology has become important and is developed specifically to assist students with disabilities in overcoming barriers. Access to information for learning by using assistive technology can help students with disabilities to maximize their potential and ability for achieving individualized objectives. In educational settings, these technologies help such students to access and share information, complete schoolwork independently, provide an environment for socializing, and enable access to information and activities in the same way as regular students. However, they do not fully benefit from them, despite regulations on assistive technology being developed continuously for them. Nevertheless, these students could help themselves to live with high technology by taking more time in learning, training, and practicing access to and use of these mechanisms. It would be more beneficial for students with disabilities if they used assistive technology until they have fully developed their skills [7]. Furthermore, a previous study found that not only the modernization of technological and educational services, but also problematic trends in their development are related to new service delivery mechanisms that change public policy and coordination among consumers, policy-makers, manufacturers, researchers, and service providers [8].

In Thailand, many undergraduate students with disabilities receive medical and educational rehabilitation services. They understand their rights to obtain assistive technology, especially for those with disabilities in a higher education system. Such students inside the system have more opportunities to use these facilities than those outside it [7], as the Disability Support Service (DSS) team in each university coordinates and works with related organizations in order to support student rights. However, it cannot guarantee that students using assistive technology will gain full benefit from them. As a result, the research question was raised as to how undergraduate students with disabilities access information for learning using assistive technology and, particularly, what types of assistive technology they used.

## 2. Method

This quantitative research was conducted in six universities located in Northern Thailand, which were under the Office of Higher Education Commission, Ministry of Education. Higher education was provided in an inclusive education system, which used the stratified random sampling

method. One hundred and forty undergraduate students with disabilities, who had enrolled in higher education in Northern Thailand during the first semester of 2015, participated in this research. The respondents had enrolled in Chiang Mai Rajabhat University (CMRU) (20.00%), Chiang Mai University (CMU) (18.57%), Lampang Rajabhat University (LPRU) (17.14%), Chaing Rai Rajabhat University (CRRU) (15.71%), Rajamangala University of Technology Lanna (RMUTL) (14.29%), and University of Payao (UP) (14.29%). They comprised 64 males and 76 females aged between 18 and 26 years (average 21.1 years). Additionally, the participants in this study had 7 types of disability, i.e., 19.29%, 37.24%, 32.14%, 2.86%, 1.43%, and 5% of them had visual, hearing, physical, intellectual, learning, and multiple disabilities, respectively, and 2.14% had autism (Table 1).

**Table 1.** Overview of students with disabilities in higher education.

General Information		N	%
Sex	male	64	45.71
	female	76	54.29
Age	18–19	28	20.00
	20–21	60	42.86
	22–23	35	25.00
	24 and up	15	10.71
	unknown age	2	1.43
Type of disability	visual	27	19.29
	hearing	52	37.14
	physical	45	32.14
	intellectual	4	2.86
	autism	3	2.14
	learning	2	1.43
	multiple	7	5.00
University	CMRU <sup>1</sup>	28	20.00
	CMU <sup>2</sup>	26	18.57
	LPRU <sup>3</sup>	24	17.14
	CRRU <sup>4</sup>	22	15.71
	RMUTL <sup>5</sup>	20	14.29
	UP <sup>6</sup>	20	14.29
Total		140	100.00

<sup>1</sup> Chiang Mai Rajabhat University; <sup>2</sup> Chaing Mai University; <sup>3</sup> Lampang Rajabhat University; <sup>4</sup> Chaing Rai Rajabhat University; <sup>5</sup> Rajamangala University of Technology Lanna; <sup>6</sup> University of Payao.

The instrument of this study was a questionnaire developed by the researcher and processed for content validity through suggestions from three related specialists. This questionnaire was developed as a rating scale checklist for gathering data in areas of the provision, usage, and needs of assistive technology. The assistive technology in this study included assistive devices and educational services. The assistive devices were equipment, material, or objects that are indicated in the Persons with Disabilities Education Promotion Regulation of Thailand as types of assistive technology that can help students with disabilities access information for learning. Types of assistive devices were classified by types of students with disabilities. Educational services were termed as related services that are indicated in the Persons with Disabilities Education Promotion Regulation of Thailand. They are the types of assistive technology that can help students with disabilities access information for learning. There are two types of educational services—environmental access and service facilities.

The participants were scheduled by the DSS officers of each university to be informed of the research objectives from the researcher. After that, they were interviewed individually by using the questionnaire. Data were analyzed by descriptive statistics.

### 3. Findings

The results of this study showed that undergraduate students with disabilities gained almost all assistive devices and educational services (98.75%) by accessing information for learning from their institutions. This access to information was provided mostly to students with visual disabilities (26.25%), followed by those with hearing (17.50%) and physical disabilities (16.25%), while 11.25% had intellectual disabilities. When considering the types of disabilities, 7 types were found mostly from access to information for learning by assistive technology. However, the results indicated that the provision of educational services had 60 items, while the provision of assistive devices possessed 19. Thus, educational services provided more assistive devices to undergraduate students with disabilities in higher educational institutions.

It was found that educational services were provided the most to students with visual disabilities (21.66%), followed by those with hearing and learning disabilities and autism, who were provided equally (16.67%), while those with intellectual disabilities were given far fewer (13.33%). Furthermore, assistive devices were provided the most to students with visual disabilities (40.00%), and those with hearing and physical disabilities were provided equally (20.00%), while those with learning disabilities, including intellectual disabilities and autism, received the least (5%). However, the universities provided 15 items of assistive devices to students with hearing disabilities, but they obtained only 14 items (Table 2).

**Table 2.** Overview of access to information for learning by assistive devices and educational services provided to students with disabilities.

Type of Disability <sup>1</sup> (N) <sup>2</sup>	Students Provided					
	Services		Devices		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
visual (21)	13	21.66	8	40.00	21	26.25
hearing (15)	10	16.67	4	20.00	14	17.50
physical (13)	9	15.00	4	20.00	13	16.25
intellectual (9)	8	13.33	1	5.00	9	11.25
autism (11)	10	16.67	1	5.00	11	13.75
learning (11)	10	16.67	1	5.00	11	13.75
Total	60	100	19	95.00	79	98.75

<sup>1</sup> Students with multiple disabilities can answer more types of disabilities. <sup>2</sup> Number of all available items in the assistive devices and educational services provided.

Results from the needs of assistive devices for students with disabilities found that those with visual disabilities had the most need for a personal computer with Braille keyboard (85.18%) and an IC recorder (66.67%). At the same time, students with hearing and physical disabilities had most need for electronic lesson materials (84.61%), and a plain trolley or electric wheelchair, respectively (32.61%). On the other hand, students with multiple disabilities had less need of some items (14.29%) such as a white cane, closed-circuit television, Zoomtech program, or hearing aid (Table 3).

Therefore, students with disabilities had the use of all assistive devices that was based on the concept of universal design [9]. When considering the types of disability, it was found that students with visual disabilities used assistive devices mostly involving an IC recorder (70.37%) and a personal computer with Braille keyboard (66.67%). At the same time, those with hearing disabilities had the use of electronic lesson materials (73.08%) and a sign language dictionary (65.38%), and those with multiple disabilities mostly used an IC recorder (42.86%) (Table 3). However, when considering frequency of use, it was found that all of the students with disabilities used assistive devices at both low and high levels. Students with visual and physical disabilities, hearing disabilities, and multiple disabilities used assistive devices at the high, moderate, and low levels, respectively.

**Table 3.** Usage and needs of assistive devices for students with disabilities based on the universal design concept.

Type of Disability	Type of Assistive Devices	% of Usage	% of Needs
visual	Braille book	37.04	44.44
	audio book	48.15	62.96
	IC recorder	70.37	66.67
	screen reading program	33.33	40.74
	personal computer with braille keyboard	66.67	85.18
	white cane	48.15	51.85
	closed-circuit television (CCTV)	33.33	44.44
	Zoomtech program	37.04	44.44
hearing	electronic lesson material	73.08	84.61
	FM system	0.00	0.00
	hearing aid	7.69	17.31
	closed captioning monitor in the classroom	61.54	69.23
	sign language dictionary	65.38	76.92
physical	plain trolley or electric wheelchair	28.89	32.61
	crutch	20.00	26.09
	picking—capturing or writing aid	15.55	19.56
	adjustable table, chair and special mouse for computer	17.39	17.39
learning <sup>1</sup>	reading aid	20.00	20.00
multiple	audio book	14.29	28.57
	IC recorder	42.86	57.14
	personal computer with Braille keyboard	14.29	42.86
	white cane	14.29	14.29
	closed-circuit television (CCTV)	14.29	14.29
	Zoomtech program	14.29	14.29
	electronic lesson material	28.57	28.57
	hearing aid	14.29	14.29
	closed captioning monitor in the classroom	14.29	28.57
	sign language dictionary	14.29	28.57

<sup>1</sup> Learning disabilities include intellectual disabilities and autism.

Besides higher educational institutions providing assistive devices based on the concept of universal design [8], as mentioned above, it was found that other tools or assistive devices provided for students with disabilities were not based on it, and these students mostly used a desktop computer (40.00%). It was then found, when considering the types of disabilities, that many autistic students using other tools or assistive devices did so with a desktop computer (66.67%). At the same time, 50% of students with intellectual and learning disabilities, and 44.23% of those with hearing disabilities used a desktop computer. On the other hand, students with hearing disabilities had less use for instruction media in the Thai sign language or fingerspelling (3.85%) (Table 4).

Results regarding other tools or assistive devices found that all of the students with disabilities mostly used a notebook (69.28%) and smartphone (52.14%). When types of disabilities were considered, it was found that, when students with hearing disabilities used other tools or assistive technology, a smartphone (92.31%) and notebook (76.92%) were mostly involved. At the same time, students with visual disabilities used a smartphone (74.07%) and notebook with a Braille keyboard (62.96%), and those with physical disabilities mostly used a notebook (77.78%). On the other hand, students with visual disabilities had less use of a portable magnifier (Table 4). However, the results of the needs for using other tools or assistive devices found that students with disabilities had need for a notebook (32.14%) and an iPad (16.43%) for educational purposes.

In addition, results regarding the problems and barriers in using assistive devices for students with disabilities in higher educational institutions were found to be 93.57% for effective use, 87.86% for external features of the technology, 87.86% for maintenance, and 83.57% for safe usage. On the other hand, skill training was found to be less of a problem or barrier in the use of assistive technology (75.00%).

**Table 4.** Providing other tools or assistive devices that are not based on the universal design concept to students with disabilities.

Type of Disability	Items of Other Tool or Assistive Devices	
	Provision to Students by an Institution	Used by Students on Their Own
visual (N = 27)	desktop computer (10) Braille display (8) portable magnifier (7) instructional media with embossed letters (5) teaching aid (2)	smartphone (20) notebook with Braille keyboard (17) document scanner (4) portable magnifier (3)
hearing (N = 52)	desktop computer (23) Telecommunication Relay Service (15) teaching aid (5) calculator (5) instructional media with Thai sign language and fingerspelling (2)	smartphone (48) notebook (40) pen mouse for computer (21) teaching aid in drawing and painting (7)
physical (N = 45)	desktop computer (15) wheelchair (3)	notebook (35) pen mouse for computer (29)
intellectual (N = 4)	desktop computer (2)	
autism (N = 3)	desktop computer (2)	
learning (N = 2)	desktop computer (1)	
multiple (N = 7)	desktop computer (3) portable magnifier (2)	notebook (5) smartphone (5) portable magnifier (2)

In term of the educational services, the results regarding “Environmental Access” found that educational services provided “independent living on campus” the most to students with disabilities (93.57%), while “transport” was provided the least (62.14%). When considering the types of disabilities, it was found that educational services provided “independent living on campus” the most to students with hearing disabilities (98.08%), while providing less to those with visual disabilities (77.78%). On the other hand, results regarding “Service Facilities” found that “coordination between teachers and the DSS” was the same as “meeting between the DSS and students with disabilities” (98.57%), while “Tutors as teacher, volunteer or student” was the service provided the least (66.43%) (Table 5). In addition, when considering the types of disability, it was found that service facilities provided “coordination between teachers and the DSS” and “meeting between the DSS and students with disabilities” the most (100%) to students with visual, physical, intellectual, learning, and multiple disabilities and those with autism, while providing less to those with hearing disabilities (96.15%).

**Table 5.** Educational services given to students with disabilities.

	List of Services	n	%
<i>Environmental Access</i>	Independent living on campus	131	93.57
	Housing and room for students with disabilities	125	89.29
	Attendance by the DSS or volunteers	124	88.57
	Mobility Training	125	89.29
	Transport service	87	62.14
<i>Service Facilities</i>	Classroom accommodation	133	95.00
	Tutors as teacher, volunteer or student	93	66.43
	Coordination between teachers and the DSS	138	98.57
	Meeting between the DSS and students with disabilities	138	98.57

Besides the educational services mentioned above, this study focused on results of those based on the concept of universal design. It was found that students with disabilities accessed almost all items of educational services. In more detail, those with learning disabilities accessed educational services the most (100%), followed by those with visual disabilities (96.30%). Additionally, when

types of disabilities were considered, the results showed that students with learning disabilities were accommodated with the necessary activities such as reading and writing services (100%); followed by students with visual disabilities who accessed the classroom required for activities such as note-taking, IC recording (96.30%), and extended testing time (88.89%). A classroom was required equally for sign language interpretation and note-taking (78.85%) for those with hearing disability, while building modifications were provided the least (11.11%) to those with physical disabilities (Table 6).

**Table 6.** Educational services based on the concept of universal design.

Type of Disability	List of Services	Students Provided	
		<i>n</i>	%
visual ( <i>N</i> = 27)	service required in the classroom such as note taking assistance, IC recording	26	96.30
	convert exams papers into Braille or large letters	20	74.07
	extended testing time	24	88.89
	Braille or electronic exam papers	19	70.37
	screen reading program for the exam/test	20	74.07
hearing ( <i>N</i> = 52)	sign language interpreting service in the classroom	41	78.85
	note taker service in the classroom	41	78.85
physical ( <i>N</i> = 45)	building modifications such as changing room for exams, elevator	5	11.11
intellectual ( <i>N</i> = 4)	extended testing time	2	50.00
autism ( <i>N</i> = 3)	division of time interval during exams	2	66.67
learning ( <i>N</i> = 2)	reading and writing service	2	100
multiple ( <i>N</i> = 7)	services required in the classroom such as note taking assistance	4	57.14
	conversion of exams papers into Braille or large letters	2	28.57
	extended testing time	3	42.86
	Braille or electronic exam papers	4	57.14
	sign language interpreting service in the classroom	3	42.86
	note taker service in the classroom	3	42.86
	division of time interval during exams	2	28.57
	reading and writing service	2	28.57

#### 4. Discussion

The results found that students with disabilities in the six universities studied received almost all assistive devices and educational services. This was because the DSS in Thai universities is required to provide education for students with disabilities in higher education by following the Persons with Disabilities Education Promotion Regulation [4]. This regulation is intended to enable persons with disabilities to access educational services and other resources at all levels and enhance their quality of life and independent living through empowerment by improving the Thai education system. It would also educate persons with disabilities in higher education.

Thus, students understood their rights to obtain assistive devices and educational services through the DSS team in the university, which has formed a long lasting collaborative network that coordinates and works with related organizations in order to support student rights. Most support for educational services and assistive technology was in the form of cooperation between the Office of Higher Education Commission, mechanisms, and networks of the DSS and continued special education programs. In this study, educational services were provided more than assistive technologies to all undergraduate students with disabilities. This result is consistent with a study by Lersilp et al. [7], who reported students with visual and hearing disabilities using this service more than other types, such as media and facilities.

Furthermore, results regarding “Environmental Access” found that educational services provided “independent living on campus” mostly to students with disabilities, which is consistent with the concept of independence for students with disabilities [10]. It was reported that persons with disabilities are based on beliefs such as respect for their individual differences, as individuality is distinct and unique. The differences in people make each person realize their needs and rights to choose and manage their own service on-demand. It is essential that persons with disabilities help each

other. On the other hand, this finding differs from that in a study conducted by Wang et al. [11], who stated that the visually impaired have difficulty accessing information in most physical environments, in which insufficient transport stops, terminals, vehicles, schedules, maps, and directories prevent them from using public transport effectively. However, “transport” was the service least provided according to a study by Ratanaphan [12], who reported no such public services, which are necessary. For example, most institutions did not provide such services or facilities for students with disabilities, i.e., a bus service, which is consistent with a survey by the Office of the Higher Education Commission [13] that stated there is a policy of equality and educational opportunity for persons with disabilities, but most higher educational institutions did not have clear measures in organizing systems and support services for such students.

“Service Facilities” provided “coordination between teachers and the DSS”, or “meeting between the DSS and students with disabilities”, mostly to students with disabilities, in accordance with Lycoming College’s principle [14] of a disability support service system on campus, which showed students with disabilities receiving the same educational standard as general ones. Students with disabilities were required to have various academic facilities and contact with DSS staff. The DSS department would coordinate support for faculty staff, including consultation with the DSS team, as appropriate.

Additionally, students with visual disabilities were given more assistive technology and educational services than other students with disabilities because of their obvious handicap. On the other hand, students with hearing disabilities received a sign language interpreting service for access to information in education, but made less use of a hearing aid. This result relates to a study by Scherer [15], who reported that deaf students needed a sign language interpreting service instead of hearing aids, and many students with analog hearing aids did not use them. In this study, a result was noted that all students with hearing disabilities never used an FM system, which does not correlate with results from Deenor [16], who found that instruments, including hearing aids, FM systems, etc., and facilities for hearing impaired students were provided in all schools for the deaf, with a budget allocated, due to the relatively high price of an FM system. However, higher educational institutions were not able to provide a budget for FM systems. Students with hearing disabilities also had to transit from one classroom to another; thus, they were unable to set up FM systems in classrooms around the university.

Furthermore, frequency of use analysis found that all assistive technology was used at both the low and high level. There was a changing trend if students perceived assistive technology as difficult to use. This relates to a study by Lesar [17], which reported that most students with disabilities were concerned about knowledge and the ability to use assistive technology. However, the area of assistive technology most needed by students with disabilities was a desktop computer and again a personal notebook. This result relates to studies by Fichten et al. [18] and Goodman et al. [19], who found that students with disabilities frequently used computers and the internet in their daily lives and for educational purposes. Moreover, the findings of this study are consistent with results from Gitlow et al. [20], who stated that the needs identified most frequently existed in the categories of aids for hearing and vision. As assistive devices are a fundamental environmental factor in maintaining independence in different activities, it is important to apply these tools [21].

## 5. Conclusions

The purpose of this study was to survey the types of assistive technology that undergraduate students with disabilities use for accessing information for learning, including assistive devices and educational services. 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 order for education to be accessible to students with disabilities, several factors should be addressed, including the provision

of services, the awareness of using assistive technology, and the support in the form of available assistive devices and educational services from university administration [22]. Additionally, most students need access to information and adaptations, such as screen magnification, dictation software, Braille, and screen readers, in order to use computers effectively [18]. These results can reflect the actions of students with disabilities, who are the stakeholders in assistive technology. Although there was a related regulation and an assistive technology provision system in each university, many types of assistive technology were not used, and some were not even received. Therefore, universities should provide the necessary environment, software and hardware, assistive devices, and educational services to enhance student access to information and effective education.

A limitation of this study was its location “in only Northern Thailand”, which might not be a general indicator for other areas of the country, as they have different supports, barriers, and cultural factors. In future studies, researchers could examine each group of students with disabilities in a wider area and in greater detail. Additionally, researchers can acquire basic data regarding access to assistive technology, usage of assistive technology, and the need for students with each type of disability to use assistive technology. This would be a guide for developing and adapting assistive technology, including assistive devices and educational services that play a professional role in further special education. In addition, it may also be a guide to research development of innovative assistive technology that accords with the needs of students with different disabilities.

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