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Factors influencing science and environmental education learning of blind students: A case of primary school for the blind in Thailand

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ABSTRACT

The main objective of this research was to study the factors influencing the science and environment of education program for blind students at the elementary level. This research used mixed methods (quantitative and qualitative approaches), specifically a questionnaire survey was conducted to better understand the current situation on Science and Environmental Education Learning among 192 blind students in 14 primary schools for the blind in Thailand and in-depth interviews with the directors, science and Environmental teachers, and students' parents, 30 interviewees in total. The data were collected and analyzed into frequency and percentage (and K-means clustering) using SPSS software. The research findings from data collection from 192 blind students illustrated that the importance of facilitator that involve teaching materials (43%) was support appropriate to Science and Environmental Education teaching materials for blind students, 34% students had a good relationship with their classmates and teachers. A total of (32%) were provided more Braille textbooks for Science and Environmental Education teaching. K-means cluster analysis showed four clusters of science and environmental education learning blind students. The study concluded that the factors influencing effectiveness of science and environmental education learning of blind students consisted of facilitators, the creation of scientific learning processes, media and technology as the medium for communicating scientific knowledge, appropriate curriculum for blind students, and cognitive abilities of blind students in physical, mental, intelligence, and emotion terms.

Contribution/Originality: This study contributes to the planning of science and environmental education for blind students in Thailand by using the factors of facilitators, supporting media and technology, teaching materials and appropriate courses. These issues affect science learning and environmental education among blind students in primary school.

1. INTRODUCTION

Science and Environmental Education Learning of the school for the blind's students is facing several problems concerning facilitators, media and technology supports, instruction materials, and appropriate curriculum. These issues affect performance in Science and Environmental Education among blind students in elementary level. A school for the blind is a learning facility for people with visual impairments (Anson & Meyrick, 2020). In this type of school, a special teaching method is used for students with special or unusual physical, intellectual and emotional characteristics. The educational institutions for blind students in Thailand provide primary school education which currently consists of 14 schools under the private and public education institutes. According to the Office of the Basic Education Commission (Ministry of Education, 2017), science and environmental are subjects in the curriculum designed for normal students. Consequently, students with disabilities may experience hardship in studying these two subjects because there is no teaching equipment, tools, media and technology, and an instructional curriculum suitable for them. Moreover, blind students do not have critical classroom resources. For example, important graphical information which is iniquitous in science is often not made available to the blind (Anson & Meyrick, 2020). Therefore, a method must be found to enable an effective learning process for blind students; where facilitators, learning process, media and technology, curriculum, and self-efficacy may play important roles (André, Linhalis, Bianchini, Fortes, & Maria da Graça, 2010; Felder & Silverman, 2002; Gilmour, Fuchs, & Wehby, 2019; Sarah & Jones, 2021; Woerkom, Nijhof, & Nieuwenhuis, 2002).

A facilitator, who is in charge of educational supports must prepare equipment and tools to make an activity possible, must act as a coach and instructors who demonstrates learning methods for students in order to make them be able to learn by themselves, such as problem-solving teaching methods (Bernie & Charles, 2009). Science and environmental education learning involve an experimental learning process to inquire answers from questions, in which the facilitator guides students to identify problems and subsequently answer them correctly. Presently, special instructors are necessary to get more help from the disabled classmates, teachers and parents for conducting multifaceted and challenging work (Sarah & Jones, 2021). Moreover, instructors are expected to carry out various tasks while also working under considerable constraints, such as limited time, funding, lack of staffing, and high degree of emotional labour (Bettini et al., 2017). Accordingly, professional development is essential for special education teachers (Darling & Richardson, 2009). School staffs, such as coaches, can adopt teacher's practices that include initiative making and professional learning. Particularly, instructional coaching in both teachers' beliefs and practices is pivotal (Shirrell, Hopkins, & Spillane, 2019). It is shown that teacher's sense making is fostered by specific pillars of a reading reform; schools use coaches or professional learning communities to support teacher development and special education teachers would benefit from collaborative, contextualized professional learning opportunities (Coburn & Woulfin, 2012). School reformation and professional development should be adhered together by content matching, curriculum and instructional resources (Woulfin & Gabriel, 2020). They illustrate greater degree of confidence in working with disabilities after being developed on specialized knowledge and skills (Pancsofar & Petroff, 2013).

Learning Process is a method that assists blind students in learning by the concept of Robert (1977), which is divided into following conceptions: Motivation, Apprehending, Acquisition, Retention, Recall, Generalization, Performance, and Feedback. In addition, Lee et al. (2013) and Cronbach (1977) claimed that the learning process must include: Goal, which is what students should gain from learning, readiness of the teachers, curriculum, teaching methods, teaching media and technology, which must have the maturity level, emotion and ability to learn, situation, the creating activities and environments for teaching and learning and other relevant environments. Interpretation is what people understand and interpret in the stimuli and involved situations. A consequence to a learning process is the result of a response that is consistent with purpose. If the consequence is consistent, learning is considered to be accomplished. Adversely, if consequence is inconsistent, learning does not take place. Thus, the process must be started over again (Cronbach, 1977).

In the case of learning process for the blind, metacognitive ability can be more effectively achieved by participatory learning including a series of activity and assessments by critical discourse and reflection for inducing deeper thinking. By using knowledge as a medium and teachers as a facilitator (Anson & Meyrick, 2020), blind children mainly learn through polyneuropathy approaches and are taught with surrogate images and analogies (Walter, Phillips, Nasreddine, & Chertkow, 2010). Scientific process skill is the ability to compose knowledge, analysing problems, making conclusion, experimenting and making a decision (Fethiye & Ayas, 2014). In the field of education, the learning process is done by performing, hearing and seeing, visualizing, imaging, acting or memorizing with attention and motivation (Felder & Silverman, 2002). Learning process is sometimes the way of teaching: some tutors focus on application, some demonstrate, and some understanding the concepts (Thornton, Ernst, & Clark, 2012).

Media and technology are tools to help students access or learn science more easily, such as belle textbooks, scientific model, experiments in science laboratories. Role of media and technology in teaching and learning and instructional media are medium for delivering knowledge and experiences between teachers and students, which help them learn effectively, understand the meaning of things clearly as the instructors intend, lessen their time spent in studying and facilitate in learning. Media and technology also create a good environment for learning, as technology has evolved over time thus making the current educational programme unavoidably adopt new technology to assist in teaching and learning. New technologies such as video conference, interactive whiteboards, e-learning and others empower students with different abilities and disabilities, which is crucial to make these environments more inclusive (André et al., 2010). Moreover, e-learning has pointed out some values in society, including equal opportunity, social support by co-operation and communication, student activities, priority to attain learning objectives, flexible learning, and integration of e-learning in the learning environment (Eibl & Schubert, 2008). Nonetheless, technologies sometime lessen students' demonstration, presenting the students' perseverance, enjoyment and motivation (Janu & Retnawati, 2015).

Nowadays, the curriculum for blind students in elementary school use textbooks and principles for normal sight students, which are not suitable for blind students. Hence, it is necessary to create a proper curriculum for blind students by using science teaching, which focuses on learner's acquisition of knowledge for themselves in order to obtain both process and knowledge from surveying, examining, experimenting, and then use the outcomes to systematize as principles, concepts and knowledge. The lack of an appropriate curriculum for students with disabilities is a major hindrance to their learning (Gilmour et al., 2019), as the current one mainly emphasizes on student's scientific process skills which only involves logical thinking skill (Fethiye & Ayas, 2014).

Self-efficacy is to assess one's capability to work or learn to some extent, or a person's belief in ability to do something influential in his life, which is based on feelings, thoughts, motivation and behaviour (Albert, 1978). Moreover, factors related to self-efficacy consist of attaining mastery and success. An individual may believe that he is able to carry out modelling, observing complex behavioural models, and receiving satisfactory results. Consequently, he may make observers feel that he is able to succeed. Verbal persuasion indicates that a person has capability to attain goal, emotional arousal which is a stimulus that affects one's cognitive abilities. Moreover, people with high efficacy tend to have courage to resolve social pressure and are open to learning experience (Woerkom et al., 2002).

The main objective of this research was to study factors influencing Science and Environmental Education Learning for the blind student at the primary level. The research aimed to find positive factors that benefit blind students, and facilitate the learning through activities process via uses of media and technology, reworking of a suitable curriculum for blind students emphasizing on learners' development in studying. These factors would help blind students to learn Science and Environmental Education more effectively.

2. RESEARCH METHODOLOGY

2.1. Questionnaire and in-Depth Interviews

This research uses the mixed method between quantitative research and qualitative research by a questionnaire survey on the current situation on Science and Environmental Education Learning among 192 blind students who study in 14 primary schools for the blind in Thailand and in-depth interviews with the school directors, scientific and environmental education teachers, and parents. In total, there were 33 interviewees including 3 policy makers for blind students' education from Ministry of Education of Thailand, in which the data were processed into frequency and percentage with SPSS.

Table 1. Research questionnaire.

Factor	Code	Question
Facilitator	A1	School directors should support teaching and learning by providing Science and environmental education teachers.
	A2	School directors should facilitate teaching and learning materials.
	A3	School directors should support grants and materials of teaching and learning.
	A4	Teachers should encourage students to be interested in learning.
	A5	Teachers should increase the number of teaching techniques by creating motivation.
	A6	Teachers should teach Science and environmental education through hands-on laboratory practice.
	A7	Teachers should increase the number of methods of instruction i.e, outdoor classroom space (Nature contact exposure).
Learning process	B1	The school creates a learning process that emphasizes students' interests.
	B2	The school creates a learning process that focuses on content in accordance with the curriculum.
	B3	The school creates a learning process with an emphasis on group work.
	B4	The school creates a learning process with an emphasis on practicing through projects.
	B5	The school creates a learning process by focusing on problem-based learning management.
	B6	The school organizes a learning process with a focus on a teacher.
Media and technology	C1	The school provides teaching and learning through media and technology of Braille textbooks.
	C2	The school provides media and computer technology classes.
	C3	The school provides teaching and learning through media and technology in terms of nature and environment.
	C4	The school provides teaching and learning emboss pictures or models as instruments.
Curriculum	D1	The curriculum for learning of science and environmental education is too difficult to understand.
	D2	The curriculum of science and environmental education is not included in Braille textbooks.
	D3	The curriculum of science and environmental education lacks materials for teaching.
	D4	The curriculum for learning of science and environmental education has a problem of communicating between teachers and students.
	D5	Learning courses of science and environmental education with imaginative techniques.
Self-efficacy	E1	Students are responsible for their assignments.
	E2	Students are willing to study.
	E3	Students have a good relationship with their friends and teachers.
	E4	Students have a public mind and participate in school activities.

2.2. Cluster Analysis

In following the questionnaire (Table 1), the K-means clustering method was applied in accordance with each respondent's interest. Formally, the cluster analysis was a method to define the data's common structure, while the

K-means method was a process to analyze patterns of a certain ungrouped information in order to form its brief image and innovative knowledge (Panthong & Taecharungroj, 2021). In the case of a study with a sampled group of students, the K-means clustering algorithm can clearly and fairly classify a set of data (Jia & Cheung, 2017; Kistofer, Permadi, & Vitadiar, 2019). The outcome of this method may include the definitive variables which was relevant to the variety of lessons that could be defined by them (Banikhalaf & Khder, 2020). The clusters amount could be identified by the silhouette method in the cluster package in R.

3. RESULTS

3.1. Questionnaires

Table 2 describes characteristics of blind students who were studying in 14 schools for the blind at the elementary level, specifically on gender, age, religion, and class level. The total number of them was 192 students.

Table 2. Personal information of the blind students. (N=192)

Demographic	Number	Percentage
Gender		
Male	100	52.10
Female	92	47.90
Age		
5-10 Years	56	28.65
11-15 Years	115	59.90
16-20 Years	21	11.49
Religion		
Buddhism	168	87.50
Christian	2	1.04
Islam	22	11.46
Class level		
Elementary schooling grade 1	24	12.50
Elementary schooling grade 2	26	13.54
Elementary schooling grade 3	35	18.23
Elementary schooling grade 4	23	11.98
Elementary schooling grade 5	25	13.02
Elementary schooling grade 6	59	30.73

The research findings from data collection through survey questionnaire on Science and Environmental Education Learning (Table 1) among 192 blind students from 14 primary schools for blind in Thailand showed that the importance of facilitator was teaching materials (43%). Thus, they should support appropriate Science and Environmental Education teaching materials for blind students so that they can access easy-using and high-performance equipment. Moreover, schools designed the learning process for blind students by focusing on the content corresponding with Science and Environmental Education teaching curriculum (25%) according to the criteria of the Office of the Basic Education Commission (OBEC), and creating a learning process by encouraging blind students to work in groups (23%). Factors concerning media and technology pointed out that schools should provide more Braille textbooks for Science and Environmental Education teaching (32%) and should increase the use of media and computer technology (27%) to enable blind students to access the program and to easily access Science and Environmental Education information. In terms of curriculum factors, the survey illustrates that at the present media and equipment that help blind students' access content and knowledge are inadequate (31%), as the curriculum was not appropriately designed for them. Teachers provide students learning with imagination techniques based on content (20%) and self-efficacy factor. It was also found that students had a good relationship with their classmates and teachers (34%) and that students had a public mind and attended school activities (28%).

3.2. Cluster Analysis

As shown in the Figure 1, the silhouette method illustrates that there were four clusters (K=4) of data which contained a local peak of the average width. Consequently, K-means cluster was applied under the condition of 1,000 random starts and maximum redundancy at the value of 1,000 to guarantee the data's potency.

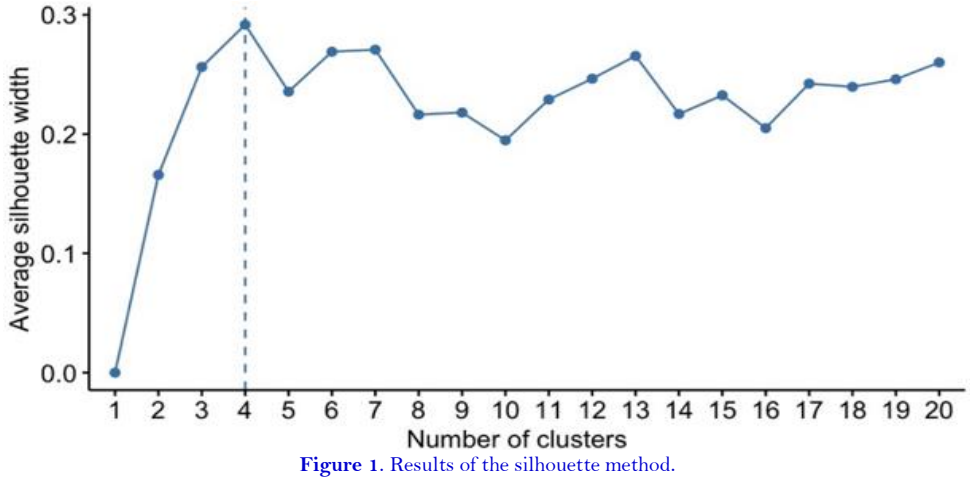

Figure 1. Results of the silhouette method.

Figure 2 shows the results of K-means cluster analysis of four clusters of science and environmental education learning blind students. In the first cluster, students emphasized self-efficacy concept, which reflected each pupil's self-awareness in his/her responsibility to a certain assignment. It was followed by the opinion that the current curriculum was not appropriate for blind students, so the school for blind students should provide technological media and braille textbook. In addition, students also demanded that school's executives should act as facilitators in their campus lives. For the second cluster, students highlighted self-efficacy noting that they were capable of and interested in Science and Environmental Education. For the point of curriculum, they expressed that the lack of braille textbook was their major disturbance in learning. Therefore, they suggested that their school should provide more braille and technological media. Their opinion toward facilitator was the same as in the first cluster, arguing that school directors should be a part in the learning process facilitation.

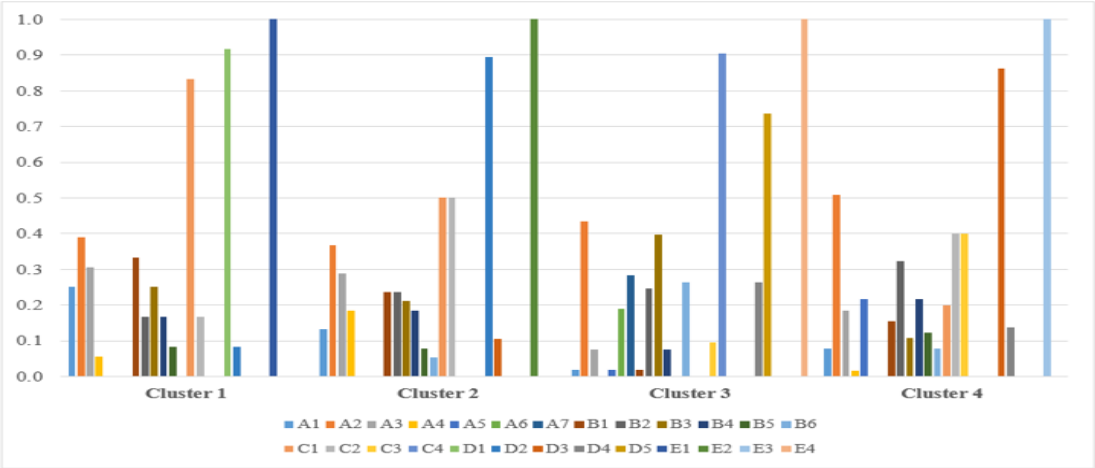

Figure 2. The four clusters that affect factors in science and environmental education learning for blind students.

The third cluster students also pointed out the importance of self-efficacy, evaluating that they had service-mind and were eager to participate in environmental education activities. Given that the current curriculum was highly reliant on imagination, students suggested that their school should offer more media like three dimensional convex models. For the learning process, they proposed that their class should contain more group learning activities. In

addition, they also had an opinion that directors should facilitate them in providing educational media. Finally, students in the fourth cluster stated that they had good relationship with friends and teachers. They believed that their school lacked classroom materials of Science and Environmental Education. Hence, directors should prioritize teaching media, which could include technological media like computer and natural and environmental media.

3.3. In-Depth Interviews

Table 3 presents the demographic data of school directors, teachers, parents and policy makers of scientific learning for the blind students sampled for the in-depth interviews. This information comprised gender, age, religion, and education. The purposive sampling method was used to select 33 interviewees in Thailand.

Table 3. Descriptive characteristics of director, teachers, parents and policy maker in in-depth interviews.

Demographic	Number	Percentage
Gender		
Male	11	33.33
Female	22	66.67
Age		
30-40 Years	13	39.39
41-50 Years	16	48.48
50-60 Years	4	12.13
Religions		
Buddhism	30	90.91
Christian	1	3.03
Islam	2	6.06
Education level		
Secondary education	10	30.30
Bachelor degree	14	45.45
Master degree	7	18.18
Doctoral degree	2	6.06

Results of the in-depth interviews with executive groups, Science and Environmental Education teachers and parents indicated that the major factor reinforcing blind students' learning performance in Science and Environmental Education was the role of facilitator, who had an important function to support and promote education of blind students. The information obtained from the in-depth interviews was as follows.

Role of school directors was to promote Science and Environmental Education Learning within schools for the blind in Thailand, which were currently facing problems with the aptitude of science teachers and the budget to provide scientific teaching materials. To solve these problems, training methods to increase Science and Environmental Education teachers' skills for blind students was required. Teachers' role needed to be more beneficiary, and advanced teaching techniques should be added in order to stimulate students' interest by finding current events to teach them. In addition, teachers should organize hands-on teaching combined with toys, exposure to materials or experiments in science laboratories such as creating a learning process for blind students within class and outside classroom.

Currently, the school for the blind people in Thailand emphasized the content of teaching and learning to be consistent with all learning groups according to the core curriculum for the primary level of the Ministry of Education, and focused on students' working through group projects by creating a technology-based learning process, which focused on students' interests as a key.The teaching of Science and Environmental Education by teachers at the school for blind students through media and technology consisted of following media: 1) Braille textbooks; teachers must have skills in using Braille to communicate with blind students, 2) Emboss media; which was a teaching medium that simulated a virtual reality that teachers could utilize. there was also ready-made

teaching materials from the Office of Special Educational Technology, and the Institute for the Promotion of Teaching Science and Technology, and 3) Computer media; which was a tool that allowed blind students to easily access information. For the case of a proper curriculum for blind students, the school for teaching blind students still used the primary core curriculum of the Ministry of Education, in which blind students learnt imaginative techniques through teacher's lectures. Therefore, there were limitations to convey meaning which it lacked concrete materials of science teaching. By designing a specific curriculum for blind students, students could gain effective access to scientific knowledge. In the term of Self-efficacy, the Science and environmental education learning of blind students had physical limits if it was built on confidence for cognition or learning, which may result in students being able to create learning activities in the classroom.

4. DISCUSSION

The cluster analysis of the factors affecting Science and Environmental Education Learning of blind students included factors like a facilitator, learning process, media and technology, curriculum, and self-efficacy. The analysis showed that the sampled students could be separated into four clusters. In general, students mostly emphasized the factor of self-efficacy as they thought that they were capable of both physical and mental tasks. Moreover, they could be responsible for what they were assigned to do and had good relationship with classmates and teachers. Overall, people with high self-efficacy were said to be more critical than others which might result in better work performance (Bandura, 1997). Therefore, if a student evaluated that he or she had potential, he or she would be more likely to success in an actual action (Richardson, Abraham, & Bond, 2012; Van Dinther, Dochy, & Segers, 2011; Vermunt & Donche, 2017; Zimmerman, 2000). To further elaborate, there were four sources of self-efficacy which were enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. The higher self-efficacy a student possesses, the better outcome of skill development, competitiveness, and resolve of that student would become (Cassidy, 2015; Komarraju & Nadler, 2013; Lee et al., 2013; Schunk & Pajares, 2005).

In term of curriculum, students asserted that the current one was not appropriate for blind learners like them, noting that the content was too complex to understand. Consequently, the school also lacked braille textbooks and classroom instruments, which were a disturbance to the current trend of the education for the blind as it highly relied on imagination. Thus, the effective Science and Environmental Education class required good media and equipment. Ordinarily, science is a subject that relies on observing and exploration, which requires vision or eyesight. Hence, the disability in seeing blind students hindered them to do full potential learning (Verver, Vervloed, & Steenbergen, 2020). Since the current mode of education for blind students was to focus on utilizing braille media, magnification, and tactile graphics, blind students should be able to use their senses other than vision to engage with those materials (Klingenberg, Holkesvik, & Augestad, 2020; Rosenblum, Cheng, Zebehazy, Emerson, & Beal, 2020).

Apart from the vision disability, the traditional way of teaching science was also an obstacle to the students (Verver et al., 2020). In this case of classroom, a teacher directly lectured and explained the content to students, which could be implied as a one-way communication. However, this method aggravated students' creativity, concentration, and enthusiasm in studying. This scenario could also happen in the classroom of normal sight students, as their teacher only wrote on the board and explained the lesson while rarely let students engage with the subject (Bell & Silverman, 2019). In term of facilitation, most students demanded that school directors should be a part in providing class materials like 3D convex models or digital media. Despite the fact that technological media like video magnifier, braille embossers, and note-taking devices may help blind students to access the content, some student might not use them even if they were available like in the case of blind students in the United States of America (Kelly, 2009).

Technology like touch screen devices granted them a new possibility to be transformed as a consumer, in which the technology was able to substitute the visual access for blind students. Modern devices' operation system (OS) like Android or iOS included visual, vibration, and audio that made the colocation of visual information possible through the nonvisual feedbacks. As similar information tends to be expressed via multiple sensory inputs, the perceptual detail could be potentially increased (Macaluso & Maravita, 2010).

Nonetheless, studies on blind students' learning via hearing and touching are still insufficient nowadays (Chien-Huey, Kuo, Hou, & Koe, 2022). As students' physical disability is holding them back from effective learning, this research aimed to study factors that helped blind students in learning. Certainly, this requires facilitators, learning process designation, appropriate media and technology, and the special curriculum. Essentially, the most important component of the successful learning of blind students is their self-efficacy.

Those factors include as follows: the role and obligations of facilitators on blind students in schools must promote the work of teaching students in media and teaching materials. The teacher must be a specialist in teaching Science and environmental education for special education, inspiring blind students to be engaged and understand the importance of the subject, as knowledge can be applied to daily life, and should create an outdoor classroom space (nature contact exposure) due to the fact that blind student cannot see the classroom materials outside the laboratory, which is another way to make the subject to be more creative and attractive. Another role of the teacher is to organize the learning environment such as classroom organization, media, materials, equipment and sound system as a learning guide provided to students to maximize their full potential as a reinforcement or inspiration. Consequently, learners should be confident and develop themselves to see the value and meaning of learning, including an evaluator to provide the feedback into learners knowing their outcomes, to make learners be able to study new knowledge or develop innovations, and be a researcher to study problems in the classroom and solve problems by conducting action research. Training teachers in inquiry-based learning that raises awareness of the necessity to build a sustainable world is important for both induction and continuous training. This was stated by the United Nations Educational, Scientific and Cultural Organization concept mentioning what the training given should go back to their scientific, cultural and educational roots (UNESCO, 2020).

Learning Process creating a learning process for blind students mainly focuses on creating activities in accordance with the basic curriculum, so that blind students could receive the same knowledge as normal students. Creating good Science and environmental education learning activities should highlight processes that are important to students as follows: creating a new process that arises from the use of knowledge and creativity to develop it, which may look like a new product, an innovation, or a new process, new educational innovations such as flipped classroom; learning activities which are a type of learning arrangement that transforms from teachers to lectures in the classroom to create or suggest learning materials for students to study in their free time and change classroom activities into activities from the lessons students have studied to practice skills, problem solving, and create interactions within the classroom, online learning activities or e-learning is an education through computer network, internet or intranet with self-taught lessons. Students' abilities and interests indicate the extent that each of them can learn and understand. The content of a lesson should include text, images, audio, video and other multimedia and brain-based learning activities, as learning management promotes both the left and right brain to learn in a balanced way and in accordance with intelligence of the learners using appropriate processes and methods.

Media and technology are an intermediary to transfer knowledge and experiences from the instructor to the learners which serves to help them learn more effectively, to help the learners to understand what they have learned clearly and exactly as the teacher wants, to cut down the time of studying and facilitating. It also helps in creating a good environment for learning. Currently, teachers would explain or give lectures to students based on the standard content. The Braille textbook is another type of media that can help students research more Science and environmental education knowledge, and computer technology, relief technology or science model and

environmental media, and science laboratory experiment. Teaching a blind child to learn is not difficult, as their ability to learn from listening to the phonetic book or reading Braille texts is excellent. Even if they are blind, their ears can work and able to bring the knowledge of teaching into the pronounceable/audio book that help them learn. There is another one way to learn for blind children in order to improve their knowledge well the audiobook for the blind. They can learn fully from the sounds that come from books and braille, which they can learn as quickly as possible.

The current curriculum uses the textbooks of the Office of the Basic Education Commission which were written by the Institute for the Promotion of Teaching Science and Technology, Ministry of Education, Thailand. Most of the content focuses on students to learn science and environmental education emphasizing on the linkage of knowledge with the process that have important skills in researching and building knowledge by the process of inquiring for knowledge and solving a variety of problems, engage with the learners in every step of the learning process. There are various activities that can be practiced and are suitable for the grade level with the essence being as follows: 1) biological science by learning about life forms in the environment, human and animal life, plant life, genetics, biodiversity and evolution 2) physical science by learning about the nature of substances, change of substance and energy movement, 3) earth and space science by learning about the elements of the universe, interaction within the solar system, space technology, earth system, geological change climate change processes and their effects on living things and the environment, and lastly 4) learning design about technology for living in a rapidly changing society by applying knowledge and skills in Science, Mathematics and other sciences to solve problems or to develop creative works through processes of selecting the use technology appropriately regarding the impact on life, society and environmental education terms, and computational science for learning about computational thinking, analytical thinking and problem solving in a process and systematic manner and applying knowledge of computer science and information and communication technology to effectively solve real-life problems. This content is viable for normal students, but is hard to blind students. So, an important factor for science and environmental education learning curriculums is to develop or create a curriculum that is suitable for blind students that able to access the contents and is easy to understand.

Self-efficacy of blind students can be perceived physically and mentally. Physical awareness of blind students able them to perceive or learn things through their senses such as listening to sound, touch, smell and taste. Each blind student's ability and senses are different depending on the physical disability. The perception of the mind of the blind student which caused by emotional and intelligence factors as a component of thinking and decision making. Therefore, another important factor enhances the effectiveness of Science and Environmental Education Learning for blind students is the self-efficacy assessment, physical and mental, intellectual, social and emotional readiness, such as the ability to study together or have good relationships with classmates and teachers, having a public mind and can work in group activities as learning group, willingness and researching knowledge of science and environmental education.

5. CONCLUSION

The result showed the factors influencing science and environmental education learning for the blind student at the primary level as follows: 1) Facilitators; 2) Learning Process; 3) Media and Technology; 4) Curriculum; 5) Self-efficacy. Facilitators have the role to promote media and materials for teaching and learning. Teachers must be expert in teaching the subjects especially designed for blind students. The factors for creating the learning process must focus on the content in relevance with the teaching of science and create activities for students to learn or to access knowledge effectively. The program focuses on the learner and organizing activities of teaching and learning through a group process, media and technology factors, science textbooks prepared in Braille characters, media reliefs and models of science and environmental education and teaching and learning through computer technology, which is built as a modern and fast tool so that blind students can easily research and access science knowledge. For

the factors of the curriculum, there must be materials and accessories for students to understand the subject, create a specific curriculum or content appropriate for blind students, and self-efficacy factors, physical competence of blind students, so that they can effectively learn science and environmental education through hearing, touching, smelling, and tasting. The intellectual abilities in terms of mental and emotional can build good relationships with friends and teachers and having a public mind able to learn through the group process.

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Competing Interests: The authors declare that they have no competing interests.
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