REIMAGINING DIGITAL EDUCATION AT SRI SANGWAN SCHOOL

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Abstract

Providing inclusive education for students with unique needs and disabilities presents a significant challenge. Working with a special education school in Thailand, Sri Sangwan School, we examined current and potential assistive solutions to enhance the student's abilities when utilizing computers for learning. After conducting surveys, interviews, and ethnographies, our findings indicate that improving computer usage with assistive devices will significantly enhance the learning experience for the students. Technology skills continue to be a key interest for students, empowering them to excel in higher education. We recommended integrating specific assistive tools and infrastructure into their IT curriculum to empower students to achieve digital literacy skills and pursue higher education and careers.

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Executive Summary

Introduction & Background

Adaptable and specialized education is essential for students with unique needs and challenges as it provides opportunities and empowers them to achieve independence. In Thailand, however, there is still a stigma surrounding disabilities, whether in education, industry, or everyday life (Cheausuwantavee & Keeratiphanthawong, 2021). Although the Thai government has implemented various policies to support this impacted group, the general population still needs to make considerable progress.

Our sponsor, Sri Sangwan School, is part of the Foundation for the Welfare of the Disabled under the Royal Patronage of Her Royal Highness Princess Mother Srinagarindra. Sri Sangwan School provides adapted education for 200+ disabled children and youth, with support from 40+ instructors. The school provides rehabilitation and focuses on teaching physically disabled students standard subjects, essential life skills, and self-reliance. In addition, they provide support after graduation and ensure that students have the necessary resources for higher education and their careers. Through our collaboration with Sri Sangwan School, we found that their digital education has several growth areas.

Objectives & Methods

The project goal is to enhance assistive technology at Sri Sangwan School for computer literacy skills by completing the following objectives:

1. Understand students' challenges and highlight specific areas for improvements.
2. Investigate the current assistive technologies used for computer-based learning at Sri Sangwan School.
3. Evaluate three assistive technologies that can enhance students' computer literacy skills.

We achieved these objectives using archival research, interviews, surveys, and ethnography. This multi-method approach increased the robustness of our project, allowing us to triangulate our findings from each method.

Findings

We made several findings regarding the needs of the students, challenges faced by instructors, and key issues preventing students from utilizing resources to their full ability. Our interviews, surveys, and ethnography consistently supported these notions and demonstrated the need to make computer-based education more adaptable. The following findings highlight both the importance of our project and key growth areas our deliverables address:

- Structural and educational barriers limit student growth and independence.

- A variety of assistive technologies are in use, but students need tailored solutions to match their unique needs.
- Software-based assistive technologies provide cost-effective solutions but face integration challenges.
- Physical assistive devices and classroom modifications improve accessibility but come with cost and sustainability concerns.

These findings guide the project at Sri Sangwan School and help us address areas for improvement. By focusing on identified challenges, we were able to target solutions that aim to improve accessibility and empower the students at Sri Sangwan School.

Outcomes

Our team produced three main deliverables that reflect our project objectives. These deliverables will help guide change and provide the groundwork for Sri Sangwan School to enact solutions that will impact their students.

The first deliverable includes the recommendation of three main assistive devices to integrate into the computer labs and facilities at Sri Sangwan School. These recommendations will outline cost, necessary resources, implementation plan, teacher training, and additional details to ensure execution. Our assistive devices cover a wide range of costs for both immediate and long-term action. We provide thorough details and resources, including contacts, constraints, and an action plan to ensure sustainability. Through research, we found a lack of training and experience among new teachers. To overcome this challenge, we also include necessary details and support for instructors.

The second deliverable is a manual that outlines how to implement and use eye-tracking and face-tracking software we developed. This software acts as a proof of concept to better understand the potential benefits and long-term sustainability.

The third deliverable is a long term connection with a key company to create a partnership with Sri Sangwan School. By connecting the school with Tobii, a global leader in eye-tracking technology, they have a straightforward way to incorporate eye-tracking software into their curriculum.

We hope that these deliverables will enact change in Sri Sangwan School and will create an environment that fosters accessibility and promotes digital learning.

Authorship

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Table of Figures		Pawin, Siraphop	Siraphop, Adem
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	Challenges Faced by Students with Physical Disabilities	Madalyn, Sean,	Mahit, Adem, Sean
	Thailand's Education System Compared to Other Countries and Disability Inclusion	Mahit, Sean, Adem	Sean, Madalyn, Mahit, Adem
	About Sri Sangwan School	Mahit, Madalyn, Bhurinat, Siraphop	Sean, Madalyn, Mahit, Adem, Siraphop
	Commonly Used Assistive Technologies	Mahit	Madalyn, Sean, Adem
Methodology	Understand Students' Challenges and Highlight Specific Areas for Improvements	Siraphop, Sean	Sean, Bhurinat, Mahit, Marissa, Madalyn, Pawin
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	Evaluate Three Assistive Technologies that can Enhance Students' Computer Literacy Skills	Marissa, Madalyn	Sean, Bhurinat, Siraphop, Mahit
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	Further Support	Madalyn	Mahit
	Conclusion	Madalyn	Mahit, Sean
References		Adem, Marissa, Siraphop	Madalyn, Marissa, Bhurinat, Siraphop, Mahit

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Table 1
Table of Abbreviations

ALS	Amyotrophic Lateral Sclerosis
AMC	Arthrogryposis Multiplex Congenita
ASD	Autism Spectrum Disorder
ASEAN	The Association of Southeast Asian Nations
AT	Assistive Technology
BMU	Belgrade Metropolitan University
BSAC	Bachelor of Science in Applied Chemistry
ERIA	Economic Research Institute for ASEAN and East Asia
IDEA	Individuals with Disabilities Education Act
IRB	Institutional Review Board
LUP	Lund University Publication
MDA	Muscular Dystrophy Association
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MiNDbank	More Inclusiveness Needed in Disability and Development
NECTEC	National Electronics and Computer Technology Center
NINDS	National Institute of Neurological Disorders and Stroke
PMR	Physical Medicine and Rehabilitation Clinics
TD	Tobii Dynavox
THB	Thai Baht
UCEDD	University Centers for Excellence in Developmental Disabilities Education, Research and Service
UDL	Universal Design for Learning
UPC	Universitat Politècnica de Catalunya

1. Introduction

Everyone has a fundamental right to access education, regardless of their ability. Inclusive learning environments should provide the support and resources needed to ensure all individuals have the opportunity to learn, develop, and contribute to society. Yet, for millions of people with disabilities, accessing this fundamental right has proven challenging, even in the digital age. In Thailand, approximately 6% of the population lives with disabilities, which is about 4.19 million people (UNICEF, 2022); inclusive education is crucial for ensuring equal opportunities. While Thailand has a competitive technology-centric job market, disabled employees represent only 8% of that total market (Cheausuwantavee, 2021). Insufficient financial aid, gaps in education, and lack of employment opportunities highlight the need for progress. These directly affect those with disabilities, particularly school children, who cannot perform equivalently in comparison with abled people (Minority Rights Group, 2025).

Technology has revolutionized education, making learning more accessible, engaging, and efficient. From artificial intelligence to virtual reality, technological advancements have transformed how students learn, teachers instruct, and institutions operate. Additionally, technical literacy has become a quintessential skill for success, regardless of ability. Early training in information and communication technology is considered to be necessary to provide young people with 21st-century knowledge (Arndt, 2016). Despite this, computer literacy skills for physically disabled people and technology usage are different from traditional cases; this is due to the fact that disabled people may find movement difficult and not easy to perform tasks. When people with developmental disabilities gain access to digital tools, it challenges stigmas and fosters greater acceptance in workplaces and communities. As acceptance grows, so does access, creating a cycle that reshapes how their capabilities are viewed (Khanlou, 2020).

Sri Sangwan School is part of the Foundation for the Welfare of the Disabled, established under the royal patronage of Her Royal Highness the Princess Mother Srinagarindra in 1954. Our project mission is to assist them by making insightful research recommendations that will make digital education more accessible. The current assistive technologies at Sri Sangwan do not allow students to perform as well and live up to their potential, especially when it comes to computer literacy. The 232 current students at Sri Sangwan School have physical disabilities, specifically Cerebral Palsy (CP) as a majority. CP is a condition that causes muscle degeneracy (Straub, K., & Obrzut, J. E. 2009); this affects their learning efficiency and daily life. The school utilizes various assistive devices to help students perform tasks, with computer classes being a main attribute. By improving existing infrastructure and researching new assistive technologies for their specific needs, students can gain easier access to computers and tackle complex tasks that were previously beyond their reach.

However, the application of assistive devices at the school still has limitations. As the student's conditions and symptoms vary, assistive devices provide support, but they do not always match the students' current needs. In addition, the school relies on donations from external organizations, resulting in project outcomes that take financial constraints into

account. Sri Sangwan School is looking for affordable but innovative technologies to better adapt to their students' needs and allow them to fulfill their potential. As new technologies are constantly emerging, there is a need for tools that are effective, affordable, sustainable, and user-intuitive for students and instructors.

To achieve this goal, we identified the needs of the students at Sri Sangwan School to understand the challenges they faced in computer education. Then, we investigated the current assistive technologies used for computer-based learning. Finally, we evaluated three assistive technologies that enable students and empower them to acquire computer literacy skills. It is our hope that the results, findings, and recommendations of this study will benefit Sri Sangwan School. We offer our insights from research on what assistive technologies will support students most, and we hope that the school becomes a model for inclusive digital education.

2. Background

2.1 Understanding Inclusive Education

Inclusive education strives to normalize the presence of people with disabilities and provide the most appropriate support and resources. According to UNESCO in 2015, inclusive education is defined as the insurance of the provision of quality education equitably to all learners regardless of disabilities. The Salamanca Statement of 1994 and Sustainable Development Goal 4 (SDG 4) reaffirm this, each emphasizing that equity in education is the cornerstone of progress towards inclusive quality education.

While inclusive education is widely accepted as being an essential practice, its implementation varies across countries, particularly in how schools accommodate students with physical disabilities. Physical disabilities, such as cerebral palsy (CP), muscular dystrophy, and spinal cord injuries, often present mobility challenges. These require assistive devices, classroom modifications, and specialized teaching strategies that are not always available, thus making access to quality adapted education difficult (Straub & Obrzut, 2009).

The 2007 Persons with Disabilities Empowerment Act of Thailand required equal education opportunities for every disabled person with education and employment quotas. Inadequate infrastructure, absence of learning assistive technologies, and minimal teacher training restrict many students with physical disabilities from studying alongside able-bodied people (Cheausuwantavee, 2021). This disparity reflects a great divide between policies on paper and how they translate to reality.

2.2 Challenges Faced by Students with Physical Disabilities

2.2.1 Inaccessible Learning Environments

The critical barrier that exists for students with physical disabilities is inaccessibility. Most schools lack ramps, elevators, and adjustable desks, thus making access to classrooms difficult for students with mobility impairments (UNICEF, 2022). Even where these facilities

exist in schools, other determinants, such as narrow hallways, missing automatic doors, and inaccessible restrooms, limit participation (UNICEF, 2022).

The obstacles are especially evident in Thailand, where the majority of rural school buildings were constructed with inadequate resources and inaccessible features for students with disabilities. A UNESCO study in 2018 found that only 25% of primary schools in Thailand had full wheelchair accessibility, limiting enrollment opportunities for children with mobility impairments (UNESCO, 2018). Furthermore, this usually keeps the student from participating in classroom activities and widens the gap in educational experiences between disabled and abled peers.

2.2.2 Inaccessibility of Assistive Technologies

Assistive technologies in inclusive education play a vital role in facilitating independent participation by students with physical disabilities in learning activities (Chinchay, 2024). These technologies range from various input and peripheral tools to software applications. However, the availability and affordability of such tools remain major concerns.

According to Cheausuwantavee (2021), many specialized schools in Thailand are not funded and trained to apply assistive technologies, leaving students with outdated or inefficient tools. For instance, in Sri Sangwan School, students with cerebral palsy have difficulty operating the normal computer interface. The available devices are not fully aligned with the needs of each and every student, therefore hindering the process of learning and accessing digital literacy skills.

2.2.3 Importance of Teacher Training in Inclusive Education

Effective inclusive education requires well-trained educators who understand the needs of students with physical disabilities and can adapt teaching methods accordingly (Vorapanya, 2012). However, many teachers in Thailand receive little to no specialized training in disability-inclusive teaching (Cheausuwantavee, 2021). As a result, students with physical disabilities often struggle with inaccessible curriculum materials, limited individualized instruction, and a lack of classroom support.

Studies have shown that teachers who receive professional development in inclusive education are more confident in using assistive tools and modifying lesson plans to accommodate students with disabilities (UNESCO, 2018). Some countries, like Finland and Canada, have incorporated teacher certification programs. Universal Design for Learning (UDL) is a viable approach Thailand may consider in order to further develop its inclusive education framework (Rydeman, 2018).

2.2.4 Social and Psychological Barriers

Social exclusion and stigma associated with physical disability often go beyond physical and institutional barriers, thus affecting the educational experience. Traditional perceptions of disability in Thai society are often embedded in a medical model, emphasizing impairment rather than ability (Cheausuwantavee, 2021). This results in negative attitudes

among peers and educators that could lower the self-esteem of students and even reduce their active participation in the classroom.

2.2.5 Bridging the Gap: The Need for a Stronger Inclusive Education Model

Thailand has made legislative changes towards promoting inclusive education. However, it still faces gaps in implementation, funding, and awareness. Such challenges need to be met with a multi-dimensional approach, including:

- Improving school infrastructure to ensure physical accessibility.
- Widening the availability of assistive technologies via government subsidies and partnering with private agencies.
- Better training for teachers by adequately preparing them with the skills needed to support students with physical disabilities.
- Awareness campaigns to dispel stigma and promote inclusive school environments.

Sri Sangwan School, being one of the pioneering schools for physically disabled students in Thailand, has already tried to implement assistive learning tools. Yet, there is a scope for integrating cost-effective and innovative technologies that will help in enhancing digital literacy and classroom participation.

The next section discusses Thailand's system of education in comparison to other countries, how different countries implement disability-inclusive policies, and what ideologies can be adopted by Thailand’s educational practices.

2.3 Thailand’s Education System Compared to Other Countries and Disability Inclusion

2.3.1 Thailand’s Funding for Accessible Learning Environments

Schools in urban areas, especially in Bangkok, have more well-funded special education programs, trained teachers, and assistive technology, while schools in rural areas lack even infrastructure to accommodate students with disabilities. This dramatically increases disparities and forces people with disabilities into a rural exodus that not everyone can afford, thus fostering a far less inclusive environment nationwide (Kantavong & Pennee, 2018). Schools in Thailand depend a lot on external funding for assistive technology, unlike Sweden and the U.S., which have government-funded resources available for people with disabilities (ERIA Study Team, 2022).

2.3.2 Teacher Training and Inclusive Education Practices

Although specialized teacher training is available in Thailand, the majority of teachers are not trained in inclusive education strategies. This makes it challenging for children with disabilities in the Thai education system to have adequate support (Sermsap Vorapanya, 2012). This is a common pattern; in Malaysia, one significant barrier to education was a lack of training for teachers to provide quality education (Yasin et al., 2010). In Japan, all teachers receive training related to disabilities as part of their teacher education. Yet, in Thailand, there

is no comprehensive system for ensuring that the universal design for learning and assistive technology are incorporated into teacher certification processes (Cheausuwantavee & Keeratiphanthawong, 2021; MEXT, 2025).

2.3.3 Assistive Technology and Digital Education for Students with Disabilities

In Thailand, technology such as screen readers and speech-to-text software are found only in urban and some international schools. The majority of public schools do not use such technologies because of their budgeting constraints (Lersilp, 2016). This makes it extremely difficult for people with physical disabilities, especially motor disabilities, who struggle to perform many tasks without specific assistive devices. Moreover, AI-driven learning tools and digital education can facilitate greater accessibility for cognitively impaired students; however, its adoption has been very slow in Thailand (Janardhanan et al., 2023). The use of assistive AI technology could be extremely beneficial for children in Thailand by providing them with various new tools such as text-to-speech technology, personalized learning curriculum, and even writing assistance software.

2.3.4 Social Stigma and Cultural Barriers

Traditional Thai notions of disability, as influenced by Buddhist notions of karma-borne suffering, are perhaps ambivalent about disability, with some people viewing it as a punishment for past misbehavior and others encouraging pity (Naemiratch et al., 2009). Traditional Buddhist ideals in Thailand affect the way many people view disabilities. The karma concept suggests that individuals are born with disabilities due to deeds in their past lives, and this generates a range of attitudes within society. Some view disability as a form of spiritual punishment, and this can result in abandonment or a lack of care for individuals with disabilities by society. Yet, Buddhism also encourages compassion and kindness, leading others to view disability as an opportunity to help those in need, either through charity or direct assistance. This ambivalence leads to an inconsistent societal response—some individuals with disabilities are assisted, while others are discriminated against or excluded (Lara, 2017).

Cultural attitudes further impact disability inclusion, with traditional Buddhist beliefs sometimes framing disability as a result of past karma, leading to social stigma and parental reluctance to enroll children in school. In contrast, Western nations emphasize self-advocacy and disability rights, promoting higher participation in mainstream education (Naemiratch et al., 2009; Paunović et al., 2014).

Social stigma prevents parents from enrolling disabled children in school, either because of shame or lack of knowledge about the services available (Naemiratch et al., 2009). Social stigma is a significant component in limiting education for disabled children in Thailand. Many parents feel an overwhelming sense of shame or embarrassment if their child is disabled, as they do not wish to be stigmatized by their community (Naemiratch et al., 2009). This stigma can lead them to keep the children hidden at home rather than bringing them to school. In other cases, parents may be ready to bring their children to school but are unaware of the resources available to assist them, such as special education classes or assistive technology. This combination of shame, social pressure, and lack of knowledge

leads to many disabled children being denied education, which in turn results in lower job prospects and a poorer quality of life.

Western countries, such as the U.S. and Sweden, emphasize self-advocacy and the rights of disabled people and encourage more integration into mainstream education (Berggrenć et al., 2016). In contrast to Thailand, where disability would be more likely to be understood from a cultural or religious point of view, Western countries construct disability as an issue of rights. In the U.S. and Sweden, for example, state policies actively encourage people with disabilities to advocate for themselves and assert their rights to education, employment, and participation in public life. Schools and universities provide accommodations so that students with disabilities can access regular education alongside their non-disabled counterparts (Berggren et al., 2016). This model encourages a sense of belonging and normalizes disability, reducing stigma and increasing opportunities for disabled individuals to acquire independence and career success. The emphasis on self-advocacy allows disabled individuals to take an active role in shaping their educational experience, a stark difference from the Thai system.

To reduce stigma, Thailand needs awareness campaigns and policy implementation to shift societal attitudes towards disability (Cheausuwantavee & Keeratiphanthawong, 2021). Changing deep-seated societal attitudes towards disability needs to be tackled in a multi-faceted way. Awareness campaigns can educate the public on the causes of disability, debunk myths about karma and punishment, and propagate the message that people with disabilities have a lot to offer society. Lastly, stronger enforcement of disability rights law is necessary to ensure that policy on the books—inclusive education mandates, for example—is sufficiently enforced. Without strong enforcement, even policy intended to be progressive can collapse due to a lack of monitoring or accountability. Cumulatively, these steps could operate to shift the cultural conception of disability from a shameful thing to be overcome into a normal aspect of human diversity to be supported and accommodated.

2.3.5 Special Education in Thailand vs. Globally

United States

The Individuals with Disabilities Education Act (IDEA) requires the Individualized Education Plans (IEPs) to guarantee that "Students with a disability are educated alongside students without a disability" (Hayes & Bulat, 2017). The IDEA is a seminal U.S. law that grants students with disabilities the right to a free, appropriate public education (Jordan et al., 2020). Under this act, schools have the obligation to develop an IEP for each student with a disability, as well as the accommodations and support that they need in order to succeed in the general education environment. This offers students with disabilities equal learning opportunities with other students, with proper support. In Thailand, however, there is no standard national IEP format (Jordan et al., 2020). This diversity means that support for students with disabilities can vary significantly from school to school, depending on resources and the commitment of individual teachers. Therefore, many students don't receive the structured and personalized assistance they need to be successful in school in Thailand.

Sweden

By law, Sweden's public schools implement Universal Design for Learning (UDL) that is advantageous to students, with state-funded assistive technology and instruction that is easily modifiable (Berggren et al., 2016; Rydeman, 2018). Sweden has been at the forefront of tackling accessibility in education with UDL (Berggren et al., 2016). UDL is a system that designs educational environments to be adaptable and inclusive to all students, not through individual accommodation afterward. This is supplemented by the state funding of assistive technology such as speech-to-text software, screen readers, and other assistive software that allows students with disabilities to engage with course content (Berggren et al., 2016; Rydeman, 2018). Thai schools do not have a comparable level of state-funded assistive technology (Lersilp, 2016). Students with disabilities in Thailand must either utilize privately funded and extremely expensive solutions or do so without access to the assistive technology necessary. This effectively results in significant educational barriers. With the lack of government investment in assistive technology, large-scale inclusive education remains difficult.

Japan

Japan integrates disability education into teachers' training to empower teachers to be capable of serving students with disabilities (MEXT, 2025). Poor teacher training in Thailand leads to inequitable support for inclusive education (Cheausuwantavee & Keeratiphanthawong, 2021; MEXT, 2025). This approach adopted by Japan in integrating disability into education is through comprehensive teacher training. All the teachers, whether subject-specializing or not, are trained in how to serve students with disabilities. This guarantees that there is some standard of training on the inclusion of students with special needs held by all instructors within the educational system (MEXT, 2025). For this reason, schools in Japan are generally best suited to provide inclusive education as well as necessary assistance to students who are disabled.

Conversely, Thailand lacks an integrated special education teacher training system. While some teachers undergo training with special programs, most general education teachers lack the skills and knowledge needed to implement proper support for children with disabilities (Cheausuwantavee & Keeratiphanthawong, 2021; Lersilp, 2016). This causes the inconsistent quality of inclusive education from one school to another, depending on the capacity of the school's personnel (Cheausuwantavee & Keeratiphanthawong, 2021; MEXT, 2025). Without a national commitment to the inclusion of disability education in teacher training, many Thai students with disabilities will continue to suffer from a lack of appropriately trained teachers.

2.3.6 Thailand's Disability Inclusion Policies are Shaped by the Persons with Disabilities Act

The Persons with Disabilities Empowerment Act of BE 2550 (2007) is an act that guarantees access to education, employment, healthcare, and social services for individuals with disabilities. This legislation promotes standard school integration, financial support, and

assistive technology provisions (WHO, World Health Organization, 2007). Specifically, Section 20, clause two states that persons with disabilities are entitled to an education that suits their physical and mental condition, and agencies involved are responsible for providing suitable and necessary facilities, media, services, and any other educational assistance (WHO, World Health Organization, 2007). In addition to Section 20, clause 4 expresses that disabled people are entitled to be accepted and fully integrated into participating in society. This ranges from participating in social to political activities. This clause, in particular, also mentions how the necessary facilities and services should be provided to these people.

Despite legislative advancements, implementation gaps persist, particularly due to resource disparities and an urban-rural divide. Urban centers, such as Bangkok, offer well-funded special education programs with trained staff and assistive technologies, whereas rural schools often lack the infrastructure to accommodate students with disabilities (Kantavong, 2017). Assistive technology remains inconsistently available, with Northern Thailand studies revealing a greater provision of educational services than assistive devices. Visually impaired students receive the most support, but assistive technology remains underfunded compared to countries like Sweden and the U.S., where government funding ensures widespread access (Lersilp, 2018; ERIA Study Team, 2022).

2.4 About Sri Sangwan School

Sri Sangwan School is committed to improving the quality of life for students with physical disabilities for free. The school serves over 230 K-9 students and has 45 teachers offering a diverse range of classes, including IT, cooking, English, trade skills, art, and math. It provides students with specialized programs, inclusive learning, and one-on-one support to ensure students build independence and achieve their educational goals. The school still follows the national syllabus for each subject but adapts its education model to fit the majority of their students.

2.4.1 History of Sri Sangwan School

Under the Foundation for the Welfare of the Disabled, Sri Sangwan School was founded by Her Royal Highness Princess Srinagarndra in 1961. The Foundation for the Welfare of the Disabled was registered in 1954 and accepted under Her Royal Highness Princess Srinagarindra’s royal patronage in 1956. The foundation initially focused on providing tutoring services to children with Polio at Siriraj Hospital. Following the Polio vaccine, the foundation shifted its focus to providing education for children with disabilities, thus leading to Sri Sangwan School.

Figure 1
Sri Sangwan School

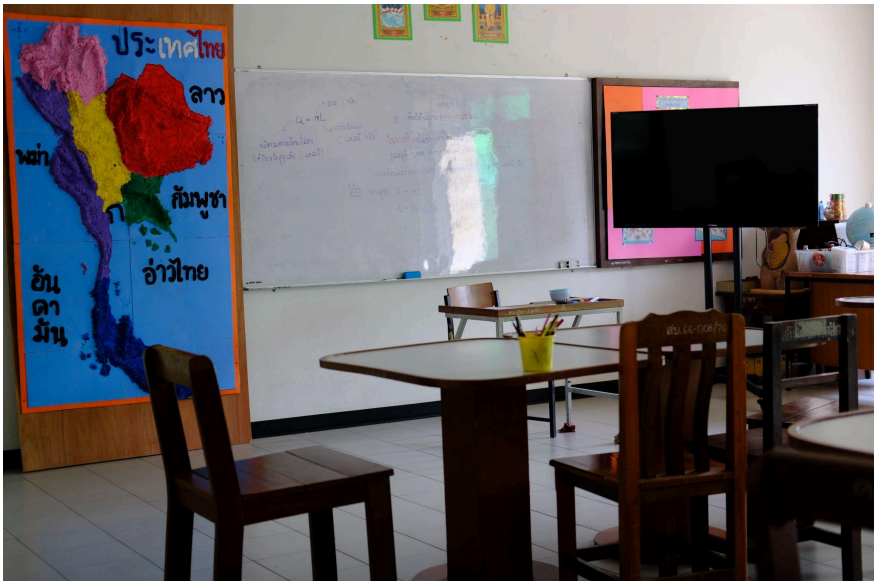
Note: Taken by Bhurinat Sumetchotimaytha

2.4.2 Education at Sri Sangwan School

The current students have a variety of conditions, where students have a range of mild to severe cognitive disabilities. Education at Sri Sangwan School does not measure children based on age but rather on their academic performance. Moreover, many physical disabilities presented in the school, mainly cerebral palsy (CP), obstruct the learning process, which makes many classes quite challenging. Students with cognitive disabilities face additional challenges as they require extensive hands-on care, and the class curriculum needs repetition for adequate comprehension. In conjunction, many of these students experience exhaustion or strain during class due to their disabilities, resulting in frequent breaks and a gradual learning pace.

Figure 2

One of the Classrooms in Sri Sangwan School



Note: Taken by Madalyn Nguyen

Students at Sri Sangwan School follow a set timetable to allocate their learning experience and meet their particular needs. Each grade is divided into two classes with roughly 10-12 students, resulting in a low student-to-teacher ratio. This design allows teachers to provide individualized attention and meet the various requirements of students with impairments. The school is open from 8:00 AM to 3:40 PM, with six one-hour daily lessons. These classes cover various topics, including general academic courses, life skills (cooking, gardening, etc.), and therapy sessions customized to the student's needs.

Class sizes and time allocation aim to balance academic learning and students' physical and cognitive capabilities. This system also integrates rehabilitation into the school day, such as physical therapy sessions held twice a week. This strategy demonstrates the school's commitment to developing students' independence and providing them with the skills they need to manage life beyond graduation.

Literacy among those with CP is poor due to slow cognitive function, affecting movement, posture, and muscle tone. For this reason, the children are generally categorized into two classes in each grade based on how their disabilities affect their learning experience. Students are divided by ability, with the first class being more abled body students and the second class being students who require additional support. Sri Sangwan’s mission is to allow its students to live independent, fulfilling lives after graduating.

2.4.3 Disabilities at Sri Sangwan School

Sri Sangwan School is responsible for students with different conditions, meaning they each have unique needs and challenges. The students face various disabilities, such as:

Cerebral Palsy:

Cerebral palsy is a group of conditions that affect movement and posture. It's caused by damage that occurs in the developing brain, most often before birth. Symptoms appear during infancy or preschool years and vary from very mild to serious. Children with cerebral palsy may have exaggerated reflexes (Mayo Clinic, 2024).

Autism:

Autism Spectrum Disorder (ASD) is a complex developmental condition that affects how people communicate, learn, behave, and interact with others. It's a neurological disorder that's influenced by both genetics and environment (CDC, 2024).

Spina Bifida:

Spina bifida is a neural tube defect that occurs when the spine and spinal cord do not form properly, leading to potential physical and intellectual disabilities (NINDS, 2025).

Spinal Cord Injury:

Spinal cord injury is when damage is done to the spinal cord that causes temporary or permanent changes in its function. It is a destructive neurological and pathological state that causes major motor, sensory, and autonomic dysfunctions. (Johns Hopkins Medicine, 2025)

Congenital Anomaly:

A congenital disorder is a structural or functional abnormality that occurs during pregnancy. They are also known as birth defects, congenital anomalies, or congenital malformations. (Mayo Clinic, 2024)

Arthrogryposis Multiplex Congenita:

Arthrogryposis Multiplex Congenita (AMC) is a rare disorder that causes joint stiffness and contractures in multiple parts of the body. It causes limited joint movement, muscle weakness, spinal deformities, and joint contractures that vary in severity and distribution. (WHO, 2023)

Muscular Dystrophy:

Muscular Dystrophy (MD) is a group of genetic diseases that cause muscles to weaken and waste away over time. It's a progressive condition that can affect the heart and muscles used for breathing. (MDA, 2020).

Loss of Limbs:

Amputation is the loss or removal of a body part such as a finger, toe, hand, foot, arm, or leg. It can be a life-changing experience affecting your ability to move, work, interact with others, and maintain your independence. (Amputee Coalition, 2025)

Table 2

Summary of Disabilities in Sri Sangwan School's Student

Summary of disabilities in Sri Sangwan School's student	
Semester 2, academic year 2024	
Disability type	**Number of students**
Sight	3
Hearing	29
Movement	232
Mental Health	10
Intelligence	59
Learning	25
Autistic	3

The table includes overlapping students, as some students are counted in multiple categories, such as being included in both 'sight' and 'hearing' disability types.

Brief Explanation of Cerebral Palsy

Individuals with CP often experience significant fatigue when performing tasks due to the increased effort required for movement and coordination. CP has specific sub-disorders under its umbrella, which are detailed below:

Table 3

Classification of Specific Cerebral Palsy Disorders

Condition	Description	Impact on Learning
Diplegia	A neurological disorder affecting symmetrical muscle function on both sides of the body, particularly the legs, causing movement and balance issues.	Difficulty adjusting position during learning due to inefficient movement of the lower body.
Triplegia	A neurological disorder affecting muscle function in three limbs, typically both legs and one arm.	Challenges in digital learning due to difficulty typing and maintaining proper sitting posture.
Ataxia	A neurological condition disrupting coordination of voluntary movements, affecting balance, gait, fine motor skills, speech, or eye movements.	Impaired fine motor skills and coordination can hinder participation in hands-on or digital learning tasks.
Hemiplegia	The impairment of muscle function on one side of the body causes weakness, restricted movement, and coordination challenges.	Difficulty performing tasks requiring bilateral coordination or significant physical effort.
Monoplegia	A neurological disorder or injury affecting one limb, causing weakness, paralysis, or difficulty in movement and coordination.	Limited use of one limb can create challenges in tasks like writing, typing, or using digital tools.
Paraplegia	A neurological disorder or spinal cord injury affecting muscle function and sensation in both legs and sometimes the lower body.	Mobility and balance challenges may limit access to physical spaces or require adaptive seating arrangements.

Note: This is taken by Michigan Cerebral Palsy Attorneys, 2015

CP encompasses a wide range of motor impairments that significantly affect physical coordination and mobility, such as diplegia, triplegia, and hemiplegia. Beyond physical challenges, CP also impacts learning by creating barriers to classroom engagement and digital education, such as posture, typing, and dexterity difficulties. These obstacles can limit students' participation in educational activities (Straub & Obrzut, 2009). Sri Sangwan School

accepts a wide variety of students and must be equipped and prepared to provide education to all the subclasses of CP.

2.4.4 Assistive Technologies at Sri Sangwan School:

Sri Sangwan School utilizes a variety of assistive technology devices to support students in digital education. These devices play a crucial role in improving the quality of life for children with disabilities by helping them overcome physical, sensory, or cognitive limitations and fostering independence in daily activities. In an educational context, assistive tools enable interaction with teachers and peers while providing access to instructional materials. The therapy department staff members play a significant role in assisting children with literacy tasks and utilizing various devices.

Typing and mouse movement, especially during computer class, demand precision, which can be challenging for students with restricted movement and cerebral issues. These challenges not only exhaust students but also slow their progress when completing tasks. When it comes to hand-intensive activities like typing, precision is essential for fingers to navigate the keyboard. Despite the availability of various assistive devices tailored to specific conditions, the primary issues of limited movement and cognitive challenges remain significant barriers. Consequently, while these assistive devices help students engage with computers, they do not directly enable them to complete tasks but rather assist them in reaching a basic level of participation.

Figure 3
The Overall Assistive Devices in Computer Subject at Sri Sangwan School

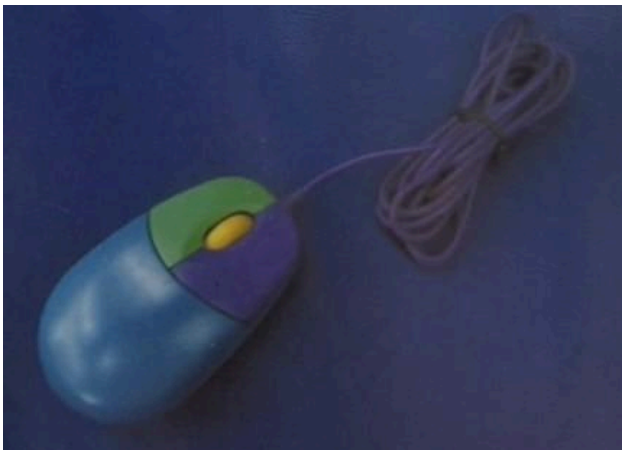
Note: Taken by Marissa Rukachantarakul

Mini-Mouse

A mini-mouse is a small mouse primarily used for students with muscle atrophy who have difficulty using a normal-sized mouse. It is easier to move and click with a mini-mouse.

Figure 4

The Image of Mini-Mouse



Note: Taken by Marissa Rukachantarakul

Numeric-Keypad

The numeric keypad is used to replace the traditional mouse. Pressing different keys on this pad will move the cursor up, down, left, and right, as well as left-click and right-click. The keys can also be modified in software to perform different tasks for other functions that the students may need.

Figure 5

The Image of Numeric Keypad

Note: Taken by Marissa Rukachantarakul

Keyguard

A keyguard is attached to a keyboard to prevent other keys from being pressed. Students with muscle atrophy have difficulty with precise movement, which can lead to mistyping. Using the keyguard on a keyboard reduces the errors caused by the occasional muscle spasm.

Figure 6

The Image of a Keyboard with a Keyguard (Plastic Cover)

Note: Taken by Mrs. Waraporn Panyaprachote

Ball Grip Writing/Typing Aid

The large, rounded ball grip is particularly suitable for individuals with arthritis or a weakened hand grip, ensuring ease of use for patients. The ball is used for grip, while the brush is used to click. The brush is made of silicon to ensure the keyboard won't break due to the user's uncontrollable strength.

Figure 7

The Image of Ball Grip Writing/Typing Aid

Note: Taken by Bhurinat Sumetchotimaytha

Switch Mouse

A switch mouse uses large arrow buttons to control the cursor. As the buttons are oversized, the device is primarily used by students without arms, who would need to use their feet to step on the switches to control the cursor.

Figure 8
The Image of Switchmouse

Note: Taken by Marissa Rukachantarakul

Trackball/Easyball

A trackball mouse is used to help students with muscle weakness. As they struggle to move a standard mouse around, they rely on moving the ball on the mouse to control the cursor on the screen. This makes it easier for some students to control the cursor. Similarly, the school also provides an easy ball mouse, which has a larger ball for ease of use (Figure 9).

Figure 9
The Image of Trackball and Easyball

Note: Trackball is on the left, and Easyball is on the right. Taken by Marissa Rukachantarakul

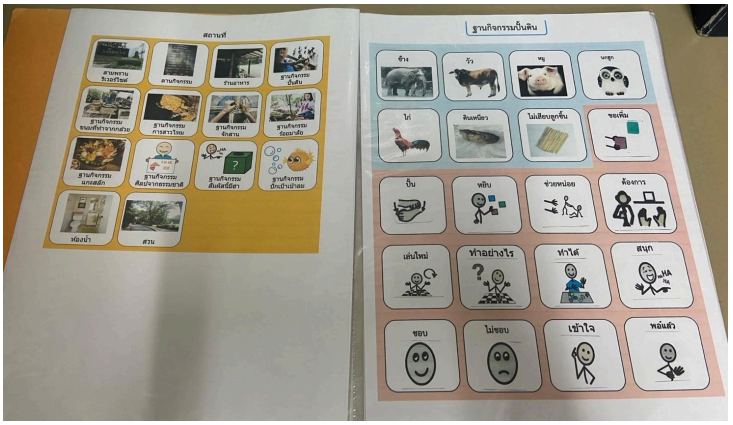
Communication Board

An Augmentative and Alternative Communication (AAC) board is a device that helps a person communicate in case of speech impairment. It can be presented in multiple forms, some of which can be non-electric to save cost, making them accessible and budget-friendly. Others are in electronic form, which could be used to express themselves with voice output, an app, or a piece of software such as a mobile phone or tablet.

A communication board is a tool used in various community settings. The board displays photos, symbols, or illustrations to support people with limited speaking ability. The user points or gestures at the images to communicate. Pictures, such as syllables, adjectives, nouns, time, or activities, are marked in colors to help users quickly and efficiently find their expressions.

Figure 10

The Paper-Based AAC that Is Used for Literacy Therapy



Note: Taken by Pawin Harijanwong

Figure 11

The Example of a Template that Is Used for Literacy Therapy

Note: Taken by Pawin Harijanwong

2.5 Commonly Used Assistive Technologies

The table below shows the various categories of common assistive devices used globally. Each category of device addresses a different need that a person with a disability may have. Multiple devices can be used concurrently to best fit the needs of the user.

Table 4

List of Assistive Devices Used Around the World

Category	Assistive Device
Input Devices	Joystick Mouse
	Sip-and-puff
	Eye tracking software
	Keyboard options with filters and correction
Software	Word Prediction Software
	Speech Generating Devices
	Magnification of screen
Physical Tools	Pencil/Pen grips
	Weighted pen or pencil
	Universal cuffs
Hardware	Digital AAC Board
	Monitor stand for adjustability
	Sit-to-stand desks

With the development of new technologies and research on devices for those with physical limitations, assistive technology has gained widespread use around the world. Schools have used a variety of technologies to help their students learn effectively and prepare them for the real world. As technology becomes more prevalent in everyday life,

schools have organized computer classes for the students to understand concepts, programs, and practice. However, computers aren't designed for those with physical disabilities, requiring schools to make accommodations and integrate assistive tools into their education. This makes learning more manageable for students with disabilities and also helps promote independence and confidence.

The Belgrade Metropolitan University (BMU) is a private university in Serbia that focuses on online tech-centric education with an emphasis on innovation. The school, being virtual, has experience with students with CP and other physical disabilities. In a proceeding in 2015 held by the school, *The Fifth International Conference on e-Learning*, they have an article about *Technology Aided Education of Students with Disabilities*. Throughout this article, they mention disabilities caused by CP, such as motor disability, visual dysfunction, auditory dysfunction, and other sensory dysfunctions. A group of people with CP were interviewed to conduct a study on what technology would prove beneficial. The researchers found that a standard keyboard and mouse posed challenges for a majority of students with CP, prompting them to explore alternative solutions. The school then provided a list of beneficial technologies.

At BMU, students move the cursor around using a mouse and other various assistive devices. Trackball, mouse switch, and joystick mice have been helpful to students who have trouble using a traditional mouse. Students also use mouse emulators to move and use the pointer without using their hands. The two primary methods, Eye-tracking software, and a sip-and-puff system, utilize eye movement and inhaling or exhaling, respectively. Additionally, they have found keyboards with unique key layouts, larger keys, one-hand keyboards, and even wearable keyboards were helpful in some instances. Using on-screen keyboards, word prediction software, and spell-checkers provided support and accessibility on the digital side of typing.

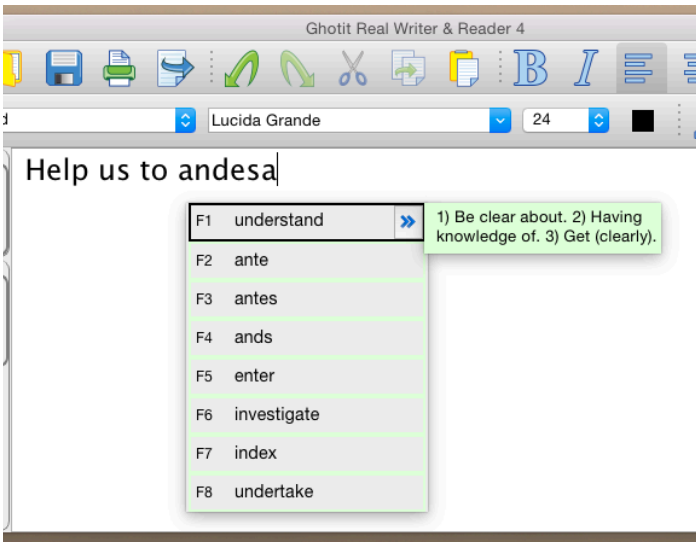
One of the tools used by the BMU and other schools is the eye-tracking/head-tracking software. The Institute on Disabilities at Temple University, one of the sixty-eight University Centers for Excellence in Developmental Disabilities Education, Research and Service (UCEDD), provides a comprehensive list of technologies for students with physical disabilities. They also have various options for computer mice and pointing device options. "Eye tracking accessories let you control your computer without touching it." (Tech Owl Temple University, 2025) Rather than a traditional mouse, the software uses a webcam to track eye movements to control the cursor. The school found that this reduces the strain for students when completing basic tasks. They use *Tobii,* the global leader in eye tracking (*Tobii,* 2025). *Tobii* is used widely in gaming, assistive technology, and medical research. The other tracking system provided is head tracking technology, where students can move their heads to move the cursor (Tech Owl Temple University, 2025). To elaborate, using the head tracking device will allow for hands-free use of the computer, utilizing the head to facilitate cursor control for those with stiff arms or hands. These systems for cursor movements have been proven beneficial for other institutions and organizations when providing accessible education.

Word prediction software is another tool that has proven helpful to other people in assisting them with their learning. This software is used on mobile devices to predict the current or next word an individual would type based on previously typed words. This reduces

the strain on students when typing out full words and sentences. A study was conducted among students with cerebral palsy who had to produce a text, one without the assistance of word prediction software and one without. “Results indicated the word prediction of the keyboard emulator software reduced typing efforts…. execution time using prediction, 61% typed the text in less time” (Jordan et al., 2020). With this reduced effort, the students can focus more on learning rather than the method used. This is essential because when students have a large cognitive load, they underperform in their curriculum, leading to poor comprehension. By reducing their efforts with word prediction software, the cognitive load is alleviated, allowing students to allocate more effort into their learning of the curriculum, ultimately enhancing their learning outcomes.

Figure 12

Example of Word-Prediction Software



Note: This is taken from Ghotit Website (2025) https://www.ghotit.com/dyslexia-word-prediction

Universal cuffs have also been proven to be beneficial to people with CP or individuals who struggle with muscular dystrophy. A universal cuff is a device used to help individuals with limited hand/grip strength. It is usually an adjustable strap that wraps around the person's hand, wrist, or arm and has a pocket or loop to hold objects. The universal cuffs allow students to fully participate in classroom activities from writing to typing. “Teachers report significant improvements in student engagement and self-esteem as children learn to manage tasks independently, which can translate into better academic performance and social interactions” (EaZyHold, 2025).

Figure 13
Picture of A Girl Using Universal Cuffs

Note: This figure is taken from EazyHold https://eazyhold.com/pages/special-education-teachers

The United States ensures systematic access to assistive technology through the Individuals with Disabilities Education Act (IDEA), which mandates that schools must provide it as part of Individualized Education Plans (IEPs). This policy ensures that students receive personalized support to address their specific learning needs (Jordan et al., 2020).

3. Methodology

The goal of this project is to enhance assistive technology at Sri Sangwan School for computer literacy skills. To achieve this goal, we developed three objectives as follows:

- Understand students' challenges and highlight specific areas for improvements
- Investigate the current assistive technologies used for computer-based learning at Sri Sangwan School
- Evaluating three assistive technologies that can enhance students' computer literacy skills

We directly engaged with the principal, caregivers, teachers, and alumni to understand the current state of Sri Sangwan School and the various benefits and challenges of existing technologies. This chapter will describe the methods we utilized to gather and analyze the research data and how the results were used to develop recommendations to improve the accessibility of the school's digital education.

3.1 Objective 1: Understand Students' Challenges and Highlight Specific Areas for Improvement

To achieve our project goal of enhancing assistive technology at Sri Sangwan School for computer literacy skills, we sought to holistically understand the students' challenges. We prioritized digital literacy struggles and how assistive infrastructure could support or enhance the students' learning. Without this understanding, we risk proposing innovative solutions that might not effectively meet the educational objectives of Sri Sangwan School. To achieve this objective, we sought to answer the following research questions.

Research Questions:

- What are the current challenges students at Sri Sangwan School face in learning computer literacy?
- What are the experiences and perspectives of teachers and alumni at Sri Sangwan School?
- What skills are students focusing on at Sri Sangwan School?

To gather this information, we used a combination of research methods to capture quantitative and qualitative data. We conducted in-depth, semi-structured interviews with teachers, alumni, and caregivers to leverage their expertise and gather detailed insights. We also distributed surveys to these demographics to collect qualitative and consistent quantitative data. We set out to learn about the challenges students face, the experiences of their teachers, and the expectations embedded in the school's education curriculum. This objective was critical because any recommendations for new or improved assistive technologies had to address the nuanced realities of the students' daily struggles, the diversity of their disabilities, and the broader educational context in which they learn. No single solution could effectively address every student's challenges, making it essential to account for even the most minor differences in their experiences.

We chose each method to complement the others, allowing for data triangulation and a more robust understanding of the school's framework. Teachers were selected as the primary demographic for interviews and surveys because they could give us a high-level understanding of the school's workings. They offered indispensable generalized information that helped us gain insight into students' learning. By including alumni and caretakers in our research, we ensured that personal experiences and long-term observations were noted, offering a comprehensive view of the student's current and historical challenges.

One of our primary sources of quantitative data is surveys. We chose surveys as they are powerful and a widely used research tool, particularly when collecting quantitative data. However, they also allow open-ended questions to capture qualitative insights. All teachers, caretakers, and alumni answered the same questions, ensuring consistency and simplifying the process of concluding. The anonymity of surveys further encourages participants to express their opinions freely and honestly. Some of the questions included in the study to achieve our first objective are as follows:

- What challenges do students with physical disabilities face in accessing digital education resources? (Open-ended)
- What would you say are the most common causes of frustration among your students? (open-ended)

Problems presented by using survey methods generally come from survey distribution, which may or may not be accessed through a broad sample size. Without control in distribution, it can also lead to lower response rates and limited depth of experience from smaller numbers of sample sizes. To mitigate this problem, we asked the principal to help distribute it to every group of teachers, collecting larger data samples and ensuring better data collection.

With the quantitative data we gathered, we analyzed and visualized the data using tools like Google Sheets, enabling us to create pie charts or other graphical representations to help us achieve our objective. Conducting surveys provided teachers, caregivers, and support staff with a time-flexible option or a non-interactive research method. Conversations with these different demographics would give us another perspective to help with our objectives.

We acknowledged that there is potential for some response bias, as participants may provide more socially desirable answers rather than truthful answers. That is why all the survey participants will remain anonymous. Since longer surveys can cause fatigue, leading to rushed answers or disengagement, we limited ours to 13 questions. This included fast, scalable quantitative data alongside open-ended questions.

The surveys provided to Sri Sangwan School teachers, caregivers, and support staff provided insights into students' challenges and areas to concentrate on. We identified gaps in current tools and their impact on student learning, which will guide improvements to enhance academic outcomes.

In contrast, our interviews allowed us to obtain rich qualitative data by exploring personal narratives and detailed accounts of the challenges and successes experienced within the school. This method proved particularly useful for understanding the subtleties behind the quantitative trends observed in the survey responses. The open-ended nature of interviews enabled us to gain a deeper contextual understanding of the school’s dynamics. Despite these advantages, interviews were time-intensive and inherently subjective, limiting the breadth of perspectives captured due to the smaller sample size.

Our interviews were conducted one-on-one, and another team member recorded the audio to reference each interview accurately. We took notes and filled out responses on a spreadsheet. The interviews help with personal interaction, which allows for more in-depth insights and a deeper exploration of the interviewee's experiences and motivations. Some of the questions asked in these semi-structured interviews to achieve the objective are as follows:

- What are the most common physical challenges faced by students?
    - As this question is broad, we would follow up with specific instances, such as:
        - When it comes to using computers?
        - When it comes to writing?
- How have students struggled while learning in class?

One primary challenge with these interviews was that they were all conducted in Thai. Since only half of the team speaks Thai fluently, they conducted the interviews and translated them for the rest of the team. This resulted in even further time limitations, and not everyone was able to analyze the unprocessed data, leading to possible missed details.

We also acknowledge that there may be a bias based on our questions. For instance, presenting a ranked list of assistive technologies limits what the interviewees can consider. This approach could unintentionally exclude other valuable technologies and influence participants to focus on the given choices. To mitigate this, we placed the ranking question at the very end of the interview. This way, we could ensure that participants first had the opportunity to discuss their challenges and struggles openly before ranking our suggested options.

Additionally, the stress of interviews and the complexity of questions can sometimes make it difficult for interviewees to articulate their thoughts fully. To address this, we followed most questions with a simpler, rephrased version that conveyed the same objective, ensuring clarity and ease of response.

In conclusion, our research methods gave us a more comprehensive understanding of the Sri Sangwan School's structure. We chose surveys and semi-structured interviews with the school's teachers, alumni, and caretakers to achieve our first objective. This approach not only determined how we conducted our research but also directly impacted the recommendations we made to our sponsor. It ultimately helped us make informed decisions, increase the efficiency of our research, and decisiveness of our recommendations.

3.2 Objective 2: Investigate the Current Assistive Technologies used for Computer-Based Learning at Sri Sangwan School

Our second objective was to investigate the current assistive technologies used at Sri Sangwan School for computer-based learning. Before making recommendations to the school, we needed to understand its current assistive technology.

We set out to answer the following research questions:

- How do students interact with technology?
- What are their likes and dislikes with each technology?
- How frequently would they use it in their coursework?
- How effective are they in helping them complete tasks?

While we acquired this overview, we also learned the following:

- The challenges and limitations that the technology has presented
- Any struggles the students are having with using the tools
- The issues with the maintenance of the technology

We conducted classroom observations, interviews, and surveys. Using this multi-method design and examining various groups, we developed an overview of each

technology and its benefits and drawbacks. Classroom observations helped us achieve the second objective.

The school provided a basis for their technology, including pictures of each technology with a description. Two to four team members observed the classroom to see how the students interacted with it. They took notes on how the students used it and what technology they had.

We communicated the purpose of the observations, emphasizing the focus on assistive technology rather than teaching styles. We conducted our observations by sitting in the corner of the classroom without interacting with students. In this case, teachers and/or the principal informed students about our presence and why we were there. We only took notes on interactions between students and assistive tools. Mainly focusing on the accessibility of the setup, classroom layout, ease of use, student interaction with peers, teachers, and technology, as well as any challenges faced.

By understanding the existing tools, we aimed to research new technology that could meet students' needs. Observing student interactions with technology helped us identify patterns of struggle, allowing us to pinpoint technology barriers and challenges. We also assessed the level of peer support, noting whether students helped each other with devices, movement, or general curriculum. Some key aspects we sought to document were as follows:

- Which assistive technologies are being used?
- What aspects of the current setup facilitate student learning?
- Do students assist each other in using assistive technologies?

We recognized that student behavior might change due to our presence and that bias could influence interpretation. However, this issue was minimized with only two in-person observations. We also acknowledged that this method is time-intensive and requires concise planning to gather relevant data. The observations posed no risk to students, as we were passive and did not interfere with classroom activities.

In addition to ethnographic observations, we interviewed teachers to understand the most common technology used, the student's struggles, and potential recommendations and solutions. The teachers have a strong understanding of the struggles of assistive technology as they work closely with the students. We aimed to capture a broad spectrum of perspectives by varying the questions, enabling us to draw well-rounded conclusions. Some of our questions included:

- What assistive device would you say students currently use the most?
- What assistive devices require the most upkeep?
- Are there physical barriers in the classroom setup (e.g., desk height, seat position) that affect learning?

These questions serve as a framework for understanding if the students are struggling with the technology or classroom setup. For example, suppose the desk and monitor height are not adjusted for the student, and they have one setup for all students. In that case, the student will feel uncomfortable in their learning environment, which may result in a lack of motivation to learn the material, hindering their education experience. This would mean we

would switch our perspective into making a more accessible classroom for each student rather than a technology to assist with using their computer.

To further understand the assistive technology present in Sri Sangwan School, we collected demographic information through translated surveys written in Thai. We aimed to collect information regarding the number of years of experience, occupations, and statuses among teachers and caregivers present in Sri Sangwan schools, excluding the students. Getting a grasp of answers and satisfaction with the example group benefits our rough understanding while conducting on-site data collection methods. It is important to design the questions so that misinterpretation by participants won't occur. An example of a question we asked in the survey (Appendix E):

- On a scale of 1 to 5, how well do you think the current educational tools and technologies support students with physical disabilities?
    - We ask this question to gauge the current tools and see if they already support them. If not, we could develop a new tool to assist the students further and make their work easier. If the number analyzed is lower, we will need a new tool to replace their old technology, which would lead to a different focus area.

In conclusion, our ethnographic observations, semi-structured interviews, and surveys helped us obtain an overview of their current technology. The observations helped us with a brief overview of their solutions. In addition, the interviews and surveys with the school's faculty helped us learn about the challenges of the technology. We identified gaps in current tools and their impact on student learning, which guided improvements to enhance academic outcomes. This strategy helped us determine how we approached the recommendations we made to Sri Sangwan School.

3.3 Objective 3: Evaluate Three Assistive Technologies that can Enhance Students' Computer Literacy Skills

Our third objective focused on finding three assistive technologies that can improve students' computer literacy skills. To accomplish this, we utilized our previously researched solutions that have been implemented at other education organizations and collected data from Sri Sangwan School to provide a realistic and cohesive set of recommendations.

Research Question: How can we best address the challenges the students face with implementable solutions?

We aimed to learn more in-depth about how to best adapt to the students, specific learning areas that need improvement, and how we can enhance the current resources at the school. To fully understand our impact, it was vital that we had a baseline of the student's digital ability, measures of improvement, and current teaching standards. This meant that we needed a way to measure the student's potential improvement. Utilizing our archival research, we were also able to cross-reference the outcomes of similar solutions at other institutions to understand how realistic and effective our proposal is. Through research, we planned on developing questions and discussions to understand how to best measure the student's

progress with the recommended solutions. Thus ensuring that we can propose impactful ideas and concepts that make meaningful differences for the students and their futures.

Understanding our research data ensures that assistive technology is not only beneficial for the student's learning but also a resource for teaching. Through interviews and surveys tailored toward the teachers, we gained valuable insight into the student's learning. Specifically, the challenges the students face and how the current solutions have been beneficial or not effective. We then isolated specific areas that needed improvements, such as difficulty with motion, computer input, software-related challenges, and standard computer usage practices. This includes challenges when using a computer desk, difficulty understanding software, and an inability to use the provided peripherals. By understanding these key issues, we applied our previously researched solutions. This research identified areas that required training and helped ensure educators and students effectively use new resources.

We gathered the data using a variety of methods, like surveys and interviews, utilizing the questions and table below:

- What gaps still exist in accessibility for students with physical disabilities, particularly in technology use?
- Are there any specific features you think a new assistive technology should have?
- What were the biggest challenges you faced when using technology at school?
- Was there anything you struggled with when adapting to technology or physical barriers in the workplace?
- What lesson do you wish were taught in school so you could use it in the workplace?

We gained direct insight from the teachers and caregivers to drive the direction of our research. To grasp how to realistically implement our solutions, we leveraged data from interviewing the principal to outline constraints. From the surveys, we were able to obtain additional insight from all staff members, which guarantees a more thorough evaluation. To recommend the best assistive devices, we took all relevant information into consideration. (Appendix J)

These methods were advantageous due to our unique target audience and the plethora of perspectives needed to have thorough research. Through interviews, we gained firsthand and direct perspectives from teachers, caregivers, alumni, and the principal. By having a rich and diverse set of perspectives from those who work directly with the students, we were able to have a widespread understanding of the needs and challenges the students face. The alumni were prompted to provide detailed first-hand experiences of their education at Sri Sangwan School and their progress afterward. This data is intended to provide us insight into the hopes and aspirations of the students at Sri Sangwan School. From the teachers and caregivers, we intended to gain insight into the challenges when instructing students and the struggles they face when utilizing computers. To ensure our project stayed within the scope of our limitations, we interviewed the principal.

While the approaches we utilized were helpful, they presented many obstacles. Due to the restricted number of interviews, we only received feedback from a small portion of participants. Although we specifically targeted technology teachers, our findings may have

been biased, and we may have overlooked varied opinions. Additionally, we missed the opportunity to get input on how the assistive technologies were really used, which would have given us important information about how well they worked in actual classroom environments.

Even while providing a ranked table with visuals and descriptions, we were unable to fully communicate the potential of each assistive technology when used in a classroom setting. This led us to develop a more detailed table, providing videos, pricing, and use cases during the second round of interviews. It proved difficult to evaluate the technologies' long-term effects because of the lack of information. Furthermore, throughout the data collection procedure, some tools and accessibility techniques needed to be explained, which may have influenced participants' perceptions and assessments of them.

In addition, the research was constrained by a short timeline, which prevented us from conducting long-term observations or a follow-up investigation. Lastly, because the feedback might not fully represent the range of students' demands and difficulties, the small sample size further limited our findings. These drawbacks emphasize the need for more research with a longer timeline and a larger, more varied sample size. Even with these challenges, the conducted research is essential to dictating the direction of the project.

4. Findings

This section presents the key observations of the data analysis in parallel to our research questions and objectives. The findings are organized by the objective they address and contain sub-findings that emphasize specific insight.

4.1 Understand Students' Challenges and Highlight Specific Areas for Improvements

4.1.1 Structural and Educational Barriers Limit Student Growth and Independence

Our research methods allowed us to look deeper into the learning environment at Sri Sangwan School. These methods—classroom observations, interviews, and survey data—revealed that the current physical and technological infrastructures are not always adequately meeting the student body's diverse needs. The evidence highlighted several interconnected areas of concern. First, there were limitations with the physical layout and structure; second, shortcomings in teacher support and the curriculum; and lastly, there were mismatches between school resources and real-world demands that could limit students' independence.

4.1.2 Classroom Infrastructure Limit Student Engagement

Classroom observations demonstrated that fixed desk heights and monitor positions forced students into awkward postures. For instance, students often sat with their legs dangling, and many had to tilt their heads to see the board. In some rooms, the rigid spatial

design resulted in narrow corridors that, although wheelchair-accessible, occasionally obstructed movement and required students to wait for others to pass, thereby slowing overall circulation. These observations suggested that the existing classroom design could have benefited from more flexible, universally designed furniture. Teacher interviews reinforced these observations:

> Teacher A mentioned that the absence of adjustable desks in computer labs placed extra strain on students who wrote with their feet, resulting in imprecise typing and discomfort.
>
> Additional insights included Teacher E's observation, which pointed out that fixed table heights in the computer room were not suited for children of varying sizes, forcing those with limited mobility into awkward positions.
>
> Teacher F noted that assistive devices like keyboards and trackballs frequently broke from excessive force, while non-adjustable furniture further added to physical discomfort.
>
> Teacher D highlighted issues such as sunlight glare on boards and the lack of proper storage on desks, which often led to assistive tools being misplaced or damaged.
>
> In specialized classes for slow learners, Teacher G observed that seating and assistive tools, such as wheelchairs and hand splints, were frequently ill-suited for young children.
>
> Teacher J pointed out that fixed furniture in English classes hindered proper writing posture—especially for students who used alternative methods like writing with their feet—while the limited use of adaptive tools left notable gaps in support.
>
> Furthermore, Teacher K remarked that students with visual impairments had to adopt uncomfortable postures, such as tilting their heads, to see the board.

Alumni interviews added to these comments by praising the school in certain areas for wheelchair accessibility. However, they also pointed out that cramped spaces in some areas of the school made the physical environment less accommodating.

4.1.3 Insufficient Teacher Training Restricts Personalized Support

Beyond the physical layout, insufficient teacher training and rigid curricula further restricted personalized support for the students. Evidence from the interviews indicated that teacher preparedness was a significant issue. Mrs. Waraporn Panyaprachote, the teacher in the AT room, stressed that new teachers often lacked experience with disabilities, which resulted in inconsistent support for the students. She also highlighted a disconnect between AT room

specialists and computer lab staff, exacerbating the gap in personalized learning. The issue of learning pace was another concern:

> Several teachers reported that students required repeated instruction due to memory retention issues, as mentioned by Teacher H, or short attention spans, as noted by Teacher L.
>
> Teacher J further emphasized the slow progress in mathematics due to calculation difficulties.

Moreover, curriculum gaps were evident in the feedback from alumni. Alumni criticized the limited emphasis on English and advanced computing languages like Python, C, and C++. For instance, Alumni C urged a stronger focus on Excel and Canva, while Teacher K noted that outdated software like Photoshop was too complex for the students. These insights indicated that educators were ill-equipped to address the diverse needs of the student population.

4.1.4 Vocational Programs Lack Alignment with Industry Needs

Evidence from alumni highlighted the need for practical technology skills such as coding and video editing. However, outdated computers and slow internet connections were significant obstacles to preparing students for workplace demands.

> Teacher I, while praising graduates who had excelled in areas like TikTok and agriculture, stressed that foundational gaps in digital fluency persisted.
>
> In addition, gaps in life skills were evident. Caregivers and teachers pointed out deficiencies in financial literacy and self-care.
>
> Teacher M advocated for more training in laundry and self-care, while Teacher A emphasized the importance of fostering "self-learning" through the Internet.
>
> Teacher I acknowledged general uncertainty about whether the students were adequately prepared to meet modern career challenges.

These findings underscored that although the school played a critical role in bridging individual needs and societal expectations, infrastructural and curricular gaps continued to hinder its ability to fully support students transitioning to tech-centric workplaces.

Summary

Our key finding has shown that the current physical, pedagogical, and technological frameworks at Sri Sangwan School are not fully aligned with the diverse needs of its students. Inflexible classroom infrastructure, insufficient teacher training, and rigid curricula create significant barriers to student engagement and independence. Moreover, despite their

promise, vocational programs are hampered by mismatches between available resources and the demands of the real world. This insight lays the groundwork for future initiatives to enhance the learning environment and overall support systems for the students at Sri Sangwan School.

4.2 Investigate the Current Assistive Technologies Used For Computer-Based Learning

4.2.1 Students Need Tailored Solutions to Match Their Unique Needs

With our team visiting Sri Sangwan School, we gathered valuable insights into the student's current technologies. We learned about how each student is unique in the way they work, the technologies they use, and how they complete their objectives. Our data analysis revealed three main insights into students' use of assistive technology.

4.2.2 Students Combine Technology and Techniques to Complete Tasks

During our initial visit to Sri Sangwan School, we conducted a set of classroom observations where a few students were working on a task, a special Canva presentation for the school. One student used a trackball mouse (Figure 9) and a clipboard. That student would use a clipboard board at an angle from the desk towards them so they could put a mouse on top for easier use. The teacher demonstrated how the students attempted to use the mouse without the clipboard, and we observed their challenges. Without the clipboard, that student struggled with getting their arm on the desk to use the trackball mouse to complete the presentation.

In contrast, they could use the mouse more comfortably when using the clipboard, as it was better for their dexterity. However, other students could use the trackball mouse on the desk, as their disabilities varied. Since a traditional mouse posed a big challenge, most students would use the trackball mouse. These were the most commonly used, resulting in the trackball mouse being the most common to break due to unintentional aggression and accidental dropping.

Figure 15

Demonstration of Mrs.Waraporn Panyaprachote using blanket to secure Siraphop Homhual

Note: Taken by Madalyn Nguyen

The teacher also demonstrated how some students would use a keyboard. Most keyboards in the school came with an attachment, which was the keyguard (Figure 6). Students who struggle with typing would use this, as each key has its slot on this guard, resulting in fewer mistyped keys. They showed us how students could use their hands, but using the silicon brush with the foam soccer ball through it was more manageable (Figure 7). This was used to make it simpler for students to grip the brush, as the foam ball was convenient to grab. Combining the brush used as a button pusher and keyguard to prevent typos helps the students type more efficiently.

For students who struggle to stay seated upright or have occasional spasms, they tend to fall out of a standard chair. The school would use a cloth similar to a scarf and wrap it under the student's arms, near the stomach area, around the chair. This would secure a student to the chair, making it harder to fall out of. This not only helped the student stay in place, but it also helped them in case something unexpected occurred; they wouldn't hurt themself on a desk.

Based on these uses of technologies and techniques, we observed that a combination assisted them the most. Therefore, each student has a unique mix of the two to help them use the computer.

4.2.3 Students with Upper Limb Disabilities Rely on Their Feet

Through ethnographic observations and semi-structured interviews, we understood how students with muscular dystrophy or limb loss can use their feet to use a computer. Teachers at Sri Sangwan aspire to have certain technologies that help students who can only

use their feet. During our semi-structured interviews, school alumni and teachers stated that certain students need to use their feet, and using a computer still poses a significant struggle.

> One of the Alumni, Alumni C, of the school responded to one of our questions with, “If it were me, I want to try and make a mouse that those with feet can easily use.”

> A teacher who teaches writing, Teacher H, stated, “I want a pen that can be controlled with the foot for students who struggle with their arms.”

From two of the interviews conducted, we understand that the trackball mouse, which is the primary mouse these students use, still isn’t beneficial since they are hoping for new technology and they need some additional technology for gripping with the foot for better control.

Although we didn’t observe any students using the mouse during our time at the school, our semi-structured interview and a teacher's demonstration helped us learn how students use their feet. The teacher placed the trackball mouse on the ground, used her feet, and explained the drawbacks of using it this way. The mouse lacks good non-slip padding, slides around, and makes it difficult to use the cursor accurately.

They also struggle to use the keyboard, as many students can only type using their feet. To overcome this, they use a silicone toothbrush, grip the brush around their toes, and type using this method. However, this method takes a while and is not as efficient, which results in a lack of motivation to work.

While the school has developed ways for students to adapt to using computers, there are still gaps that need to be filled. The trackball mouse lacks stability, and typing is inefficient and discouraging. Alumni and teachers seek better options for these students that will benefit them in the future.

4.2.4 Adaptive Gripping Tools are Needed to Improve Accessibility for Students with Limited Hand Strength and Dexterity.

A common finding in our ethnographic observations and interviews was that a primary struggle for students in all classes is holding various items. Students who can’t grip items properly tend to have a rubber band tied to their hand or arm and hold the item between them. Other students who are able to grip items but have limited strength tend to hold bigger objects. Yet, no matter what, the item tends to fall out of their hands.

> A teacher, Teacher G, had stated, “... bring the item that they need to hold and tie it with a rubber band to increase the gripping strength of the students….”

> Another teacher, Teacher J, mentioned that "The pencil must be big so it's easier for them to grip.”

> Teacher K was asked about difficulties some students tend to face and mentioned, “If there is an assistive device helping to hold a pen/pencil, it would be very helpful.”

When asked, *What skill would you like to see the student improve for their future and daily life while using an assistive device?*, Teacher J stated, “As is, there is a device to assist them on holding items.”

Through these interviews with teachers, finding that students struggle with holding items, they also seek better technology that will help with holding various items. They seek some technology, similar to the rubber band, to help.

Summary

We found that students at Sri Sangwan School have many assistive devices when using a computer. Yet our observations showed that they require tailored solutions to their needs. Each student, depending on their disability, required different combinations of technologies and techniques to complete their tasks.

Students with muscular dystrophy or loss of limbs in their upper body adapt by using their feet. Tools such as the trackball mouse and keyboard with keyguard paired with the ball grip typing aid still pose challenges. Through interviews with alumni and caregivers, they highlighted the need for new solutions for more foot-accessible devices to better their ability to use a computer and encourage learning.

Finally, students who have limited hand strength have struggled with gripping various objects. They often rely on rubber bands, oversized tools, or tools with objects through them. Teachers have emphasized the need to improve their grip to complete tasks more independently. While they have current solutions for this problem, there still remains room for improvement in their ability to grip.

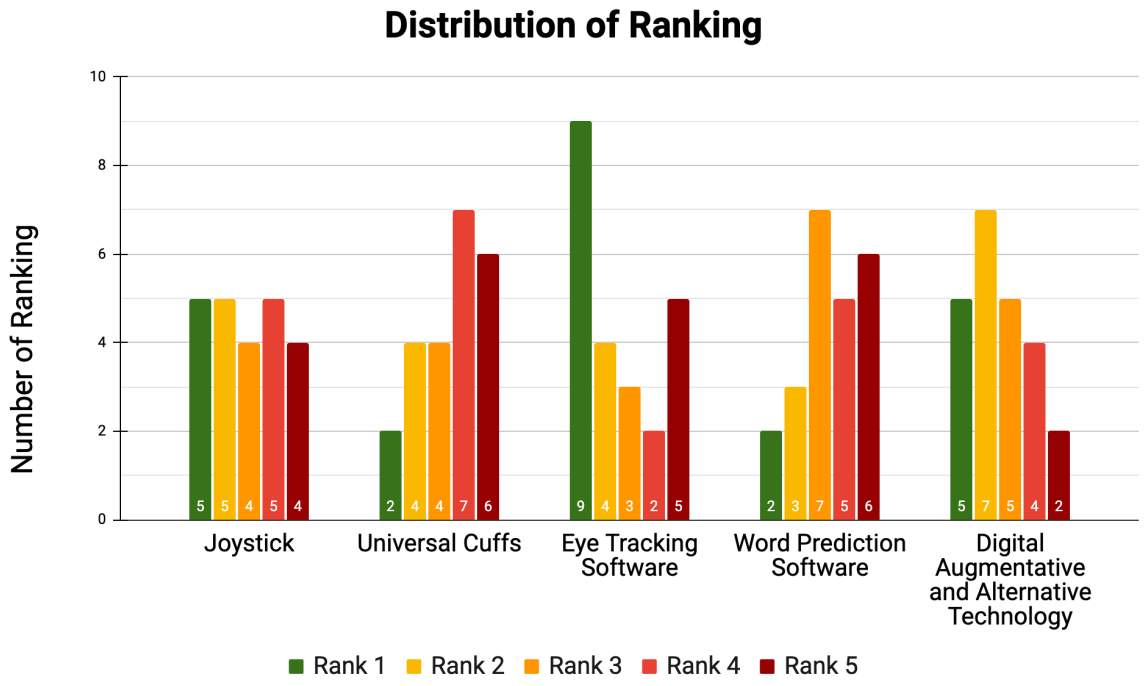
4.3 Investigate the Current Assistive Technologies Used for Computer-Based Learning

During our initial classroom observations and prior research, we developed a list of useful assistive technologies the school does not currently provide. This list was filtered down from our archival research (Table 4). Since these technologies are being used in other schools and have been proven useful, we included them in our list for rankings. Through our observations, we understood the needs of the students and had the teachers rank five different technologies. These vary based on what the school desired, the budget, and most importantly, what will be most beneficial to the majority of the students.

From the list we provided in the interviews (Appendix J), we had the teachers rank each technology from rank 1 to rank 5. One being the highest, meaning this would benefit the students the most, and five being the lowest, would not benefit the students. From our 23 interviews with teachers, caregivers, and alumni, we have these rankings.

Figure 16

Distribution of Rankings of Recommended technology from Teachers



Note: Ranking of assistive devices from 23 participants

With this, we gave each rank an assigned value and calculated the average. The highest average would provide us with technologies to focus on. We found that the eye-tracking software had the highest average at 3.43. This signifies that teachers would prefer this technology most among others. The other averages are 3.39 for digital AAC Technology, 3.09 for joystick mice, 2.57 for word prediction software, and 2.52 for universal cuffs.

With these rankings from 23 interviews, we focused on the top 3 being the eye tracking software, the digital AAC Technology, and finally, the Joystick mouse. Yet through further research, the digital AAC boards are per person and will not particularly assist in being able to use a computer as it is just a personalized tablet. They are beneficial in helping a student learn and communicate but do not necessarily assist in computer usability.

> "...these 10 kids will have their tablets wherever they go. .... Sadly, 10 other people would also want it as well, ...but we do not have it" - Mrs. Meena Rodklai, Sri Sangwan's School Principal.

During our observation, we saw each student with their own board to communicate, which means each student would then need their own digital AAC board. The cost of each board was also expensive, which led us to not pursue this technology. Instead, we pursued word prediction as an alternative.

4.3.1 Software Assistive Technologies Are Cost-Effective but Challenging to Integrate

Eye Tracking Software

Eye Tracking combines a webcam and software to see your face, more specifically your eyes, and is able to calculate where you are looking. Certain companies that develop both cameras and/or software have an accessibility option where the cursor can move with your eyes. With some software using a webcam you already have, the cost-effective softwares can range from approximately 12 USD or approximately 590 THB (if a webcam is already provided) or 52 USD or approximately 1760 THB (if webcams need to be bought). This eye-tracking software is provided by *Beam* and can be bought from their website or Steam. A higher-end camera and software is approximately 2250 USD or just under 75,000 THB provided by *Tobii*, who are a global leader in eye tracking technology, trusted by companies like *Unilever* and academic institutes like Harvard and Chulalongkorn University.

Through research, we found eye tracking to prove beneficial for students with physical disabilities. Studies were conducted with individuals with cerebral palsy utilizing eye-tracking software to assess its effectiveness and usability.

A study was done on students with severe physical impairments (aged 1-15) to examine their parent's satisfaction with the gaze-based assistive technology. This study found that children increased their computer usage. The children had more activities per day, and the time spent performing activities had decreased (Borgestig et al., 2016). They also found high satisfaction with the assistive technology from the parents.

Another study was conducted on adults in Taiwan with amyotrophic lateral sclerosis (ALS), which is a neurodegenerative disease that affects nerve cells in the brain as well as the spinal cord. This study was a case-control study of 20 adults. Ten adults didn't use an eye-tracking assistive device, while the other ten did. The participants had picked up the technology and how to use it within a few days. The scientists assessed the patient's quality of life and severity of depression through a questionnaire. They also did the same with caregivers to rate their quality of life with that person. At the end of this 6-month study, the group with the eye-tracking technology had significantly less depression, significantly higher quality of life, and reduced the caregiver burden (Hwang et al., 2014).

This was our justification for adding eye-tracking technology to our table of rankings for the teachers, alumni, and school caregivers.

Through our interviews and the initial set of rankings presenting what eye tracking is and how it can be used, our team developed a graph and found eye tracking to have the most number of votes, as well as being ranked one, for a technology to be integrated into the school.

Word Prediction Software

Word prediction software is another software that can help students with physical disabilities complete tasks faster and more efficiently. Word prediction is a form of machine learning where an algorithm is able to analyze patterns of previously typed words and predict

the next word. With the predicted word, you are able to select it, making it faster to type as well.

A study was conducted with students with cerebral palsy, and they had students type paragraphs before and after using word prediction. A small sample size of six students participated in the study. They found improvements in five of the six students in spelling and reduced the proportion of misspelled words by at least half, which means 43% misspelled words without the word prediction to 19% with word prediction. Teachers of these students also noted an increase in the quantity of writing and student motivation in their classes (MacArthur, 2000).

Another similar study was done among students with cerebral palsy where they had to produce a text, one without the assistance of word prediction software and one without. “Results indicated the word prediction of the keyboard emulator software reduced typing efforts…. execution time using prediction, 61% typed the text in less time” (Jordan et al., 2020). With this effort reduced, the students can focus more on the task at hand. This is our justification for adding word prediction to our table of rankings for the teachers, alumni, and caregivers from the school.

The software most commonly used throughout these studies was Co:Writer, which specializes in word prediction. A study was done to examine the impact of this software on 24 students. Surveys were then completed by teachers and adults of the school in British Columbia (Mirenda et al., 2006). With this technology, they found that it helped students write more with less strain, experience less frustration when writing, and read more easily what they had written. They also found a higher percentage of correctly spelled words and word sequences (Mirenda et al., 2006). Yet this study was done with the English language rather than the Thai language, which might lead to inconsistency if implemented.

Through our interviews and the initial set of rankings to present what word prediction is and how it can be used, our team developed a graph and found word prediction to be ranked number four out of five. The disconnect between our research and teachers' thoughts of the software could be from our lack of the way we presented this technology. We presented the software as it could only be used in English, yet word prediction is also available in Thai, as provided by *NECTEC*. Thus, teachers would not have supported this as they were led to believe it could only be used in English and not their native tongue.

Drawbacks of Integrating Software

Many challenges are posed by integrating software into teaching and learning. Regarding software specifically, a school needs the infrastructure to support it, the proper technology and security, sufficient resources, and people for maintenance and technical problems. From a teaching perspective, teachers would need to be trained in this technology as well. Yet one main concern that comes with all this would be time.

A school in South Africa had worked on integrating software into their school. They highlighted a few key struggles, one of the primary ones being the unavailability of policy on technology (Ramorola, 2013). Since there was no proper format or guidelines to implement the technology, it raised a concern when they interviewed teachers. Without any sense of direction, teachers don't have guidance on how to effectively use their technology in their

classrooms. In this case, at Sri Sangwan School, if teachers are not able to effectively understand how the provided technology works, they are unable to integrate it into their teaching. Well-implemented software needs guidelines or a format to help students effectively learn.

Another study in Turkey was conducted using information and communication technology integrated into a private school. In this study, data was collected from 105 teachers, 25 administrative staff, and 376 students to understand the effective integration of technology (Gülbahar, 2006). They mention that the school already has an adequate infrastructure, including a solid network, up-to-date computers, and the latest versions of their software. From integrating software and learning about its experience from the demographics above, the study learned how schools must be adequately equipped with proper tools. Yet, one key point they mention in the end is a *work-in-progress* document. Due to rapidly updating technology, revisions or updates will be needed in the future. With this, a document should have future implementables with each technology (Gülbahar, 2006).

Overall, integrating new software into a school presents various challenges, from infrastructure and policy gaps to training and maintenance. We have learned that having a clear framework, sufficient resources, and continuous updates are important for long-term success. With this, Sri Sangwan School needs proper planning and adaptability to fully leverage new software to enhance students' education. Therefore, to ensure effective integration of eye tracking and/or word prediction software, the school must be aware of all drawbacks of integration and provide any updates before spending time and money.

4.3.2 Physical Assistive Devices Raise Cost Concerns

Adjustable Desks and Ergonomic Layouts

Implementing adjustable desks, ergonomic layouts, and advanced technological structures can significantly enhance accessibility for students with diverse needs. To address the difficulties highlighted in our first key finding, these improvements will alleviate obstacles when learning and engaging. Adjustable equipment can enhance posture, relieve muscles and pain, and improve concentration for students with diverse physical needs. Studies demonstrate that standard desk heights are incompatible, leading to discomfort and reduced participation for certain students. Research on Chinese students indicates that adjustable desks, designed according to age-specific anthropometric data, enhance comfort and learning effectiveness by conforming to students' body measurements (Shi & Yu, 2022). Similarly, Sri Lankan University classrooms reported less discomfort following the ergonomic modification of desks to align with the user's positions. (Lin, 2024)

Adjustable Monitor Stands

Incorporating adjustable monitor stands helps enable students with vision impairments or mobility limitations by allowing them to adapt their workstations to their needs. This reduces strain and enhances focus during computer-based learning. Static monitor angles frequently cause students to have improper posture, resulting in persistent pain (Lin, 2024).

WiFi Infrastructure

Enhancing WiFi infrastructure promotes digital inclusion, especially for students who are dependent on cloud-based assistive tools such as voice-to-text software. Research indicates that unreliable WiFi hinders students' performance, limiting real-time working and access to online learning tools (Alasuutari et al., 2024; Krazinski et al., 2023).

Storage Solutions

Utilizing the accepted solutions for storage would enhance the functionality of assistive devices, such as trackballs or keyguards, hence minimizing occurrences of misplacement or breakage. Interviews with educators revealed common concerns about the loss and deterioration of tools due to insufficient storage. Systematic reviews indicate that the inclusion of secure, labeled storage areas in classrooms can improve the durability of devices (De Oliveira Soares Campos Araújo et al., 2023). By implementing these strategies, the school has become more successful at fostering an inclusive and accessible learning environment.

Joystick Mouse

Joystick-based input devices offer a reliable alternative for users with limited hand dexterity by converting simple joystick movements into precise cursor control. Several recent studies support their inclusion as a key assistive technology: A study published in PMR Clinics (Dicianno et al., 2010) demonstrated that joystick interfaces significantly improve mobility. In the context of powered wheelchairs, the use of a joystick not only facilitates easier navigation but also enhances control precision for individuals with severe motor limitations. Research from LUP (Nilsson, 2024) has shown that even infants as young as 3–4 months can develop an understanding of cause and effect by using a joystick to control a powered wheelchair. This early demonstration of learnability indicates that joystick devices are intuitively accessible, making them particularly effective for users with limited motor function. Further supporting this, a study from UPC (José et al., 2012) describes how the joystick integrated into a wheelchair can be repurposed as a computer mouse. This finding underscores the versatility of joystick interfaces in facilitating digital access—allowing users to seamlessly transition from mobility control to computer interaction.

Seeing this direct parallel of the joystick used for wheelchair mobility, its natural intuition, and how it can be translated in using the computer was our justification for adding them to our list of assistive devices for the teachers, alumni, and caregivers to rank.

Cost and Sustainability Concerns

Although advanced assistive devices like adjustable desks, monitor stands, and secure storage solutions can greatly enhance accessibility, their higher initial costs and ongoing maintenance expenses present a significant challenge. Research shows that height-adjustable desks, for example, can cost two to three times more than standard desks (Shi & Yu, 2022; Sudholz et al., 2016). Securing additional funding, streamlining maintenance, and providing

adequate teacher training are essential strategies to ensure these investments remain sustainable over the long term.

By strategically allocating resources and advocating for external support, Sri Sangwan School will be able to sustain accessibility improvements in the long term. Addressing these cost and sustainability concerns is essential for ensuring that students with disabilities have equitable access to education. By utilizing strategic planning and investment, educational institutions can establish a more inclusive learning environment that benefits all students.

5. Recommendations & Conclusion

Throughout the course of the project, our team had the opportunity to engage with a diverse range of individuals during our time in Thailand. Our project allowed us to observe the inspiring successes of Sri Sangwan School and contribute to a vitally important mission. We gained immense insight from those at Sri Sangwan School and heard invaluable, eye-opening perspectives. While the alumni, teachers, and caregivers shared their experiences of overcoming and determination, the strength we observed at the school can be described as nothing short of the indomitable human spirit. During our project, we had the honor of understanding the importance of education, equity, and opportunity.

5.1 Recommendations

The goal of this project is to assist Sri Sangwan School in enhancing assistive technology for computer literacy skills. We utilized our analyzed data to understand which of the assistive devices are best applicable to the school. We identified some key constraints, such as cost, long and short-term impact, infrastructure compatibility, maintenance, and required faculty support, that guided our recommendations. These recommendations stem from our archival and on-site research, which allowed us to determine how to best address areas of improvement.

5.1.1 The Right Joystick Mouse can Support Assistive Learning

Our first recommended device addresses the shortcomings of the physical assistive devices currently used as peripherals. We found that a joystick mouse can be utilized to improve many of the movements based on challenges vocalized by alumni and teachers. As an established assistive device currently used at other education-based institutions, it can be immediately implemented and utilized by students. With a mid-range cost and learning curve, it’s a device that can have quick and long-term impact.

Very few companies provide a joystick mouse that fits the needs of the students we are working with. The primary company that provides these mice is *Pretorian Technologies*, a company based in the United Kingdom that provides a variety of devices but specializes in mouse alternatives. And the other company is a more well-known one, *Microsoft*. Each joystick mouse from each company has its benefits as well as their drawbacks.

The mice provided by *Pretorian Technologies* are the standard when it comes to joystick mice. The picture of the joystick we used for interviews with teachers, alumni, and

caregivers was from this company. They provide nine different mice ranging from £212.80 - £382.80. As they are not locally based, shipping from the United Kingdom to Thailand comes with a cost. Their mice are accessible via a Windows operating system and have no minimum system requirements, which is applicable to the school's current computer labs. Since the mice are pre-loaded with the necessary drivers, no additional installations are needed. It can be plugged into a free USB port and ready to use. Each mouse provides a variety of features. On the lower end, the main features provide precise tracking and cursor control, a double-click option, and a low profile. Although they primarily mention the mouse being put on the desk, they can also be on the ground for students to use their feet. The main drawback of the mouse they provide is the cost, as the base price exceeds 9000 THB without shipping. Although this company specializes in assistive devices, almost no studies have actually utilized their mice but rather their other devices.

The other adaptive mouse provided by *Microsoft* is part of their adaptive family. To use the mouse, you must buy their adaptive hub, which starts at 99.99 USD. The mouse costs an extra 60 USD, totaling approximately 160 USD. The only requirements for this device are a Windows operating system and a free USB-C port. This mouse also has a plug-and-play function, where once connected to the hub via Bluetooth or cable, it is ready to use. This mouse is another small form factor mouse primarily meant to be used on a desk, but it can be put on the ground for students as well. A key benefit to *Microsoft's* adaptive family is that one adaptive hub can host many of its other mice and switches as well. Since the joystick is small, they provide the ability to have their own custom 3D-printed designs that attach to their devices. With this, the school can print out larger joysticks and swap the new attachment with the standard one. This allows for flexibility as they can tailor the 3D-printed model to the student. This could lead to a shorter life span of the product. As some students are not able to control their strength, it has a higher potential to break or be worn down faster.

The joystick mice from *Pretorian Technologies* and *Microsoft* both have the ability to improve accessibility for students with movement challenges. *Pretorian Technologies* provides its assistive devices with plug-and-play functionality, yet it comes at a higher cost. *Microsoft,* on the other hand, offers modularity and customization with 3D printing, making it a more flexible solution, yet it comes with its life span. The choice between the two of them relies on the school's budget and its long-term usability. Implementing either of these devices has the potential to better assist in digital literacy by helping the students engage with technology more effectively.

5.1.2 Top Performance versus Cost-Effective Eye Tracking Solutions

Our second recommendation focuses on providing assistive software and hardware that can be applicable to the majority of students and help with their ability to control a mouse without a physical mouse. Eye tracking works by using an infrared camera or infrared sensors to detect and analyze eye movements. A brief calibration process is used to calculate what someone is looking at on a screen. Eye tracking is able to interpret gaze, blinks, and fixations. This, combined with other software, often helps people use computers, tablets, and phones hands-free. As seen in Sri Sangwan, there are many assistive devices to try and overcome cursor movement, yet it still lacks in a lot of areas, from each technology needing

to be tailored to the student, technology breaking due to uncontrollable strength, and physical strain trying to use devices.

We have two primary recommendations for eye-tracking technology. One is a camera, and the other is software provided by *Tobii*, an eye-tracking company. The other is software with some external written code and uses a pre-existing camera. With both of these, students are able to control the cursor with their eyes, but one is much more accurate than the other.

Figure 17

Disabled person using PCEye (Tobii Dynavox.) (2025)

Note: This figure is taken from Tobii
https://www.tobiidynavox.com/pages/pceye

Tobii Dynavox Eye Tracking, PCEye paired with TDControl

Tobii is a company that has been in eye tracking for over 20 years. They have certain branches within their company that specialize in certain areas. *Tobii Dynavox* is their branch, which is focused on AT for communication and computer usage. With this, they have a technology called the PCEye, and paired with their TD Control software; students would not need to use any limbs to control the computer. They would only need their eyes. The PCEye is a hardware device that requires certain computer specifications.

- Operating System: Windows 10 or later
- Processor: 2 GHz processor or faster
- Memory: 8 GB of RAM
- USB Port: USB port of 2.0 or higher
- Screen Size: Up to 27 inches (Tobii, 2025)

The school is already equipped with the necessary computer specifications, making integration of this technology convenient. The PCEye is an infrared camera that delivers precise screen target selection and fast recovery time in case the device loses track of the eyes. TD Control allows over 20 specialized user profiles to assist each student with their

needs. TD Control remembers each user, and when a student goes back to their device, they are able to log into their TD user profile and start using the computer hands-free.

Figure 18
Image of the PCEye camera and TD Control

Note: This figure is taken from Tobii Dynavox (2025) https://www.tobiidynavox.com/pages/pceye

We had the opportunity to meet with a *Tobii* representative who displayed PCEye's capabilities. We watched as they demonstrated how students are able to use this camera and software to control a computer hands-free. Although there is a steep learning curve, once they understand how to fully utilize the technology, students would not need to use a mouse or keyboard and have full control over a computer.

With new and advanced technology comes an expensive price tag. The PCEye for a single unit is 2250 USD, which is over 75000 THB. This price comes with TD Control as well as a lifetime warranty in support of this product. The representative explained how any damage done to the product can be sent back to *Tobii* for a completely new PCEye. This lifetime warranty is highly sustainable in helping the school save money in the long term. They also stated that the more units bought, the lower the cost per unit.

Beam Eye Tracking Software

The other eye-tracking technology is purely software-based. It is called Beam Eye Tracker, and it can be bought either from *Beam's* website or Steam. Beam Eye Tracker uses the already built-in webcam or an external one. It is able to calculate where your face is and then learn where your eyes are, and from there, you are able to undergo the calibration process to use the eye tracker. Our team had attempted to use Beam and found a few challenges, the main one being the consistency of the eye tracker. We would look somewhere on the screen, and it would be slightly off, which would result in us having to look further away from what we wanted to look at initially.

Although this technology is cheaper, we believe it is not precise enough for students with physical disabilities. Through some coding, we were able to develop an extension where a user would be able to move the cursor with their gaze. With this extension if you look to your desired location, although it may be a bit off, you are able to move the cursor. This still requires the use of a mouse for left and right click functionality. This would lead to less movement of the overall mouse as you would need to make the minor adjustment for it. This software costs approximately 590 THB in Thailand but since it doesn't come with a webcam there would be an additional cost for a camera for the school. We reached out to the company and for our application the minimum specification for the web camera should be 720p and 30fps. The minimum pc requirements for this software are listed below and are all meant with the schools current computers.

- Operating System: Windows 10 or better
- Processor: Intel i5-4590 or AMD FX8350 or greater
- Memory: 500 MB RAM

With both of these options we leaned towards recommending *Tobii's* PCEye and their technology to assist the students of Sri Sangwan School. Many challenges are posed with Beam Eye Tracking and with long-term sustainability for the school, Beam Eye Tracking would not be feasible. Despite the price tag of *Tobii's* PCEye, eye tracking technologies can help the students and assist in the long-term (Donmez, 2022).

5.1.3 Comparing Two Word Prediction Softwares

Our third recommendation focuses on providing a word prediction software that can help students type faster as well as learn easier. Word prediction can be found on many everyday devices and softwares. One of the primary ones being on the iPhone IOS Messages. When typing a word, suggestions will appear above the keyboard based on what you are typing or what you may plan to type. These suggestions are made using natural language processing. With this students are able to type faster as they would not need to type out the whole word as the word prediction is assisting them in their next word.

We found two primary word prediction softwares had come up. Co:Writer being the primary one and was found throughout many studies, and *NECTEC's* word prediction software specifically built for the Thai language.

Co:Writer is compatible with any Windows or ChromeOS and provides many features. Word prediction being the primary reason Co:Writer is used, there are other features like flexible spelling. For example, a student wants to type "dragon" but they don't understand the way it's spelled, they can spell "jargon" and the flexible spelling is able to understand they mean "dragon". Being able to write the full sentence the algorithm understands what the student could intend.

Other features being speech to text and vice versa. This software requires a license which costs approximately 4.99 USD/month from their website (*Read&Write for Education - Reading, Literacy & Assistive Software*, 2025). But they also state that it is free for teachers who want to utilize it for their school. Co:Writer has potential drawbacks when integrated into schools in Thailand. The software is primarily meant for the English dictionary, which

poses a challenge as the students have their English class on paper rather than computer. With this, it makes the software almost obsolete unless the school plans to adapt their English class to utilize computers more.

The other software, provided by *NECTEC,* is Thai word prediction software. Not many studies have been done using *NECTEC,* nor is there much information on how to obtain the software. *NECTEC* has been provided to many schools to help their students with Thai. This software has been implemented in over 900 schools across Thailand, and it is not just beneficial for students with disabilities (Dtmd-Saw, 2021). They have found high success and have put over 100 million baht into the development and expansion of this software. Although no price per license is stated, no place to buy, or any further information, we believe reaching out and potentially partnering with *NECTEC* will be beneficial to Sri Sangwan School. It is developed for students with disabilities and specifically built for the Thai language to assist in learning.

We have learned from numerous studies (Jordan et al., 2020; MacArthur, 2000; Mirenda et al., 2006) from different schools that word prediction software has proven beneficial in helping students learn the language and make writing easier. While Co:Writer offers different features, like flexible spelling and speech-to-text, it is limited to English only. On the other hand, *NECTEC* and its software have been deployed in over 900 schools across Thailand, making it a promising solution. However, not having much information on how to obtain a license could pose a long-term struggle. Partnering with either company may provide the school with the tailored, accessible tool that they need to enhance the student's education experience.

5.2 Limitations

While our research provided ample insight that resulted in findings to develop recommendations, several limitations must be acknowledged.

Our research focused exclusively on the alumni, teachers, caregivers, and the principal at Sri Sangwan School, which limited the breadth of our findings. As a result, we only gained the perspectives of those at Sri Sangwan School and potentially missed valuable insight that could have been provided from outside sources. Although our project specifically addresses digital education at Sri Sangwan School, it affects the potential generalizability that could be applied elsewhere.

Our primary aim was to find or develop solutions that could empower the students at Sri Sangwan School. Due to our IRB and working with a susceptible population, we were unable to conduct direct research with the students themselves and had to rely on insight from teachers, caregivers, and alumni. Although this insight provided very detailed and valuable information, it may not have fully reflected the experiences of current students.

Although we found and developed solutions that could best apply to Sri Sangwan School based on our research, we were unable to implement and test them with the students. Without direct and first-hand feedback, we are unable to measure the exact impact and effectiveness of our recommendations. To best understand the viability of our research recommendations, we utilized archival research to find similar devices implemented at other education organizations that demonstrate parallels to Sri Sangwan School.

Despite these limitations, we utilized alternative methods or sources to ensure our findings and recommendations can still improve the digital literacy of the students. Even with our limitations, we still believe these recommendations will bring about impactful change at Sri Sangwan School. When implementing our recommendations, we hope the school observes and assesses the effectiveness and adapts to best suit the students at Sri Sangwan School. In the future, we recommend that researchers further explore the direct effectiveness of our recommendations and observe the interactions and experiences the students have with the assistive devices.

5.3 Long-term and Short-term Impact of Our Recommendations

To ensure sustainable and continuous improvement in the digital literacy experiences of students at Sri Sangwan School, our recommendations aim to both allow for immediate implementation and timeless solutions. Having a large range of costs and low implementation requirements allows Sri Sangwan School to integrate these solutions so students can benefit without needing extensive resources or teacher training. A main concern of the teachers was tools that need regular maintenance or often break due to abnormal usage, which is a common issue of many of the currently used assistive devices. Many of the suggested tools require little to no maintenance and are best adapted for the students at Sri Sangwan School to ensure long-term use.

Enhancing the digital experience for students equips them with vital skills, allowing them to pursue higher education, meaningful careers, and greater opportunities. This alone provides these students with the opportunity to excel and change the pre-existing stigmas that surround disabilities in Thailand. Although there is significant progress still needed to change the attitude and treatment of those with disabilities, providing these students with resources and support to reach their full potential is the first step.

5.4 Further Support

Although we have provided the groundwork for implementing the recommendations, we wanted to ensure that the more emerging and promising solutions will be applied. Through external research and networking, we reached out to various companies that developed our recommendations to learn more about their solutions and the implementation process for Sri Sangwan School.

We connected with a *Tobii* Eye Tracking Liaison for Thailand and Vietnam to learn more about the product application; he demoed the product and outlined pricing for Sri Sangwan School. In addition, we learned that if this is a solution that the school pursues, any maintenance, setup, software updates, and training would be provided. As well as any issues or damage that occur, the lifetime warranty will cover it. This connection allows for ongoing support and remedies the concerns previously voiced. We hope Sri Sangwan School leverages this connection to follow through with the implementation of *Tobii's* product into its current curriculum.

5.5 Conclusion

Our study aimed to evaluate the current IT curriculum at Sri Sangwan School and recommend three assistive devices and general suggestions to create a more adaptable environment to improve the digital literacy skills of the students. Through conducting archival research, interviews, surveys, and ethnographies, we discovered key areas of improvement and education goals of the students. Our findings indicate that having well-adapted assistive devices that address the unique needs of the students allows them to learn effectively, resulting in minimal setbacks. Additionally, with sufficient support, these students are able to learn topics and subjects that weren't previously available to them. Our three recommended assistive devices, eye tracking software, word prediction software, and joystick mice, address the majority of disabilities and needs of the students. These devices vary in cost, infrastructure, and implementation resources and have minimal teacher training needed, to provide the school with a range of options. The general suggestions provided help to alleviate fundamental challenges the students experience, like difficulty with maneuverability or better technical practices. To summarize all our findings, we have compiled three recommended assistive devices to enhance the digital education for students based on our understanding of the current climate of Sri Sangwan School.

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Appendix

Appendix A: Informed Consent Agreement for Participation in a Research Study (English)

Investigator(s):

Madalyn Nguyen, Mahit Verma, Mohammed Adem Djadid, Sean Arackal, Pawin Harijanwong, Siraphop Homhual, Marissa Rukachantarakul, Bhurinat Sumetchotimaytha

Contact Information: srisangwanissp@gmail.com

Title of Research Study: Reimagining Digital Education for Sri Sangwan School

Sponsor: Sri Sangwan School

Introduction

You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks, or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study:

The purpose of the study is to learn more about methods, solutions, and current ideas being used to make education, specifically for digital education, more accessible for students and youth with physical disabilities. In addition, we hope to learn what areas in education and career readiness need more support and help.

Procedures to be followed:

Interviews: Participants will be asked a series of questions based on their expertise, lived experiences, and relation to physical disabilities. From the questions, participants will be encouraged to share their personal experiences and any unique perspectives on our project.

Surveys: Participants will be asked to fill out a questionnaire that includes questions about their expertise, lived experiences, and relation to physical disabilities. They may be asked to rate ideas, methods, and solutions for accessibility on a scale. All participants will be required

to fill out information about demographics, but we will not ask questions regarding contact info or personally identifiable information.

Focus Groups: Groups of participants will be asked to lead discussions focused on different topics regarding education, physical disabilities, and accessibility services. Researchers may ask questions or make comments to guide the discussions. Anything said or mentioned during these discussions may be recorded or documented.

Classroom Observations: Classrooms will be observed by researchers or recorded for research. All participants will be informed observations will occur and will have the option to opt-out.

Duration of Participation: Participants will be involved in this study through one or more of the previous methods: interviews, surveys, focus groups, and classroom observations. Each interview will last approximately 30–45 minutes, while focus groups are expected to take 1–1.5 hours. Surveys will take around 15–20 minutes to complete. Classroom observations, when applicable, will occur during regular school hours for sessions lasting no more than 2 hours. Participation duration will vary based on the specific methods in which participants are involved. You will be informed in advance about the expected time commitment for your participation.

Risks to study participants:

Some of our research methods will require questions about personal information that may be sensitive or difficult to talk about. While participants aren't required to answer anything that may be uncomfortable, these conversations may be difficult to hear.

Benefits to research participants and others:

The feedback and data from participants will help us make informed decisions and contribute to the increase in accessibility in education.

Record keeping and confidentiality:

Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsors, or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of data will not identify you.

Alternative procedures:

If you choose not to participate in this study, there are no alternative procedures or treatments applicable to this research. Your decision will not impact any services or opportunities available to you outside this study.

Compensation or treatment in the event of injury:

For more information about this research or about the rights of research participants, or in case of research-related injury, contact: srisangwanissp@gmail.com , the IRB Manager Ruth McKeogh, Tel. 508 831-6699, Email: irb@wpi.edu, and the Human Protection Administrator Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu.Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. In the unlikely event that you experience harm or injury during your participation, medical treatment will be made available as appropriate. However, by participating in this study, you do not give up any of your legal rights. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit. (This section is required.) By clicking yes below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

Additional clauses to add to Consent Agreements, as appropriate:

Significant new findings or information, developed during the research, may alter the subject's willingness to participate in the study. Any such findings will be promptly communicated to all research participants.Should a participant wish to withdraw from the study after it has begun, the following. Procedures should be followed:

Deletion of any collected information from the individual who has withdrawn from the study.

Special Exceptions:

Under certain circumstances, an IRB may approve a consent procedure that differs from some of the elements of informed consent set forth above. Before doing so, however, the IRB must make findings regarding the research justification for different procedures The IRB must also find that the research involves "no more than minimal risk to the subjects."Other requirements are found at 45 C.F.R. §46.116.

Appendix B: Informed Consent Agreement for Participation in a Research Study (Thai)

ข้อตกลงยินยอมสำหรับการเข้าร่วมศึกษาวิจัย

ข้อมูลติดต่อ : srisangwanissp@gmail.com

ผู้สนับสนุน : โรงเรียนศรีสังวาลย์

โครงการวิจัยเรื่อง : การพัฒนาการศึกษาเชิงดิจิทัลของโรงเรียนศรีสังวาลย์ (Reimagining Digital Education for Sri Sangwan School)

ผู้วิจัย : นาย ภูริณัฐ สุเมธโชติเมธา, นาย ภวินท์ หริจันทร์วงศ์, นางสาว มาริสา รุกขจันทรกุล,
นาย สิรภพ หอมหวล, Madalyn Nguyen, Mahit Verma, Mohammed Adem Djadid,
Sean Arackal

บทนำ

ก่อนที่จะลงนามในใบยินยอมให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยให้ทราบถึงวัตถุประสงค์ของการวิจัย วิธีการวิจัยรวมทั้งกติกาที่ต้องเคารพ กิจกรรมการวิจัย ความเสี่ยง รวมทั้งผลประโยชน์ที่อาจเกิดขึ้นจากการวิจัย และเกิดความเข้าใจดีแล้ว

วัตถุประสงค์ของการวิจัย

วัตถุประสงค์ของการวิจัยคือเพื่อเรียนรู้ถึงกรรมวิธี การแก้ไขปัญหา และความคิด ณ ปัจจุบันที่สามารถนำไปใช้กับการสร้างการเรียนรู้ โดยเฉพาะการศึกษาเชิงดิจิทัล เพื่อให้เยาวชนรุ่นใหม่ที่มีทุพพลภาพหรือเป็นผู้พิการ นอกจากนี้ผู้วิจัยมีความสนใจถึงวิธีที่จะพัฒนาการศึกษาเพิ่มเติมในส่วนอื่นๆ

ขั้นตอนการดำเนินงาน

การสัมภาษณ์ : ผู้สัมภาษณ์จะได้รับคำถามที่เกี่ยวกับอาชีพของตน ประสบการณ์ที่พบเจอ และความเกี่ยวเนื่องถึงความพิการทางกายภาพผู้ที่ถูกสัมภาษณ์จะมีการเล่าถึงประสบการณ์ที่ตนได้พบจากคำถามที่ตั้งไว้

แบบสำรวจ : ผู้เข้าร่วมการสำรวจจะถูกขอให้กรอกแบบสอบถามซึ่งรวมถึงคำถามที่เกี่ยวกับประสบการณ์ที่พบเจอสิ่งที่เกี่ยวข้องกับความพิการของตนเองและยังอาจมีคำถามให้คะแนนเกี่ยวกับแนวความคิด,วิธีการแก้ไขปัญหา,และแนวทางการแก้ไขปัญหาผู้เข้าร่วมการตอบแบบสอบถามจะได้กรอกข้อมูลเชิงสถิติเชิงประชากรแต่จะไม่พาดพิงถึงข้อมูลผู้ติดต่อหรือข้อมูลส่วนตัว

การตอบคำถามแบบกลุ่ม : กลุ่มผู้เข้าร่วมจะถูกขอให้พูดอภิปรายในหัวข้อที่หลากหลายซึ่งพาดพิงเกี่ยวกับการศึกษา,ความพิการ,และการเข้าถึงอุปกรณ์สาธารณะผู้วิจัยอาจถามและให้ความคิดเห็นเพื่อประกอบการอภิปรายซึ่งอาจจะถูกบันทึกไว้ในรูปแบบวิดีโอหรือการจดบันทึก

การสังเกตการจัดกิจกรรมการเรียนรู้ : ผู้วิจัยจะสังเกตห้องเรียนระหว่างการเรียนการสอนเพื่อดูวิธีการเรียนรู้สำหรับการวิจัยซึ่งผู้เข้าร่วมทุกท่านจะถูกแจ้งล่วงหน้าโดยผู้วิจัยและสามารถที่จะปฏิเสธการถูกบันทึกได้

ระยะเวลาในการเข้าร่วม : ผู้เข้าร่วมทุกท่านจะมีส่วนร่วมในการวิจัยโดยใช้หนึ่งในวิธีการข้างต้น ซึ่งได้แก่การสัมภาษณ์ การสำรวจ การตอบคำถามแบบกลุ่ม และการสังเกตการการจัดกิจกรรมการเรียนรู้ ซึ่งในแต่ละการสัมภาษณ์จะใช้เวลาประมาณ 30 - 45 นาที ระหว่างที่การตอบคำถามแบบกลุ่มจะใช้เวลาประมาณ 15 - 20 นาที การสังเกตการจัดกิจกรรมการเรียนรู้จะจัดขึ้นระหว่างคาบเรียนซึ่งจะใช้เวลาไม่เกิน 2 ชั่วโมง ระยะเวลาการเข้าร่วมจะขึ้นอยู่กับวิธีการสำรวจที่กล่าวมาข้างต้นซึ่งข้อมูลในเรื่องของเวลาจะถูกแจ้งให้ท่านทราบล่วงหน้า

ความเสี่ยงจากการสำรวจ : การสำรวจบางวิธีจะใช้คำถามที่เกี่ยวข้องกับข้อมูลส่วนตัวที่อาจกระทบจิตใจที่เกิดจากการพูดคุยซึ่งในกรณีที่ผู้เข้าร่วมไม่สะดวกตอบเนื่องจากผลกระทบทางจิตใจ ผู้เข้าร่วมการสำรวจสามารถปฏิเสธการตอบคำถามที่กระทบต่อจิตใจของท่านได้

ผลประโยชน์สำหรับผู้เข้าร่วมวิจัยและผู้ที่เกี่ยวข้อง : ข้อเสนอแนะและข้อมูลจากผู้เข้าร่วมจะช่วยประกอบการตัดสินใจให้กับผู้วิจัย เพื่อเพิ่มความสะดวกต่อการเข้าถึงทางการศึกษา

การเก็บบันทึกข้อมูลและข้อมูลที่เป็นความลับ : ข้อมูลจากท่านที่ถูกเก็บบันทึกไว้ในการวิจัยนี้จะถูกเก็บไว้เป็นความลับตามข้อกฎหมาย อย่างไรก็ตามไม่ว่าจะกรณีใดๆ ผู้มีส่วนร่วมในการเก็บข้อมูล ผู้สนับสนุนหลายท่าน หรือผู้ที่ออกแบบการจัดการข้อมูล และคณะกรรมการพิจารณาของสถาบัน Worcester Polytechnic Institute (WPI IRB) จะสามารถตรวจสอบและมีสิทธิในการเข้าถึงข้อมูลที่ถูกปกปิดซึ่งมีชื่อของท่านบันทึกไว้ แต่จะไม่มีการระบุตัวตนของท่านในการตีพิมพ์หรือการนำเสนอใดๆ

ทางเลือกอื่นในการเก็บข้อมูล : หากท่านเลือกที่จะไม่เข้าร่วมการสำรวจครั้งนี้ จะไม่มีผลกระทบต่อท่านนอกเหนือการวิจัยนี้ ซึ่งการตัดสินใจของท่านจะไม่ส่งผลกระทบต่อตัวท่านใดๆทั้งสิ้น

การชดเชยหากเกิดเหตุไม่คาดฝัน : หากท่านต้องการข้อมูลเกี่ยวกับการวิจัยนี้หรือข้อมูลเกี่ยวกับสิทธิ์ของผู้เข้าร่วม หรือข้อมูลเพิ่มเติมในกรณีที่เกี่ยวข้องกับการบาดเจ็บจากการทำวิจัย สามารถติดต่อได้ที่ srisangwanissp@gmail.com, the IRB Manager Ruth McKeogh, โทร : (+1)508-831-6699, อีเมล : irb@wpi.edu และสามารถติดต่อ the Human Protection Administrator Gabriel Johnson, โทร : (+1)508-831-4989, อีเมล : gjohnson@wpi.edu การเข้าร่วมงานวิจัยของท่านนี้เป็นการเข้าร่วมอย่างสมัครใจ หากท่านปฏิเสธการเข้าร่วมการสำรวจนี้ ท่านสามารถตัดสินใจที่จะหยุดการเข้าร่วมงานวิจัยได้ทุกเมื่อโดยไม่มีการลงโทษหรือเสียผล

ประโยชน์ใดๆหากมีเหตุการณ์ไม่คาดฝันที่อาจเกิดขึ้นและทำให้ท่านบาดเจ็บระหว่างงานวิจัย ผู้วิจัยจะชดเชยค่าใช้จ่ายการรักษาทางการแพทย์ให้ตามความเหมาะสม อย่างไรก็ตาม ท่านไม่ได้สละสิทธิ์ทางกฎหมายใดๆที่เกี่ยวกับท่าน ผู้ตรวจสอบโครงการขอสงวนสิทธิ์ในการยกเลิกหรือเลื่อนขั้นตอนวิจัยเมื่อใดที่เห็นสมควร (จำเป็นในส่วนนี้) การลงนามด้านล่างแสดงถึงการรับทราบว่า ท่านได้รับแจ้งและยินยอมที่จะเข้าร่วมในการวิจัยตามที่อธิบายไว้ข้างต้น โปรดตรวจสอบให้แน่ใจว่า ข้อสงสัยที่ท่านมีได้รับคำตอบตามความพึงพอใจก่อนลงนาม ท่านมีสิทธิ์ที่จะเก็บสำเนาของข้อตกลงยินยอมสำหรับการเข้าร่วมศึกษาวิจัยนี้

ลงชื่อ .....ผู้ให้ความยินยอม

( )

วันที่ ..... /..... /.....

Appendix C: Verbal Consent Script (English)

Introduction

"Hello, my name is [Your Name], and I am a student/researcher working on a project titled *Reimagining Digital Education for Sri Sangwan School*. This study is supported by Sri Sangwan School and Worcester Polytechnic Institute (WPI). I would like to ask for your participation in this research. Before you decide, I want to explain what the study is about, what your participation involves, and any risks or benefits. Please feel free to ask any questions at any time."

Purpose of the Study

"The purpose of this study is to better understand how to make digital education more accessible for students with physical disabilities. We are also interested in learning about areas in education and career readiness that may need more support."

What Participation Involves

"If you agree to participate, you may be asked to:

1. Participate in an interview where you share your expertise, lived experiences, or perspectives.
2. Complete a survey that asks questions about accessibility and rates different ideas and solutions.
3. Join a focus group discussion about education, physical disabilities, and accessibility services.
4. Allow us to observe a classroom setting where you are present.

You can choose which activities you want to participate in, and you can skip any questions that make you uncomfortable."

Confidentiality

"Your participation is completely voluntary, and your information will be kept confidential. We will not use your name or any identifying details in reports or presentations. Only the researchers and authorized personnel, such as the WPI Institutional Review Board, may access the data. Any publication or presentation of the results will ensure your anonymity."

Risks and Benefits

"The risks of participating are minimal. Some questions might ask about personal information or experiences that may be sensitive or difficult to discuss. You can skip any questions or stop participating at any time without any consequences.

The benefit of your participation is that your insights will help improve accessibility in education for students with physical disabilities."

Voluntary Participation

"Participation in this study is entirely voluntary. If you decide not to participate or to stop

participating later, you will not face any penalties or loss of benefits. You can let me know at any time if you would like to withdraw from the study."

Questions and Contact Information

"Do you have any questions about the study or your participation? You can also contact us at [srisangwanissp@gmail.com] or the WPI Institutional Review Board if you have questions later."

Consent

"If you agree to participate in this study, please say 'yes.' If not, you may let me know now or at any point during the study."

Wait for the participant to say "yes" or confirm their consent.

Documentation of Verbal Consent

The researcher should document the participant's consent with the following details:

- Date and time of verbal consent.
- Participant identifier (e.g., Participant 1).
- Specific activities consented to (e.g., interview, survey).

Appendix D: Verbal Consent Script (Thai)

บทพูดขอความยินยอม

บทนำ

ผม / ดิฉัน .....*[ชื่อจริง-นามสกุล]*..... เป็นนักศึกษาจากจุฬาลงกรณ์มหาวิทยาลัย ที่ขณะนี้ทำงานวิจัยในหัวข้อเรื่อง การพัฒนาการศึกษาเชิงดิจิทัลของโรงเรียนศรีสังวาลย์งานวิจัยนี้ได้มีการสนับสนุนจากโรงเรียนศรีสังวาลย์และมหาวิทยาลัย Worcester Polytechnic Institute (WPI) จากสหรัฐอเมริกา พวกเราขอเชิญชวนให้ท่านเป็นหนึ่งในอาสาสมัครผู้เข้าร่วมในการทำงานวิจัยนี้ ก่อนที่ท่านจะตัดสินใจ พวกเราจะทำการอธิบายจุดประสงค์ของงานวิจัยรวมถึงจุดประสงค์ของงานที่อาสาสมัครถ้าหากมีข้อสงสัยใดๆก็ตามสามารถแจ้งให้ทราบได้

จุดประสงค์

จุดประสงค์ของงานวิจัยนี้คือการทำความเข้าใจการศึกษาระบบดิจิทัลเพื่อพัฒนาการให้มีความเข้าถึงกับนักเรียนที่มีความพิการนอกจากนี้งานวิจัยดังกล่าวยังสนใจเรื่องของการศึกษาต่อและการทำงานหลังจากจบการศึกษาที่โรงเรียนศรีสังวาลย์

หน้าที่ของอาสาสมัคร

หากท่านตัดสินใจร่วมเป็นหนึ่งในอาสาสมัคร ท่านอาจต้องเข้าร่วมกิจกรรมดังกล่าว

1. เข้าร่วมการตอบคำถามสัมภาษณ์เพื่อ แลกเปลี่ยนประสบการณ์ หรือความคิดเห็นในการทำงานซึ่งเกี่ยวข้องกับความพิการ
2. ตอบแบบสำรวจเพื่อแลกเปลี่ยนและประเมินความคิดเห็นเรื่องเทคโนโลยีเพื่อช่วยความพิการ
3. เข้าร่วมการตอบคำถามแบบกลุ่ม โดยท่านจะสนทนากับอาสาสมัครท่านอื่น ในหัวข้อเกี่ยวข้องกับการศึกษา ความพิการ ฯลฯ
4. อนุญาตให้นักศึกษาทำการวิจัยระหว่างมีการเรียนการสอนในห้องเรียนที่ท่านสอน

ท่านสามารถเลือกกิจกรรมหรือปฏิเสธกิจกรรมที่ท่านไม่พึงประสงค์ทำได้และปฏิเสธการตอบคำถามที่ทำให้ท่านไม่สบายใจ

การรักษาความลับ

ข้อมูลของท่านจะไม่ถูกเปิดเผยในการนำเสนอ มีแค่ผู้ทำวิจัยและผู้เกี่ยวข้องเช่น นักศึกษาทำวิจัยของจุฬาลงกรณ์มหาวิทยาลัย นักศึกษาของ WPI คณะกรรมการจริยธรรมการวิจัยในคนของ WPI และที่ปรึกษางานวิจัยที่จะสามารถเห็นคำตอบของท่าน การตีพิมพ์หรือการนำเสนออย่างไรก็ตามจะไม่มีการเปิดเผยข้อมูลส่วนตัวใดๆ

ความเสี่ยงและผลประโยชน์

ความเสี่ยงที่อาจเกิดขึ้นจากการเข้าร่วมนั้นมีโอกาสเกิดขึ้นน้อย บางคำถามอาจจำเป็นต้องตอบด้วยข้อมูลส่วนตัวหรือประสบการณ์ที่อาจกระทบจิตใจหรือยากที่จะพูดคุยท่านสามารถที่จะข้ามคำถามที่ไม่ประสงค์ที่จะตอบหรือถอนตัวจากการเข้าร่วมโดยไม่มีผลกระทบที่ตามมา

ผลประโยชน์จากการเข้าร่วมแบบทดสอบนั้นคือความคิดเห็นของท่านที่สามารถนำมาพัฒนาปรับปรุงการเข้าถึงระบบการศึกษาสำหรับนักเรียนที่ศึกษาในโรงเรียนศรีสังวาลย์

การมีส่วนร่วมโดยความสมัครใจ

การเข้ามามีส่วนร่วมในงานวิจัยครั้งนี้ขึ้นอยู่กับความสมัครใจเท่านั้น หากท่านตัดสินใจที่จะไม่เข้าร่วมหรือยุติการเข้าร่วม ท่านจะไม่ได้รับโทษหรือสูญเสียสิทธิผลประโยชน์ใดๆ ท่านสามารถแจ้งให้ผู้วิจัยทราบเมื่อใดก็ตามที่ท่านประสงค์ที่จะไม่ร่วมการวิจัยต่อ

คำถามและข้อมูลติดต่อ

หากท่านมีคำถามใดๆเกี่ยวกับการวิจัยหรือการเข้าร่วมของท่านโปรดติดต่อผู้วิจัยได้ที่[srisangwanissp@gmail.com] หรือคณะกรรมการจริยธรรมการวิจัยในคนของ WPI

ความยินยอม

หากท่านยินยอมที่จะเข้าร่วมตอบแบบสำรวจในครั้งนี้ โปรดพูดตกลงหากไม่ต้องการเข้าร่วม ท่านสามารถแจ้งให้ผู้วิจัยทราบตอนนี้ หรือเมื่อใดก็ตามระหว่างการเก็บข้อมูล

เอกสารประกอบความยินยอมด้วยวาจา

ผู้วิจัยควรเก็บข้อมูลผู้เข้าร่วมตามรายละเอียดดังกล่าว

- วันที่และเวลาของความยินยอม
- รหัสประจำตัวผู้เข้าร่วม (เช่น ผู้เข้าร่วม ก.)
- วิธีการเก็บข้อมูลที่ถูกยินยอม (เช่น การสัมภาษณ์, การตอบคำถาม)

Appendix E: Survey Questions (English)

1. What is your role in the educational community?
    a. Educator
    b. Alumni
    c. Parent
    d. Caregiver
    e. Other: _____
2. How many years have you been involved with education for students with physical disabilities?
    a. 0-2 years
    b. 3-5 years
    c. 6-10 years
    d. 10+ years
3. What is your relation to people with physical disabilities?
4. On a scale of 1 to 5, how well do you think the current educational tools and technologies support students with physical disabilities? (5 being very well, 1 being not well)
    a. Excellent
    b. Good
    c. Fair
    d. Poor
5. How frustrated would you say your students are when trying to learn using the assistive technologies provided by the school? (5 being very well, 1 being not well)
    a. Excellent
    b. Good
    c. Fair
    d. Poor
6. What would you say are the most common causes of frustration among your students? (Open-ended)
7. What challenges do students with physical disabilities face in accessing digital education resources? (Open-ended)
8. What accessibility tools or resources have been most effective in supporting these students? (e.g. screen readers, adaptive keyboards, voice recognition software)
9. Are there infrastructure or policy changes that you believe would improve educational outcomes for students with physical disabilities?
    a. Yes (Please elaborate): _____
    b. No
10. How well does the school foster collaboration among educators, caregivers, and experts to support students with physical disabilities?
    a. Excellent
    b. Good
    c. Fair
    d. Poor

11. What additional resources would help build a more inclusive educational community for these students? (Open-ended)
12. In your opinion, what should be the top priority for enhancing education for students with physical disabilities over the next five years? (Open-ended)
13. Are there any emerging technologies or practices that you believe could significantly improve digital education for this group? (Open-ended)

Appendix F: Survey Questions (Thai)

1. ท่านมีบทบาทหน้าที่อะไร
    a. ผู้สอน
    b. ศิษย์เก่า
    c. ผู้ปกครอง
    d. ผู้ดูแล
    e. อื่นๆ .....
2. ท่านทำงานเกี่ยวกับการศึกษาของนักเรียนที่มีความบกพร่องทางร่างกายมากี่ปีแล้ว?
    a. 0-2 ปี
    b. 3-5 ปี
    c. 6-10 ปี
    d. 10+ ปี
3. ท่านมีความเกี่ยวข้องกับผู้พิการอย่างไร
4. ท่านคิดว่าเครื่องมือที่ใช้ในการเรียนการสอนที่มีอยู่ตอนนี้เหมาะสมกับนักเรียนผู้มีความพิการมากแค่ไหน (5 เหมาะสมมาก, 1 ไม่เหมาะสม)
    a. ยอดเยี่ยม
    b. ดี
    c. ปานกลาง
    d. ควรปรับปรุง
5. ท่านคิดว่านักเรียนมีความพึงพอใจกับการใช้อุปกรณ์ช่วยเหลือระหว่างการเรียนหรือไม่? (5 พึงพอใจ, 1 ไม่พึงพอใจ)
    a. ยอดเยี่ยม
    b. ดี
    c. ปานกลาง
    d. ควรปรับปรุง
6. ในความคิดของท่าน โดยทั่วไปอะไรคือสาเหตุที่ทำให้นักเรียนเกิดความไม่พึงพอใจ
7. ท่านคิดว่าอุปสรรคหรือปัญหาของนักเรียนที่มีความพิการทางกายภาพอาจพบเจอในการเรียนผ่านระบบดิจิทัลคืออะไร
8. ท่านคิดว่าอุปสรรคหรือปัญหาของนักเรียนที่มีความพิการทางกายภาพอาจพบเจอในการเรียนผ่านระบบดิจิทัลคืออะไร
9. ท่านคิดว่ามีนโยบายอะไรที่จะช่วยในการเรียนของนักเรียนที่มีความพิการ
    a. มี โปรดระบุ: _____
    b. ไม่มี
10. ท่านคิดว่าการประสานงานระหว่างผู้สอน,ผู้ดูแลและผู้เชี่ยวชาญของโรงเรียนมีประสิทธิภาพต่อนักเรียนที่มีความพิการดีเท่าไร (5 เหมาะสมมาก, 1 ไม่เหมาะสม)
    a. ยอดเยี่ยม
    b. ดี
    c. ปานกลาง
    d. ควรปรับปรุง
11. ทรัพยากรอะไรที่ท่านคิดว่าสามารถนำมาช่วยให้นักเรียนที่มีความพิการเข้าถึงต่อการศึกษาได้
12. ท่านคิดว่าอะไรคือสิ่งที่สำคัญที่สุดที่จะช่วยการเรียนรู้ของนักเรียนที่มีความพิการภายในระยะเวลา 5 ปีข้างหน้า
13. ท่านคิดว่าอะไรคือสิ่งที่สำคัญที่สุดที่จะช่วยการเรียนรู้ของนักเรียนที่มีความพิการภายในระยะเวลา 5 ปีข้างหน้า

Appendix G: Survey Results and Summary

1. What is your role in the educational community?
   ท่านมีบทบาทหน้าที่อะไร
   (Total response: 43)

Table 5

Question 1 Survey Response

Role	Frequency
ผู้สอน	34
ผู้ดูแล	8
อื่นๆ	1

Note: *อื่นๆ : นักศึกษาฝึกงาน ศิษย์เก่า*

2. How many years have you been involved with education for students with physical disabilities?

ท่านทำงานเกี่ยวกับการศึกษาของนักเรียนที่มีความบกพร่องทางร่างกายมากี่ปีแล้ว?

(Total response: 43)

Figure 19

Question 2 Survey Pie Chart (Thai)

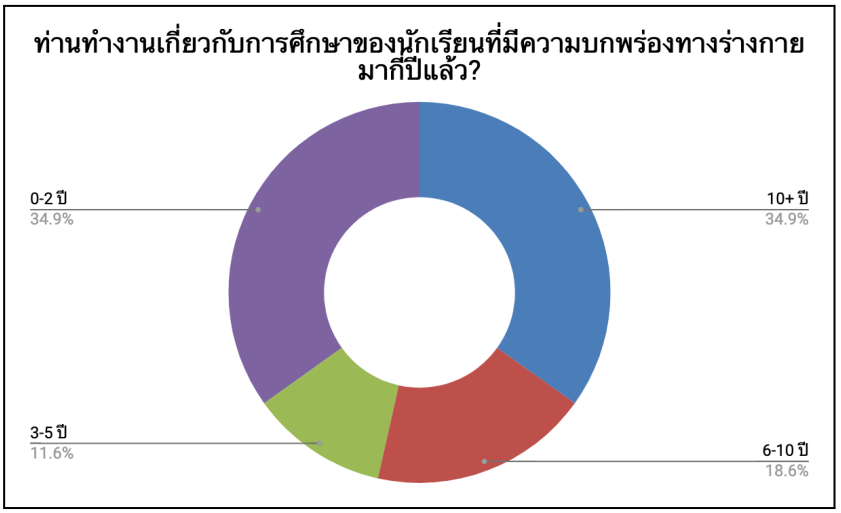
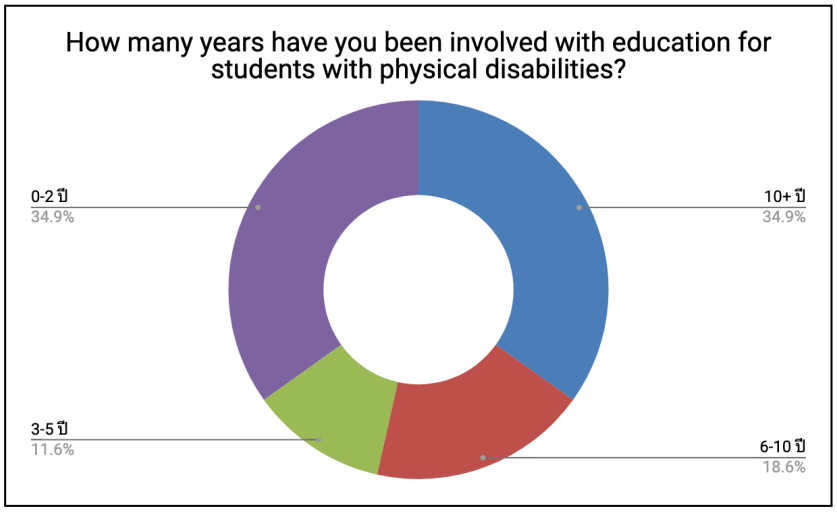


Figure 20

Question 2 Survey Pie Chart (English)



3. What is your relation to people with physical disabilities?

   ท่านมีความเกี่ยวข้องกับผู้พิการอย่างไร

   (Total response: 43)

Table 6

Question 3 Survey Responses

เป็นผู้พิการ
ครูผู้สอน
ครูผู้สอนนักเรียนผู้พิการ
เป็นครูผู้สอน
ครู
ครู
เป็นครูผู้สอน
ครู
ครู
ครูผู้สอน
ครูผู้สอน
เป็นครูผู้สอน
ครูผู้สอน
ครูผู้สอน
ครูผู้สอน
ครู
ผู้ดูแล
ครู
ผู้ดูแล และเป็นแม่ของลูกที่พิการ
ครูผู้สอน
พี่เลี้ยง
เป็นพี่เลี้ยง และเป็นผู้ดูแลเด็กพิการ
คือคนทั่วไปทีควรได้รับโอกาสเท่าเทียมคนปกติ
เป็นครู
ครูผู้สอน

เป็นครูผู้สอน
ครูผู้สอน
การดูแลเบื้องต้น ความพร้อมและพัฒนาการเรียนรู้ของเด็กแต่ละคน
เป็นครูผู้สอน
สามารถพัฒนาตามศักยภาพแต่ละคนได้แตกต่างกัน
ครูผู้สอน
ครูผู้สอน
ครูผูสอน
ครู
ครูผู้สอน
ครูผู้สอน
ครู
ครูผู้สอน
เป็นครู
ผู้ช่วยครู ดูแลเด็กคะ
พี่เลี้ยงเด็ก
เจ้าหน้าที่ดูแลเด็ก
พี่เลี้ยงศรีสังวาลย์

4. On a scale of 1 to 5, how well do you think the current educational tools and technologies support students with physical disabilities? (5 being very well, 1 being not well)

ท่านคิดว่าเครื่องมือที่ใช้ในการเรียนการสอนที่มีอยู่ตอนนี้เหมาะสมกับนักเรียนผู้มีความพิการมากแค่ไหน (5 เหมาะสมมาก, 1 ไม่เหมาะสม)

(Total response: 42)

Figure 21

Question 4 Survey Pie Chart (Thai)

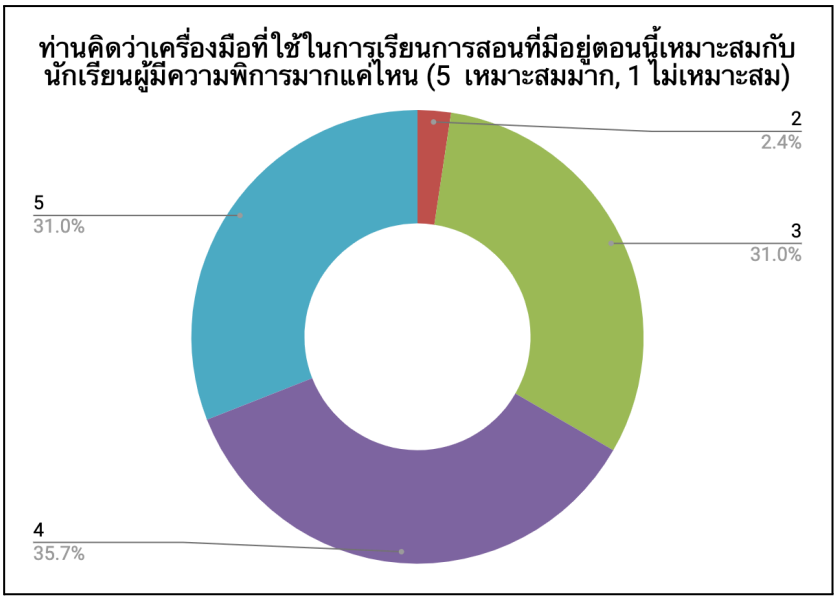
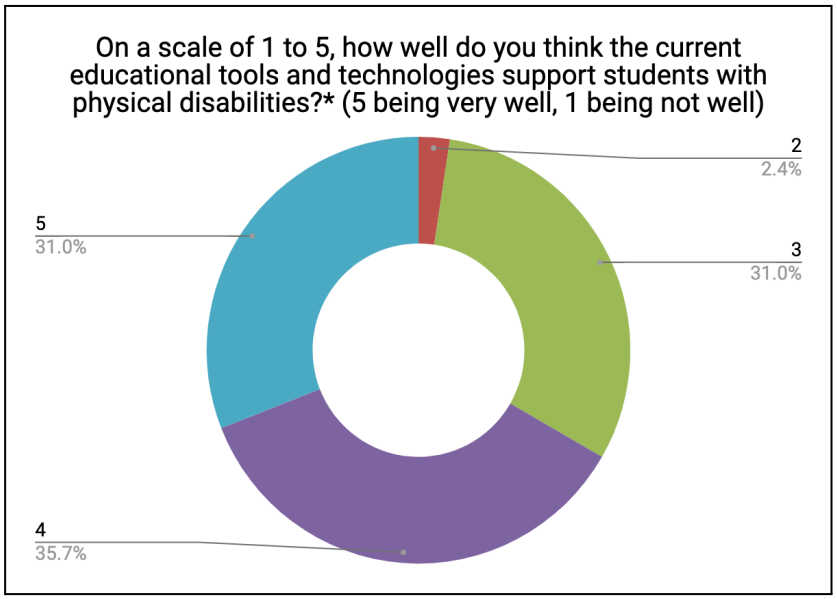


Figure 22

Question 4 Survey Pie Chart (English)



5. How frustrated would you say your students are when trying to learn using the assistive technologies provided by the school?

ท่านคิดว่านักเรียนมีความพึงพอใจกับการใช้อุปกรณ์ช่วยเหลือระหว่างการเรียนหรือไม่?

(5 พึงพอใจ, 1 ไม่พึงพอใจ)

(Total response: 42)

Figure 23

Question 5 Survey Pie Chart (Thai)

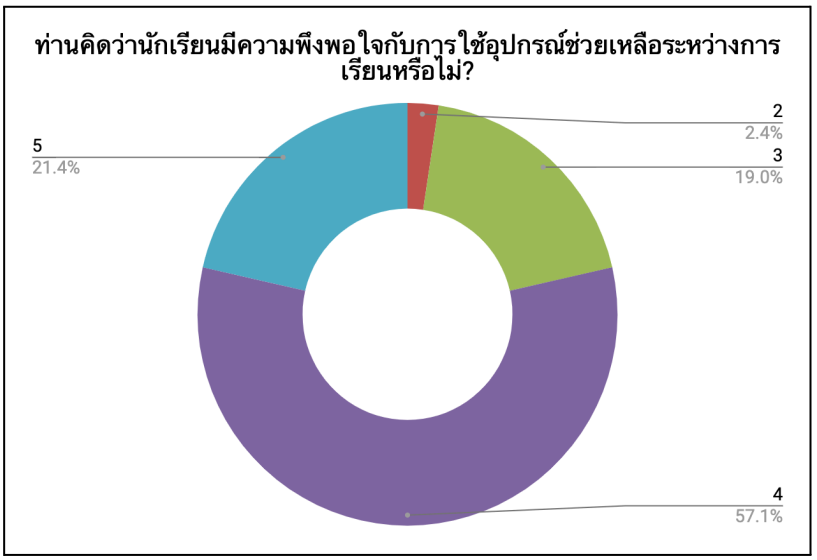
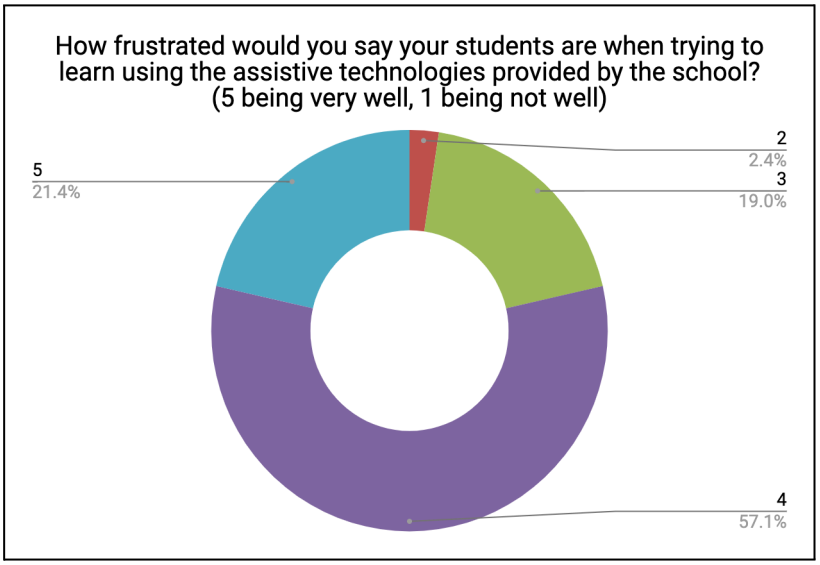


Figure 24

Question 5 Survey Pie Chart (English)



6. What would you say are the most common causes of frustration among your students? (open-ended)

   ในความคิดของท่าน โดยทั่วไปอะไรคือสาเหตุที่ทำให้นักเรียนเกิดความไม่พึงพอใจ

   (Total response: 42)

Table 7

Question 6 Survey Responses

สภาพร่างกายไม่พร้อม
การเรียนที่มีเนื้อหามากเกินไป
นักเรียนไม่เข้าใจอุปกรณ์ หรืออุปกรณ์บ้างชชิ้นไม่เข้ากับนักเรียนพิการ นักเรียนจึงไม่สนใจไม่อยากทำ
ไม่มี
การทำงานหรือใช้งานหนักๆ
สื่อที่เหมาะสมกับความบกพร่องทางด้านร่างกายแต่ละประเภท
สภาพอากาศ
วิธีการสอนและกิจกรรมการเรียนที่ส่งเสริมให้นักเรียนเกิดการเรียนรู้
การเรียนที่มีขั้นตอนและกระบวนการคิดที่เยอะ
นักเรียนมาหลายอาการ การเข้าถึงหรือเข้าใจนักเรียนอาจไม่ครบทุกคน นักเรียนอาจจะไม่พึงพอใจ
การเรียน และกิจกรรมที่เน้นวิชาการมากเกินไป
-
เครื่องมือไม่ครบและไม่เหมาะสมหรับตัวบุคคล
บางอุปกรณ์ไม่เหมาะสมกับนักเรียน
บางอย่างไม่เอื้อต่อตัวเด็กแต่ละคน
การที่ไม่ได้รับตามสิ่งที่ตัวเองต้องการ
การไม่ได้รับตามที่สิ่งต้องการ
ทำเองไม่ได้
อารมณ์ของนักเรียนเอง
กายอุปกรณ์
ความไม่เข้าใจความพิการของนักเรียน
เข้าไม่ถึงเทคโนโลยี
การเข้าถึงระบบอินเทอร์เน็ต
เข้าไม่ถึงเทคโนโลยี

สื่อสารไม่ค่อยเข้าใจ เวลาโดนขัดใจ
การสื่อสารเวลาโดนขัดใจ
ระบบสัญญาณinternet
ไม่มี
การอ่านไม่ได้
น้องไม่มีปัญหาใดๆ ให้ความร่วมมือดีหมด
ความไม่ชินกับอุปกรณ์
ไม่มีค่ะ
ร่างกาย การเคลื่อนไหว
ไม่มี
ระบบสัญญาณinternet
ไม่มี
การอ่านไม่ได้
น้องไม่มีปัญหาใดๆ ให้ความร่วมมือดีหมด
ความไม่ชินกับอุปกรณ์
ไม่มีค่ะ
ร่างกาย การเคลื่อนไหว
ไม่มี

7. What challenges do students with physical disabilities face in accessing digital education resources? (Open-ended)

   ท่านคิดว่าอุปสรรคหรือปัญหาของนักเรียนที่มีความพิการทางกายภาพ อาจพบเจอในการเรียนผ่านระบบดิจิทัลคืออะไร

   (Total response: 42)

Table 8

Question 7 Survey Responses

1 อาจจะเป็นเพราะ Internet 2 เป็นเพราะคอมพิวเตอร์ loading ช้า
-
ไม่มีอุปกรณ์
อุปกรณ์ไม่เพียงพอ
อุปกรณ์การเขียน แป้นพิมพ์และเมาส์ที่เป็นอุปสรรคต่อการเข้าถึงระบบดิจิทัลของเด็กที่มีความบกพร่องทางร่างกาย
การเข้าถึงอุปกรณ์ในกลุ่มที่มีความพิการมาก
นักเรียนบางคนอ่านไม่ออก
ไม่มี
สภาพร่างกาย
ความไม่พร้อมของนักเรียนและเครื่องมือสื่อสาร
องศาการมอง ค่าสายตา ลักษณะความพิการที่แตกต่าง
การใช้อุปกรณ์และสิ่งอำนวยความสะดวก
สื่ออนไลน์
อุปกรณ์ที่ใช้ควรมีความเหมาะสมกับสภาพร่างกาย
การใช้อุปกรณ์ลำบาก
การเข้าถึงอุปกรณ์และเวลาน้อยเนื่องจากกิจกรรมอื่นๆ
ขาดอุปกรณ์
ไม่เข้าใจในการเรียนผ่านระบบดิจิทัลเท่าที่ควร
การเคลื่อนไหว และการรับรู้ที่ช้ากว่าปกติ
-
พัฒนาการของนักเรียนที่ยังไม่พร้อมกับเนื้อหาที่เกินขีดการเรียนรู้ของนักเรียน
นักเรียนอ่านไม่ออก
ระดับการรับรู้ และการช่วยเหลือคฝตนเอง

การนั่งวิลแชร์เป็นเวลานานๆ
การนั่งวิวแชร์นานๆ
ความเข้าใจ
นักเรียนไม่มีสมาธิ
อุปกรณ์ไม่พร้อม
ผู้ดูแลหรือผู้ช่วยเหลือไม่เข้าใจวิธีการดูนักเรียน
เข้าถึงเนื้อหาที่ไม่พึงประสงค์
อุปกรณ์บางชนิดนักเรียนไม่สามารถเข้าถึงได้
เข้าไม่ถึงเนื้อหาที่ไม่พึงประสงค์
การเคลื่อนไหวของมือ และ การสื่อสาร
สัญญาณอินเตอร์เน็ตไม่เพียงพอ
สัญญาณอินเทอร์เน็ตไม่พอ
ไม่มี
เขียนไม่ได้
บางคนพิมพ์ได้แต่ช้า แต่เขาก็สามารถพิมพ์ได้อยู่
ปัญหาสายตา
เด็กๆอ่านได้แต่เขียนไม่ได้
สมาธิ
ดีมากค่ะต้องการเรียนรู้สำหรับนักเรียน

8. What accessibility tools or resources have been most effective in supporting these students? (e.g. screen readers, adaptive keyboards, voice recognition software)
   ท่านคิดว่าเครื่องมือหรืออุปกรณ์อะไรที่ช่วยเหลือการเรียนของนักเรียนที่มีความพิการได้ดีที่สุด เช่น เครื่องอ่านหน้าจอ คีย์บอร์ดอัจฉริยะ ฯลฯ
   (Total response: 42)

Table 9
Question 8 Survey Responses

เมาส์ที่มีลักษณะ เป็นแผ่นเหมือนแผ่นรองเมาส์ แต่จะมีขนาดใหญ่กว่า เหมาะสำหรับนักเรียนที่ใช้เท้าในการคลิกเมาส์หรือพิมพ์ มันจะทำให้นักเรียนที่ใช้เท้า เกิดอาการเมื่อยที่น้อยลง หรืออาจจะไม่เมื่อยเลย เหมาะสำหรับนักเรียนที่ให้มือลำบากด้วย
-
คอมพิวเตอร์พกพา
เครื่องอ่านหน้าจอ
ตัวช่วยในการเขียนและการอ่าน/เครื่องมือเนื้อหา
Tablet + software
คีย์บอร์ดอัจฉริยะ
เครื่องอ่านหน้าจอ
คีย์บอร์ดอัจฉริยะ
คอมพิวเตอร์ที่เหมาะกับเด็ก
เครื่องช่วยอ่าน และสะกดคำ
คีย์บอร์ดอัจฉริยะ
สิ่งอำนวยสะดวก
อุปกรณ์ที่ใช้ควรมีความเหมาะสมกับสภาพร่างกาย
-
คีย์บอร์ด
อุปกรณ์ต้องเหมาะสมกับความพิการ
เครื่องอ่านหน้าจอ
หลายอย่างที่สามารถนำมาปรับใช้ได้ขึ้นอยู่กับความพิการ แต่โดยพื้นฐานควรมีคอมพิวเตอร์ที่นักเรียนสามารถเข้าถึงได้ตลอด
-
คีย์บอร์ดอัจฉริยะ
เครื่องอ่านหน้าจอ

ทั้ง2 อย่าง
เครื่องอ่านหน้าจอ
เครื่องอ่านหน้าจอ
แท็บเล็ต
เครื่องอ่านจอ
ไอแพต
ขึ้นอยู่กับสภาพความพิการของนักเรียน ว่าบกพร่องในด้านอะไรบ้าง
จออัจฉริยะ
แท็บเล็ต
ใช้จออัจฉริยะ
ตัวช่วยการอ่านและการสื่อสาร
คีย์บอร์ดอัจฉริยะ
คีย์บอร์ดอัจฉริยะ
ใช้ได้เก่งทั้งหมด
เครื่องอ่านหน้าจอ
เม้าส์ trackball ใช้เท้าใช้อะไรได้
เครื่องอ่านหน้าจอ
คอมพิวเตอร์
เครื่องอ่านหน้า คำสั่งค้นหา หรือพิมพ์โดยใการช้เสียงสั่งงาน.
คอมพิวเตอร์คีย์บอร์ดค เทคโนโลยีต่างๆ

9. Are there infrastructure or policy changes that you believe would improve educational outcomes for students with physical disabilities?
    a. Yes (Please elaborate): _____
    b. No

ท่านคิดว่ามีนโยบายอะไรที่จะช่วยในการเรียนของนักเรียนที่มีความพิการ

    c. มี โปรดระบุ: _____
    d. ไม่มี

(Total response: 42)

Table 10

Question 9 Survey Responses

Yes / No	Elaboration
ไม่มี	
ไม่มี	
ไม่มี	
ไม่มี	
ไม่มี	
มี โปรดระบุ:	การเข้าถึงสื่ออุปกรณ์ สถานที่ การเดินทาง
มี โปรดระบุ:	เรียนแบบฐานสมะรรถนะ
ไม่มี	
ไม่มี	
มี โปรดระบุ:	ลดการเรียนเน้นทักษะการช่วยเหลือตนเองให้ได้มากที่สุด
มี โปรดระบุ:	เน้นให้นักเรียนเรียนรู้จากการทำด้วยตนเองพร้อมครูช่วย มากกว่าครูสอนอย่างเดียว
มี โปรดระบุ:	สื่อเทคโนโลยี
มี โปรดระบุ:	ให้นักเร่ยนได้ฝึกอาชีพโดยเน้นการฝึกอาชีพเป็นหลัก
มี โปรดระบุ:	การออกแบบสื่อการสอนที่เหมาะสมกับนักเรียน
ไม่มี	
มี โปรดระบุ:	การสร้างสื่อนวัตกรรมให้ตรงกับปัญหาของนักเรียนแต่ละคน
ไม่มี	
มี โปรดระบุ:	นโยบาย ที่มุ่งเน้นต่อเด็กพิการเท่านั้น
มี โปรดระบุ:	ลดการบ้าน เพิ่มโอกาสและวลาในการค้นคว้าเรียนรู้เพื่อนำเสนอด้วยตัวเอง
ไม่มี	

มี โปรดระบุ:	แบ่งกลุ่มประเภทความบกพร่องของนักเรียนและใช้เครื่องมือตามกลุ่มที่แบ่ง
ไม่มี	
มี โปรดระบุ:	ช่วยตนเองให้ได้มากที่สุด
ไม่มี	
ไม่มี	
ไม่มี	
ไม่มี	
มี โปรดระบุ:	อุปกรณ์ที่เข้าถึงได้
ไม่มี	
ไม่มี	
มี โปรดระบุ:	ต้องช่วยเหลือตั้งแต่แรกเกิด
ไม่มี	
มี โปรดระบุ:	การเอาใจใส่ต่อเด็กและกำลังใจ
ไม่มี	
มี โปรดระบุ:	การเข้าถึงคอมพิวเตอร์ที่เหมาะสมกับคนพิการ
ไม่มี	
ไม่มี	
ไม่มี	
ไม่มี	
มี โปรดระบุ:	อุปกรณ์เสริมทักษะในการอ่านเขียน
มี โปรดระบุ:	เรียนรู้ด้วยสื่อภาพสี และเสียง และดนตรีในการประการเรียน
มี โปรดระบุ:	ด้านกายภาพและให้ความเรียนรู้ แก่เด็กๆ

10. How well does the school foster collaboration among educators, caregivers, and experts to support students with physical disabilities?

ท่านคิดว่าการประสานงานระหว่างผู้สอน ผู้ดูแล และผู้เชี่ยวชาญของโรงเรียนมีประสิทธิภาพต่อนักเรียนที่มีความพิการดีเท่าไร (5 พึงพอใจ, 1 ไม่พึงพอใจ)

(Total response: 42)

Figure 25

Question 10 Survey Pie Chart (Thai)

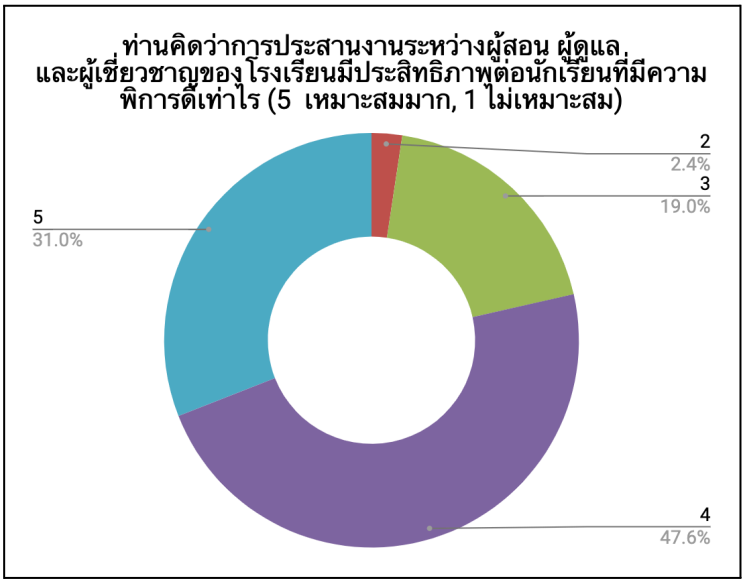
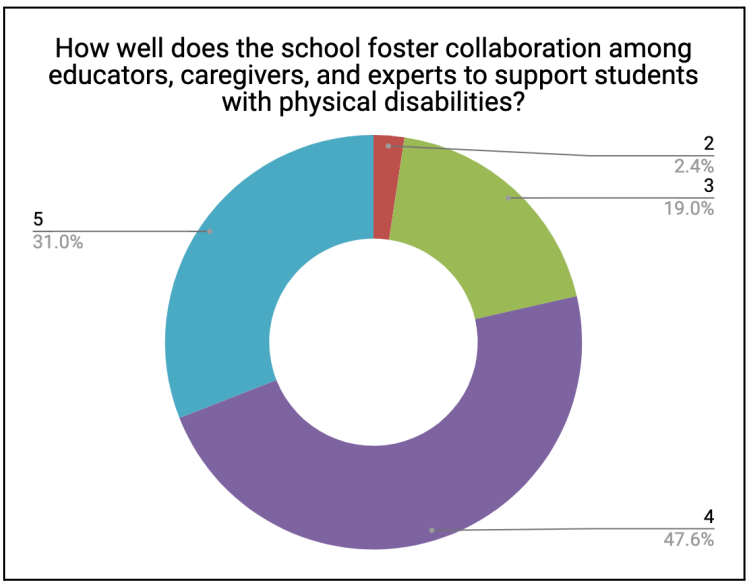


Figure 26

Question 10 Survey Pie Chart (English)



11. What additional resources would help build a more inclusive educational community for these students? (Open-ended)

    ทรัพยากรอะไรที่ท่านคิดว่าสามารถนำมาช่วยให้นักเรียนที่มีความพิการเข้าถึงต่อการศึกษาได้

    (Total response: 42)

Table 11

Question 11 Survey Responses

โทรศัพท์ Notebook iPad คอมพิวเตอร์
-
เทคโนโลยี
เทคโนโลยี
-
อุปกรณ์เทคโนโลยี
อุปกรณ์ที่ช่วยในการสื่อสาร
แท็บเล็ต
เทคโนโลยี
ครูมีความสำคัญต่อเด็กในการกระตุ้นพัฒนาการ
เทคโนโลยีการเคลื่อนไหวร่างกาย และจัดท่าทางฟ
สื่อนวัตกรรมที่เหมาะสมกับเด็กพิการ
นวัตกรรมการเล่นดนตรีสำหรับเด็กนักเรียนที่ไม่มีแขน
ครูที่มีความเชี่ยวชาญ
ขึ้นอยู่กับบุคคล
ความรู้ความสามารถของครู
เทคโนโลยี
ธรรมชาติ
เงินทุน
-
การเข้าถึงแหล่งเรียนรู้ที่นักเรียนสามารถนำไปใช้ในชีวิตประจำวันได้จริง
เครื่องอ่าน
สื่อการเขียน
ทุนการศึกษา

ทุนการศึกษา
ครู
แท็บเล็ต
อุปกรณ์ที่เหมาะสม
บุคคลที่เข้าใจเด็กนักเรียน
ทรัพยากรทางเทคโนโลยี
เทคโนโลยีอัจฉริยะ
เทคโนโลยีอัจฉริยะ
ทรัพยากรธรรมชาติ ที่แวดล้อมอยู่ในสถานศึกษา
สื่อนวัตกรรมเทคโนโลยี
แทปเลต
การเรียนการสอนที่ปูพื้นฐาน ออกไปใช้ชีวิตข้างนอกได้
คอมพิวเตอร์
ด้านเทคโนโลยีสื่อสาร
เทคโนโลยีที่ทันสมัย ตอบโจทย์ปัญหาของนักเรียน
คอมพิวเตอร์
บุคลากรที่มีความรู้ ความเข้าใจเกี่ยวกับเด็กพิการ สิ่งแวดภายในโรงเรียน สิ่งแวดล้อมครอบครัว และรอบข้างเป็นปัจจัยหลัก
คุณครูและบุคลากรผู้ดูแลด้านต่างๆ

12. In your opinion, what should be the top priority for enhancing education for students with physical disabilities over the next five years?* (Open-ended)
ท่านคิดว่าอะไรคือสิ่งที่สำคัญที่สุดที่จะช่วยการเรียนรู้ของนักเรียนที่มีความพิการภายในระยะเวลา 5 ปีข้างหน้า
(Total response: 42)

Table 12
Question 12 Survey Responses

ไม่มีคำตอบ
-
เทคโนโลยี แอพพลิเคชั่นต่างๆ
เทคโนโลยี
เทคโนโลยีอำนวยความสะดวก
การฝึกทักษะชีวิต และการใช้เทคโนโลยี
ความหลากหลายของกิจกรรม และ เครื่องมือที่ช่วยส่งเสริมให้นักเรียนได้เกิดการเรียนรู่ที่คข ล่องตัวขึ้น
แท็บเล็ต
เทคโนโลยี
การกระตุ้นพัฒนาการทุกด้านของผู้เรียน
กำลังใจ และความเข้าใจในตัวนักเรียนแต่ละคน
สื่อเทคโนโลยีที่ทันสมัย
นวัตกรรม
โกรธและบุคลากรที่มีความร่วมมือร่วมใจในการออกแบบกิจกรรมในการเรียนการสอนของนักเรียนที่มีความพิการทางด้านร่างกาย
-
สื่อและการเข้าใจผู้พิการ
อุปกรณ์ช่วยเขียนสำหรับนักเรียนที่ไม่สามารถเขียนได้
ทักษะอาชีพ
การเริ่มปูพื้นฐานอย่างถูกทางตั้งแต่อนุบาล และการพัฒนาตัวเด็กตามศักยภาพของแต่ละบุคคล ที่สามารถทำได้จริงในบริบทของสถานศึกษานั้นๆ
-
เรียนรู้จากสภาพแวดล้อมและสิ่งที่นักเรียนจะได้พบในชีวิตประจำวัน

การอ่าน
สื่อเทครูโนโลยี
ปัจจัย 4
ปัจจัย4
สื่อ สิ่งอำนวยความสะดวก
แท็บเล็ต
การเข้าถึงระบบทางการแพทย์
บุคคลที่เข้าใจเด็กนักเรียน
เทคโนโลยี
นักเรียนทุกคนสามารถเข้าถึงเทคโนโลยีให้มากที่สุด และให้ทันสมัย
ใช้เทคโนโลยีเป็นการสอนที่ทันสมัย
ระบบคอม และ สื่อสารเรียนที่ทันสมัย
คีย์บอร์ดอัจฉริยะ
ทักษะด้านอาชีพ
ตอนนี้ดีอยู่แล้ว
คอมพิวเตอร์
เกี่ยวกับการเรียนให้เต็มที่และมีด้านเทคโนโลยีคู่กันด้วยก็จะดี
เทคโนโลยี
คอมพิวเตอร์
สื่อ พัฒนาการทางด้านร่างกาย และสมอง เครื่องมือเทคโนโลยี
พัฒนาในด้านการเรียนรู้และ ด้านกายภาพ

13. Are there any emerging technologies or practices that you believe could significantly improve digital education for this group? (Open-ended)

    ท่านคิดว่ามีเทคโนโลยี อุปกรณ์หรือหลักสูตรอะไรที่ท่านอาจจะเคยเห็นแล้วคาดว่าสามารถช่วยกับการเรียนรู้ในระบบดิจิทัลสำหรับนักเรียนที่มีความพิการได้ดีที่สุด

    (Total response: 42)

Table 13

Question 13 Survey Responses

อุปกรณ์ที่สามารถพูดแล้วพิมพ์ได้เลย แล้วก็อยากให้มี แปลภาษา สมมุติว่าพูดภาษาอังกฤษแล้วอยากให้แปลเป็นไทย หรือพูดภาษาจีนแล้วอยากให้แปลเป็นภาษาอังกฤษได้ด้วย
-
แอพลิเคชั่นในเครื่องมือสื่อสาร
แอพพลิเคชั่นในอุปกรณ์ไร้สาย
-
เทคโนโลยีด้าน Speech
กระดานสื่อสาร
แท็บเล็ต
เทคโนโลยี
ควรมีหลักสูตรเฉพาะสำหรับเด็กเพราะเด็กมีศักยภาพที่แตกต่างกัน
-
คีย์บอร์ดอัจฉริยะ
คอมพิวเตอร์ และ แท็บเล็ต
-
-
สื่อเป็นสิ่งสำคัญแต่ต้องมีครูที่มีความสามารถ
อาชีพเพื่อคนพิการ
เทคโนโลยี
ทฤษฎีเรียนปนเล่น
-
-
เครื่องอ่านคำอ่าน
รู้ทันAI

แทบเล็ต
ใช้แท็บเล็ตในตัว
คอมพิวเตอร์แบบสัมผัส
แท็บเล็ต
ระบบสัญญาน
Numeric keypad. /Trackball /keygard
ใช้จออัจฉริยะ
แท็บเล็ต
ใช้สื่อการสอนเป็นจอสัมผัส
คีย์บอร์ดอัจฉริยะ
คีย์บอร์ดอัจฉริยะ
โปรแกรมสำหรับคนพิการ
ไม่มี
เม้า
ไม่มี
เครื่องช่วยอ่านหน้าจอ
เครื่อแปลภาษา
สื่อเทคโนโลยีเป็นเครื่องมือสำคัญอีกรูปแบบหนึ่ง ที่ช่วยให้ครูจัดการเรียนการสอน รวมไปถึงเป็นการพัฒนาผู้เรียนให้ดีขึ้น เนื่องจากปัจจุบันเด็กๆ มีความรู้ ความสามารถทางด้านเทคโนโลยีมากขึ้น อีกทั้งอุปกรณ์ต่างๆ ที่ช่วยให้เด็กๆได้มีความรู้ และพัฒนาตนเองในการเรียนได้
ช่วยให้เด็ก ได้เรียนรู้ในด้านการศึกษา ในอนาคตในภายภาคหน้า

Appendix H: Interview Questions (English)

General Questions for Teachers:

1. How many years have you been involved with education for students with physical disabilities?
2. Which subjects are you currently teaching?
3. How have students struggled while learning in the class?

Ask Question 1 for teachers teaching other subjects apart from computer	Ask Questions 1 - 3 for teachers teaching computer

4. What are the most common physical challenges faced by students?
    a. (If unsure answer) What are the most common challenges, specifically with Writing/Reading/Speaking/Moving?
5. What assistive device would you say students currently use the most?
    a. Movement Disability
    b. Hearing Disability
    c. Intelligence/Learning Disability
6. What assistive devices require the most upkeep? (Example: repairs, replacements, etc.)
7. Are there physical barriers in the classroom setup (e.g., desk height and seat position) that affect learning?
8. What skills or abilities would you like to see these students develop with the help of assistive technology?
    a. For Education/Learning?
    b. For the Job Force?
    c. For Independence/Self-Reliance?
9. What gaps still exist in accessibility for students with physical disabilities, particularly in technology use?
10. Are there any specific features you think a new assistive technology should have?
    a. What feature do you think will help with [CHALLENGES THEY MENTION]
11. Do you feel the school adequately prepares the students to use technology in daily life? (Yes or No)
12. What's one thing the school could do now to better prepare students with disabilities for modern jobs?
13. Rank the following devices based on their usefulness to the students. Rank 1-5 with 1 being the best.
    a. Joystick Mouse
    b. Universal cuffs
    c. Eye tracking software
    d. Word Prediction Software
    e. Digital AAC Board

Questions of teachers teaching other subjects apart from computer:

1. Are there any specific tasks or activities that students find particularly difficult?

Questions of teachers teaching computers:

1. What are the most common challenges faced by students while using the computer?
2. What are the most common difficulties students face when using computers (e.g., navigating interfaces, using the mouse, typing)?
3. What are the programs and activities taught in the computer class?

Questions for Alumni:

1. What is your age / How long have you been working?
2. Were there specific tools or technologies that made learning easier for you?
3. Did you feel the computer lab and its resources were accessible and tailored to your needs?
4. What were the biggest challenges you faced when using technology at school?
5. Are there any specific improvements you can suggest for future students?
6. Do you feel the school adequately prepares you to use technology in your current job or daily life?
7. Are there any technical skills you wish you had developed more at school?
8. If you could go back, what specific changes would you recommend to improve the school's approach to supporting students with physical disabilities?
9. Was there anything you struggled with when adapting to technology or physical barriers in the workplace?
10. What would be the lesson that you wish it would be taught in the school, so you could use it in the workplace?
11. What's one thing the school could do now to better prepare students with disabilities for modern jobs?
12. Is there a specific problem you faced with technology at school or work that inspires you to suggest a new solution?
13. If you could create one tool or technology for students with disabilities, what would it be and why?
14. What gaps still exist in accessibility for students with physical disabilities, particularly in technology use?
15. What are the most important technological skills you faced during work?
16. Rank the following devices based on their usefulness to the students. Rank 1-5 with 1 being the best.
    a. Joystick Mouse
    b. Universal cuffs
    c. Eye-tracking software
    d. Word Prediction Software
    e. Digital AAC Board

Questions for the Principal:

1. How many years have you been involved with education for students with physical disabilities? How long have you been in this position?
2. What is the greatest challenge that the school is currently facing? Have you come across a solution for it?
3. What challenges do you face in supporting students, and how have they been addressed?
4. What do you think of Sri Sangwan School's strengths and weaknesses in education when compared to the Thai curriculum?
5. Are there any ongoing projects or initiatives in particular that still need support?
6. Do you have any organization or schools that you use as a role model?
7. What are the examples of organizations or similar facilities that you are in contact with? And are there any case studies that you are interested in?
8. What gaps still exist in accessibility for students with physical disabilities, particularly in technology use?
9. Are there any current assistive technologies at the school that have been successful and most popular?
10. What assistive devices at the school require the most upkeep? (Example: repairs, replacements, etc.)
11. What skills or abilities would you like to see these students develop with the help of assistive technology?
    a. For Education/Learning?
    b. For the Job Force?
    c. For Independence/Self-Reliance?
12. Did you feel the computer lab set-up and its resources were accessible and tailored to the student's needs?
13. Do you feel the school adequately prepares the students to use technology in daily life? (Yes or No)
14. If you could create one tool or technology for students with disabilities, what would it be and why?
15. How does the school utilize technology in teaching? Please provide some specific examples.
16. Does the school focus on applying digital education sources to students' learning?
    a. If not, why ?
    b. If yes, What steps is the school taking to integrate online learning for students? What obstacles are presented when trying to do this?
17. Do you have a plan for finance-dependent students to access quality education?
18. [Brief: Based on the interview…] Do you have any plans for small problems that immediately need to be changed/fixed? I.e. WiFi and adjustable seats in the computer room
19. In the future, what is your ideal goal for this school and what would be the expected path or direction of the school? Especially in the computer lab / AT room?

20. In your opinion, what is a reasonable price range for assistive technology?
    a. How much of a certain AT would you need? Ex. A specialized software requires a license per computer, how many would need to be bought?
    b. What is the school's budget for the assistive devices? (Focuses on the AT that the school buys and does not rely on charity)
    c. How did the school allocate resources to the newer assistive device compared to upkeep of the old ones?
21. Except for the interns that we have seen, what types of jobs or higher education do the school's graduates pursue?
22. Rank the following devices based on their usefulness to the students. Rank 1-5 with 1 being the best.
    a. Joystick Mouse
    b. Universal cuffs
    c. Eye-tracking software
    d. Word Prediction Software
    e. Digital AAC Board

Questions for Caregivers:

1. How many years have you been involved with education for students with physical disabilities?
2. How many students do you take care of in each group?
3. What subjects do you most often help students with?
4. What assistive device would you say students currently use the most?
    a. Movement Disability
    b. Hearing Disability
    c. Intelligence/Learning Disability
5. What assistive devices require the most upkeep? (Example: repairs, replacements, etc.)
6. If the students do not have assistive devices, what can the students do independently?
7. Are there physical barriers in the classroom setup (e.g., desk height, seat position) that affect learning?
8. What skills do you think are needed when taking care of the student?
9. What are the symptom(s) or the condition(s) you see that the student possess
    a. How does that affect their learning, or how does that affect your plan to take care of them?
10. What are the common problems students face in learning and in daily life?
11. What assistive devices do you use to help with your work responsibilities?
12. If possible, do you think the specified problem can be resolved with assistive technology, or do you have any recommended tools that the school doesn't yet have?
13. What specific medications that the student uses and how impactful are the side effects of a student's medications on their learning progress/daily life compared to without the medication?

14. Rank the following devices based on their usefulness to the students. Rank 1-5, with 1 being the best.
    a. Joystick Mouse
    b. Universal cuffs
    c. Eye tracking software
    d. Word Prediction Software
    e. Digital AAC Board

Appendix I: Interview Questions (Thai)

<u>คำถามทั่วไปสำหรับคุณครู:</u>

1. ท่านทำงานเกี่ยวกับการศึกษาของนักเรียนที่มีความบกพร่องทางร่างกายมากี่ปีแล้ว?
2. ตอนนี้ ท่านกำลังสอนวิชาอะไรอยู่?
3. นักเรียนประสบปัญหาอะไรขณะเรียนบ้าง?

ถามคำถาม 1 สำหรับคุณครูท่านอื่น	ถามคำถาม 1 - 3 สำหรับคุณครูวิชาคอมพิวเตอร์

4. ความลำบากทางกายภาพที่นักเรียนพบเจอบ่อยที่สุดคืออะไร?
   (หากไม่มั่นใจ) ความลำบากทางกายภาพที่นักเรียนพบเจอบ่อยที่สุดอาจเป็นด้านใดระหว่าง
   การเขียน การอ่าน การพูด หรือ การเคลื่อนไหว ?
5. ท่านคิดว่าอุปกรณ์ช่วยเหลืออะไรที่นักเรียนใช้บ่อยที่สุด เช่น
   1.1 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการเคลื่อนไหว
   1.2 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการได้ยิน
   1.3 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการเรียน
6. อุปกรณ์การช่วยเหลือตัวไหนซ่อมหรือบำรุงรักษาบ่อยที่สุด?
7. อุปสรรคทางด้านกายภาพในห้องเรียนใดบ้างที่มีผลกระทบต่อการเรียน? (เช่น ความสูงของโต๊ะ ตำแหน่งที่นั่ง)
8. ท่านอยากเห็นนักเรียนพัฒนาทักษะหรือความสามารถใดมากที่สุดโดยใช้อุปกรณ์ช่วยเหลือ
   a. ด้านการศึกษา
   b. ด้านการทำงาน
   c. ด้านการพึ่งพาตัวเองในชีวิตประจำวันในอนาคต
9. ท่านคิดว่ามีจุดไหนที่ยังสามารถพัฒนาได้เพื่อเพิ่มประสิทธิภาพการเข้าถึงเทคโนโลยีสำหรับนักเรียนที่มีความพิการทางร่างกาย?
10. ท่านคิดว่าคุณสมบัติเพิ่มเติมใดที่เครื่องช่วยเหลือใหม่ๆควรจะมีคืออะไร? และท่านคิดว่าคุณสมบัติใดจะสามารถช่วยอะไรได้ จากที่ท่านได้กล่าวมา?
11. ท่านคิดว่าทางโรงเรียนเตรียมความพร้อมให้กับนักเรียนหรือไม่สำหรับการใช้คอมพิวเตอร์ในชีวิตประจำวัน?
12. แนะนำสิ่งหนึ่งที่โรงเรียนสามารถทำได้ในตอนนี้เพื่อเตรียมนักเรียนที่มีความพิการให้พร้อมสำหรับงานยุคใหม่ได้ดียิ่งขึ้นคืออะไร?

13. ในความคิดเห็นของท่าน หากมีการติดตั้งอุปกรณ์ติดตามการเคลื่อนไหวของดวงตา ท่านคิดว่าในเรื่องของการใช้งานจะมีประโยชน์อย่างไรบ้าง และเหตุผลเป็นอย่างไร?
    a. Joystick Mouse (ก้านควบคุมแทนการใช้เมาส์)
    b. Universal cuffs (สายรัดมือที่ช่วยให้การจับยึดอุปกรณ์)
    c. Eye tracking software (อุปกรณ์ติดตามดวงตาแทนการใช้เมาส์)
    d. Word Prediction Software (ซอฟแวร์เสนอคำระหว่างที่ผู้ใช้กำลังพิมพ์)
    e. Digital AAC Board (กระดานช่วยสื่อสารอิเล็กทรอนิกส์)

คำถามสำหรับคุณครูท่านอื่นๆ:

1. ท่านคิดว่ามีกิจกรรมอะไรที่ นักเรียนรู้สึกว่ายากเป็นพิเศษ?

คำถามสำหรับคุณครูวิชาคอมพิวเตอร์:

1. อะไรคือความท้าทายหรืออุปสรรคที่พบเจอบ่อยที่สุดในขณะที่นักเรียนใช้คอมพิวเตอร์?
2. ท่านคิดว่าอะไรคือความลำบากที่พบเจอจากการใช้อุปกรณ์ช่วยเหลือ? เช่น หน้าจอควบคุม การใช้เมาส์ การพิมพ์ดีด
3. ในคาบคอมพิวเตอร์นักเรียนได้เรียนโปรแกรมอะไรเป็นหลักและกิจกรรมในห้องเรียนเป็นอย่างไร?

คำถามสำหรับศิษย์เก่า:

1. ท่านทำงานมากี่ปี และจบจากโรงเรียนศรีสังวาลย์มานานเท่าไร?
2. ขณะที่ท่านเป็นนักเรียนมีอุปกรณ์ช่วยเหลือใดที่ทำให้การเรียนของท่านสะดวกขึ้นบ้าง?
3. ท่านรู้สึกว่าอุปกรณ์ต่างๆในห้องคอมพิวเตอร์มีการจัดวางตำแหน่งและสามารถนำมาใช้ได้สะดวกหรือไม่?
4. ท่านคิดว่าอุปสรรคใดที่ท่านเจอระหว่างการเรียนในห้องคอมพิวเตอร์ท้าทายที่สุด?
5. มีส่วนใดที่ท่านอยากจะบอกทางโรงเรียนให้ปรับปรุงเพื่อที่จะพัฒนาการเรียนการสอนของนักเรียนในรุ่นต่อไป?
6. ท่านคิดว่าทางโรงเรียนเตรียมความพร้อมให้กับนักเรียนหรือไม่สำหรับการใช้คอมพิวเตอร์ในชีวิตประจำวัน?
7. หากท่านย้อนไปตอนที่ท่านเรียนท่านอยากพัฒนาทักษะใดที่ท่านไม่ได้มีโอกาสพัฒนา?
8. หากท่านสามารถย้อนเวลากลับไปได้ ท่านอยากจะปรับแนวทางของโรงเรียนในด้านใดเพื่อสนับสนุนการเรียนของนักเรียน?
9. ท่านได้ประสบปัญหาในการใช้คอมพิวเตอร์หรืออุปสรรคทางกายภาพในที่ทำงานหรือไม่ อย่างไร?

10. คิดว่าเนื้อหาหรือบทเรียนอะไร ที่ควรได้รับการสอนที่โรงเรียน เพื่อนำความรู้ไปใช้ในระหว่างการทำงาน?
11. แนะนำสิ่งหนึ่งที่โรงเรียนสามารถทำได้ในตอนนี้เพื่อเตรียมให้นักเรียนที่มีความพิการทางร่างกายพร้อมสำหรับงานยุคใหม่ได้ดียิ่งขึ้นคืออะไร?
12. มีปัญหาใดที่ท่านเผชิญกับการใช้คอมพิวเตอร์ที่โรงเรียนหรือที่ทำงานและท่านคิดว่าจะแนะนำวิธีแก้ไขปัญหานี้อย่างไร?
13. ถ้าหากท่านสามารถสร้างอุปกรณ์ช่วยเหลือหรือเทคโนโลยีได้หนึ่งอย่างให้แก่นักเรียนที่มีความพิการทางร่างกาย จะสร้างอะไร เพราะเหตุใด?
14. มีช่องโหว่ใดบ้างที่สามารถแก้ไขได้ในการเข้าถึงเทคโนโลยีสำหรับนักเรียนที่มีความพิการทางร่างกาย?
15. ท่านคิดว่าทักษะทางเทคโนโลยีใด สำคัญที่สุดในที่ทำงานที่ท่านพบเจอ?
16. ในความคิดเห็นของท่าน หากมีการติดตั้งอุปกรณ์ติดตามการเคลื่อนไหวของดวงตา ท่านคิดว่าในเรื่องของการใช้งานจะมีประโยชน์อย่างไรบ้าง? เพราะอะไร?
    a. Joystick Mouse (ก้านควบคุมแทนการใช้เมาส์)
    b. Universal cuffs (สายรัดมือที่ช่วยให้การจับยึดอุปกรณ์)
    c. Eye tracking software (อุปกรณ์ติดตามดวงตาแทนการใช้เมาส์)
    d. Word Prediction Software (ซอฟแวร์เสนอคำระหว่างที่ผู้ใช้กำลังพิมพ์)
    e. Digital AAC Board (กระดานช่วยสื่อสารอิเล็กทรอนิกส์)

<u>คำถามสำหรับผู้อำนวยการ:</u>

1. ท่านทำงานเกี่ยวกับการศึกษาของเด็กนักเรียนที่มีความพิการมาแล้วกี่ปีและท่านดำรงตำแหน่งผู้อำนวยการมานานแค่ไหน?
2. อะไรคือความท้าทายที่ใหญ่ที่สุดที่โรงเรียนกำลังเผชิญอยู่และมีแนวทางแก้ไขอย่างไร?
3. ท่านเผชิญกับความท้าทายอะไรบ้างในการช่วยเหลือและสนับสนุนนักเรียนแล้วแก้ไขปัญหาอย่างไรบ้าง? (เช่น การสนับสนุนทุนนักเรียน, การช่วยกิจวัตรประจำวันของนักเรียน, การเก็บข้อมูลของนักเรียน, อุปกรณ์ช่วยเหลือของนักเรียน, การเตรียมความพร้อมให้กับนักเรียน)
4. ท่านคิดว่าการเรียนการสอนในวิชาคอมพิวเตอร์ของทางโรงเรียนในปัจจุบันมีจุดแข็งและจุดอ่อนอย่างไร? และหากเปรียบเทียบกับการศึกษาไทย?
5. ปัจจุบันนี้มีโครงงานที่กำลังทำอยู่หรือแผนงานใด ที่ต้องการการสนับสนุนบ้าง?
6. ท่านมีโรงเรียนหรือองค์กรที่เป็นต้นแบบให้กับโรงเรียนนี้หรือไม่?
7. ท่านมีหน่วยงาน หรือโรงเรียนตัวอย่างที่กำลังติดต่ออยู่หรือไม่?
   และ มีอะไรที่ประทับใจหรือตัวอย่างในโรงเรียนหรือหน่วยงานที่ท่านสนใจหรือไม่?
8. ท่านคิดว่ามีจุดไหนที่ยังสามารถพัฒนาได้เพื่อเพิ่มประสิทธิภาพการเข้าถึงเทคโนโลยีสำหรับนักเรียนที่มีความพิการทางร่างกาย?
9. อุปกรณ์ช่วยเหลือใดในโรงเรียนที่ประสบความสำเร็จและได้รับความนิยมมากที่สุดในปัจจุบันเพราะเหตุใด?
10. อุปกรณ์การช่วยเหลือใดในโรงเรียนที่ได้รับการซ่อมหรือบำรุงรักษาบ่อยที่สุด?
11. ท่านอยากเห็นนักเรียนพัฒนาทักษะหรือความสามารถใดมากที่สุด โดยใช้อุปกรณ์ช่วยเหลือ
    a. ด้านการศึกษา
    b. ด้านการทำงาน
    c. ด้านการพึ่งพาตัวเองในชีวิตประจำวันในอนาคต
12. ท่านรู้สึกว่าอุปกรณ์ต่างๆในห้องคอมพิวเตอร์มีการจัดวางตำแหน่งและสามารถนำมาใช้ได้สะดวกหรือไม่?
13. ท่านคิดว่าทางโรงเรียนเตรียมความพร้อมให้กับนักเรียนหรือไม่สำหรับการใช้คอมพิวเตอร์ในชีวิตประจำวัน?

14. ถ้าหากท่านสามารถสร้างอุปกรณ์ช่วยเหลือหรือเทคโนโลยีได้หนึ่งอย่างให้แก่นักเรียนที่มีความพิการทางร่างกาย จะสร้างอะไร? เพราะเหตุใด?
15. โรงเรียนมีแนวทางในการนำเทคโนโลยีมาใช้ในการเรียนการสอนอย่างไร?ช่วยยกตัวอย่างเทคโนโลยีนั้นได้ไหมครับ
16. มีการพัฒนาระบบการเรียนโดยใช้สื่อดิจิทัลในการเรียนรู้หรือไม่? เพราะเหตุใด?
    a. (หากตอบว่าใช่) โรงเรียนกำลังพยายามนำสื่อการเรียนการสอนโดยใช้สื่อดิจิทัลมาใช้กับนักเรียนอย่างไร?
    b. มีอุปสรรคใดที่ท่านพบเจอจากการพยายามนำสื่อการเรียนการสอนโดยใช้สื่อดิจิทัลมาใช้กับนักเรียน?
17. มีแนวทางช่วยเหลือนักเรียนที่มีปัญหาทางเศรษฐกิจให้สามารถเข้าถึงการศึกษาที่มีคุณภาพได้อย่างไร?
18. ท่านมีแผนที่จะปรับปรุงปัญหาเบื่องต้นที่สามารถแก้ไขอย่างไร เช่น WiFi, เก้าอี้ที่สามารถปรับระดับความสูงได้?
19. ในอนาคตท่านมีเป้าหมายอะไรสำหรับโรงเรียนแห่งนี้และมีแนวทางดำเนินการอย่างไรในเรื่องของการใช้คอมพิวเตอร์?
20. ท่านคิดว่าช่วงราคาของเทคโนโลยีที่เหมาะสมช่วยเหลือความพิการคือเท่าไร
    a. ทางโรงเรียนต้องการอุปกรณ์จำนวนเท่าไร ถึงจะเพียงพอต่อความต้องการของเด็ก สมมุติถ้าเป็น โปรแกรมที่ต้องซื้อในแต่ละเครื่อง?
    b. ทางโรงเรียนมีงบประมาณเท่าไรสำหรับอุปกรณ์ช่วยเหลือ?
    c. ทางโรงเรียนให้ความสำคัญกับการรักษาบำรุงอุปกรณ์ช่วยเหลือตัวเก่า หรือการซื้ออุปกรณ์ช่วยเหลือตัวใหม่?
21. นอกจากศิษย์เก่าที่พวกเราถามนักเรียนส่วนใหญ่ที่จบไปทำงานหรือเรียนต่อในด้านไหนบ้าง?
22. ในความคิดเห็นของท่านหากมีการติดตั้งอุปกรณ์ติดตามการเคลื่อนไหวของดวงตา ท่านคิดว่าในเรื่องของการใช้งานจะมีประโยชน์อย่างไรบ้าง? เพราะอะไร?
    a. Joystick Mouse (ก้านควบคุมแทนการใช้เมาส์)
    b. Universal cuffs (สายรัดมือที่ช่วยให้การจับยึดอุปกรณ์)
    c. Eye tracking software (อุปกรณ์ติดตามดวงตาแทนการใช้เมาส์)
    d. Word Prediction Software (ซอฟแวร์เสนอคำระหว่างที่ผู้ใช้กำลังพิมพ์)
    e. Digital AAC Board (กระดานช่วยสื่อสารอิเล็กทรอนิกส์)

<u>คำถามสำหรับผู้ดูแล:</u>

1. ท่านทำงานเกี่ยวกับการศึกษาของนักเรียนที่มีความบกพร่องทางร่างกายมากี่ปีแล้ว?
2. ท่านดูแลนักเรียนกี่คน/กลุ่มละกี่คน?
3. ปกติท่านช่วยเหลือนักเรียนในวิชาอะไรบ้างและวิชาไหนที่ต้องการความช่วยเหลือมากเป็นพิเศษ?
4. ท่านคิดว่าอุปกรณ์ช่วยเหลืออะไรที่นักเรียนใช้บ่อยที่สุด เช่น
    1.1 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการเคลื่อนไหว?
    1.2 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการได้ยิน?
    1.3 สำหรับนักเรียนที่มีปัญหาเกี่ยวกับการเรียน?
5. อุปกรณ์การช่วยเหลือตัวไหนซ่อมหรือบำรุงรักษาบ่อยที่สุด?
6. ตอนที่นักเรียนไม่ได้มีอุปกรณ์ช่วยเหลือความพิการนักเรียนจะสามารถช่วยเหลือตัวเองอย่างไรได้บ้าง?
7. อุปสรรคทางด้านกายภาพในห้องเรียนใดบ้างที่มีผลกระทบต่อการเรียน? (เช่น ความสูงของโต๊ะ ตำแหน่งที่นั่ง)
8. ท่านคิดว่าการดูแลนักเรียนนั้นควรมีทักษะอะไร?
9. อาการหรือภาวะใดบ้างที่ท่านสังเกตเห็นว่า นักเรียนมีระหว่างการเรียน
    a. อาการนั้นส่งผลอย่างไรกับการเรียนของนักเรียนหรือส่งผลอย่างไรกับการดูแลนักเรียนเป็นพิเศษหรือไม่?

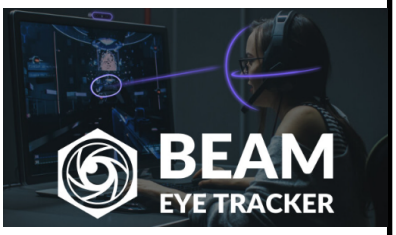
10. อะไรคือปัญหาทั่วไปที่นักเรียนพบเจอระหว่างการเรียนในห้องเรียนและในชีวิตประจำวัน
11. ท่านใช้อุปกรณ์ช่วยความพิการหรืออุปกรณ์อะไรที่ช่วยแบ่งเบาภาระงานของท่านบ้าง?
12. หากเป็นไปได้ท่านคิดว่าปัญหาที่พบเจอสามารถแก้ปัญหาโดยใช้เทคโนโลยีได้หรือไม่ หรือมีเทคโนโลยีใดที่โรงเรียนยังไม่มีที่ท่านสามารถแนะนำได้บ้าง?
13. นักเรียนต้องใช้ยาอะไรพิเศษหรือไม่?และผลข้างเคียงของยาส่งผลต่อการเรียนหรือกิจวัตรประจำวันของนักเรียนมากเพียงใด?และหากเปรียบเทียบกับตอนที่นักเรียนไม่ได้รับประทานยา?

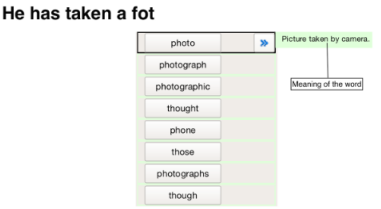
14. ในความคิดเห็นของท่านหากมีการติดตั้งอุปกรณ์ติดตามการเคลื่อนไหวของดวงตา ท่านคิดว่าในเรื่องของการใช้งานจะมีประโยชน์อย่างไรบ้าง? เพราะอะไร?
    a. Joystick Mouse (ก้านควบคุมแทนการใช้เมาส์)
    b. Universal cuffs (สายรัดมือที่ช่วยให้การจับยึดอุปกรณ์)
    c. Eye tracking software (อุปกรณ์ติดตามดวงตาแทนการใช้เมาส์)
    d. Word Prediction Software (ซอฟแวร์เสนอคำระหว่างที่ผู้ใช้กำลังพิมพ์)
    e. Digital AAC Board (กระดานช่วยสื่อสารอิเล็กทรอนิกส์)

Appendix J: Ranking Sheet Used for Interviews

Table 14

Appendix J, Ranking Sheet Used for Interviews

Name	Description	Translation	Photo
JoyStick Mouse	A specialized input device that allows users to control a cursor with a joystick instead of a traditional mouse.	เป็นอุปกรณ์การป้อนข้อมูลเพื่อให้ผู้ใช้สามารถควบคุมเมาส์ด้วยการใช้ก้านควบคุมแทนการใช้เมาส์	
Universal Cuffs	Assistive straps that wrap around the hand to hold tools like utensils, pens, or styluses.	สายรัดมือที่ช่วยให้การจับยึดอุปกรณ์อย่างช้อน ส้อม หรือปากกาง่ายขึ้น	
Eye Tracking Software	Technology that enables users to control a computer or device using eye movements. Explain it uses a webcam and will track and calculate movements of your eye to the screen	เทคโนโลยีที่สามารถทำให้ผู้ใช้ควบคุมคอมพิวเตอร์หรือควบคุมอุปกรณ์โดยใช้การเคลื่อนไหวของตา ให้อธิบายเรื่องของการใช้กล้อง webcam ซึ่งจะทำหน้าที่ติดตามและคำนวณการเคลื่อนไหวของดวงตาลงไปบนจอ	

Word Prediction Software	A tool that suggests words as a user types, improving typing speed and accessibility for individuals.	เครื่องมือที่เสนอคำระหว่างที่ผู้ใช้กำลังพิมพ์ เพื่อที่จะพัฒนาความเร็วของการพิมพ์สำหรับผู้ใช้	
Digital Augmentative and Alternative Communication Board	An electronic communication board that helps non-verbal individuals express themselves by selecting words, phrases, or symbols on a touchscreen or display.	กระดานช่วยสื่อสารแบบอิเล็กทรอนิกส์ที่สามารถช่วยผู้ที่มีปัญหากับการสื่อสาร ซึ่งจะให้ผู้ใช้กดเลือกคำ ประโยค หรือภาพบนจอ	

Note: This is use in interview sessions with all the participants for ranking different assistive device

Appendix K: Interview Quoting

Quoting for Teachers:

1. What are the most common challenges faced by students while using the computer? (Teacher A)

   The digital computer room does not have the adjustable desk, so it is a problem for the young students because they have not fully grown, meaning that they are kind of levitating during the class as their legs are above the floor.

2. What gaps still exist in accessibility for students with physical disabilities, particularly in technology use? (Teacher A)

   Moving on to the ideal expectation of students, it would be great if they could practice all the programs to really apply the knowledge and basics; to elaborate, **they should know the methods and concepts of the programs to further extend their knowledge in further education**. In addition, it would also be great if they could perform self-learning by the internet to equip them with skills.

3. What physical challenges happen in the classroom? (height of table, shape of table, etc.) (Teacher E)

   For the normal classroom, there are not many challenges since the **table is already designed for the specific children, but the computer room has a fixed position and height,** so the student tends to have a hard time.

4. Which assistive device would need the most often fixing? (Teacher F)

   Keyboard because the student can't control their strength, which often leads to them smashing or hitting the keyboard, making the keys come out. And their numeric key, which they use often. And some computers are old and tend to have a hard time upgrading software. Some rooms are better than other rooms. **Every year we would erase all program and redownload to get rid of unwanted files.**

5. Which assistive device would need the most often fixing? (Teacher G)

   I would say wheelchair since many kindergarten children don't really have many assistive devices. And since they are young, they cant really walk yet. Most of them don't start writing yet unless the teacher assigns it for them (not common). For those who cant speak, they will go to speech therapy and we also help them.

6. During teaching, what difficulties did students face? (Teacher J)

   Speaking of English class, I would say writing since they would have stiffness on their hands for those who can write; the pencil must be big so it's easier for them to grip.

7. What physical challenges happen in the classroom? (height of table, shape of table, etc.) (Teacher K)

   Some of the kids have bad eyesight so when they are looking at the board they will tilt their heads and that is not good for their posture, and some of the kids who are tall but have short-eyesight need to sit at the back of the room so they cannot see the board. So we tried our best to adjust the seating for accompany all of the problems

8. During teaching, what difficulties did students face? (Teacher K)

   Art is objective, so producing any kind of work does not require only a paintbrush. However, if there is an assistive device helping to hold a pen/pencil are very helpful.

9. What gaps still exist in accessibility for students with physical disabilities, particularly in technology use? (Mrs. Waraporn Panyaprachote, AT room's teacher)

   Students who are in the AT room program also require to be in computer lessons. Any moderation done for the students in the AT program needs to be applied for them in the normal computer lesson as well. This requires the help of IT staff and the computer teachers which often are new and lack knowledge to apply the change fully, this is a problem as sometimes it can lead to the students unable to take part in class activity if the accommodation is not up to standard.

10. What skill would you like to see the student improve for their future and daily life? (Teacher I)

    We must first understand that the school is set to prepare the student for field jobs mostly. Since we are preparing, we can't really talk about future jobs. As for daily life, we would like to see the student safely able to use technology and skilfully use the assistive device.

11. What could be improved to better support students with physical disabilities by assistive devices? (Teacher I)

    AI. Program that helps them with learning. **For teaching using computers some of the programs are too old.** So it's about computers in general. I want to see the students **use the computer to do anything they want, because most of the students here cannot go find other type of jobs**, mostly they can find jobs that include: using their voice, computer because in the future it's difficult for them to travel and even harder without a caretaker, so they must be at their home. For example, Fai is famous in tiktok for her makeup skills, and the other person is another student of mine who has artho his entire body, but is very smart. Right now he is at Nakhonpathom disabled center. He is an expert at cactus(ไม้อวบน้ำ?) and earthworms. He's a lecturer that is very smart. These skills he learns from outside we only teach the basics and he goes out

12. Suggest one that the school can better prepare the student for future life. (Teacher H)
    - Right now, the school allows teaching lessons along with practicing physical therapies. Some schools let the student go to therapy outside the school, but here we have an hour for the children to go do therapy.
    - For the technology, **I feel like they should have bigger screen and long cables**
    - Adjustable slide shows and bigger pen for writing
    - **Want a pen for the feet use (write with foot)**

13. Are there any assistive devices that could help? (Teacher G)

    Bring the item that they need to hold and tie it with rubber band to increase the gripping strength of the students but its not really an innovation

14. What skill would you like to see the student improve for their future and daily life while using an assistive device? (Teacher J)

    I want them to be able to read and write because I don't want them to be taken advantage of. As is, there is a device to assist them on holding item (maybe in science lab, so they can stir substance and be involved with their friends)

Quoting for Alumni:

1. If you could create an assistive device for the student, what would it be and why? (Alumni C)

    If it were me, I would want to try and make a mouse that those with feet can easily use, and I would like the base of the mouse to be like the mouse pad since some buttons for the mouse are small and hard to click. I think it would be easier to use. I want the mouse to be big like a mouse pad, and underneath it should be the function of a mouse to make it easier for those who can only use their feet. It would reduce strains on the muscles, and they would not have to put their feet on the table. I want the mouse to be 2 times bigger than a mouse pad.

Quoting for the Principal:

1. What are the challenges in terms of assistive devices?

    They gather other people and can bring us 10 tablets, but we do not accept money. We asked them for the spec, and they will buy it for us after we list the 10 kids who needed it for learning through typing. So these 10 kids will have their tablets wherever they go. This includes for them to bring it home, if they are not going to bring it back with them it won’t help them. Sadly, 10 other people would also want it as well, everyone wants a tablet, but we do not have it. Then we will try to find it. First, we will find it for them. Secondly, we teach them how to use it effectively, what are the pros and cons, and how to

operate it which itself is already challenging. Sometimes, when they bring it back home they come back with it broken. We cannot download any apps on it.

Appendix L: Ethnography Pictures

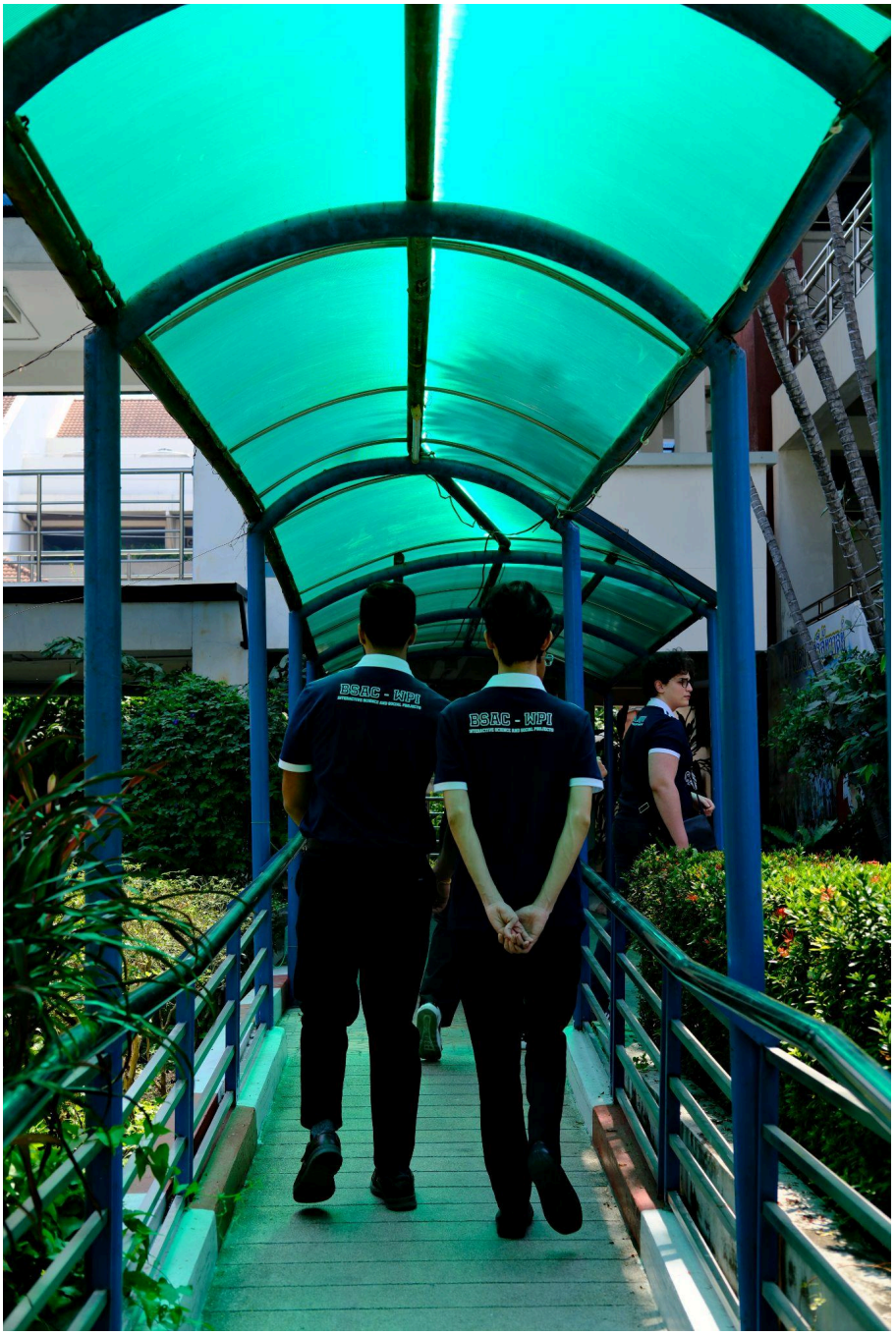
Figure 27

Appendix L, Ethnography-1

Note: The team watching student performance in the music room. Taken by Madalyn Nguyen

Figure 28

Appendix L, Ethnography-2



Note: The team walking around the school. Taken by Madalyn Nguyen

Figure 29

Appendix L, Ethnography-3

Note: Mrs. Wannaporn Panyaprachote demonstrated using a blanket to secure Siraphop Homhual in the AT room.
Taken by Madalyn Nguyen

Figure 30

Appendix L, Ethnography-4

Note: The picture of the team, and advisors with the school's board. Taken by one of the school's faculty