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Research Article

Development of UBU-ASLC system for supporting the teacher professional development program: A case study of Asperger's syndrome learning for Thai educators

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Abstract

With the advancement of technology use in educational settings, information and communication technology has been increasingly incorporated into the teacher professional development (TPD) programs to enhance knowledge acquisition, retention, and transfer. This study describes a research pilot of the development and use of a web application, the *Ubon Ratchathani University Applied Science Learning Center* (UBU-ASLC) system, as a deliverable of a TPD program in Thailand to build knowledge of Asperger's syndrome (AS) among educators. In Thailand, AS is not well-known compared to autism spectrum disorder due to the paucity of research and resources, and educators are challenged to nurture their students with AS to meet their full potential. The UBU-ASLC system was developed with multi-faceted software to support diverse modes of learning. The implementation of the system occurred in the city of Ubon Ratchathani, located in north-eastern Thailand. The participants of this study were in-service and pre-service teachers, who exhibited strong interests in learning about AS. The results suggested that the UBU-ASLC system was a valuable component of the TPD program, enhancing knowledge retention and promoting the creation of a professional learning community.

Keywords: Professional training, teacher professional development, knowledge transfer, web application, Asperger's syndrome

บทความวิจัย

การพัฒนาระบบ UBU-ASLC สำหรับสนับสนุนโปรแกรมพัฒนาวิชาชีพครู: กรณีศึกษาการเรียนรู้เกี่ยวกับแอสเพอร์เกอร์ซินโดรมของบุคลากรทางศึกษาไทย

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บทคัดย่อ

ด้วยความก้าวหน้าของการใช้เทคโนโลยีในด้านการศึกษา เทคโนโลยีสารสนเทศและการสื่อสารได้ถูกนำมาบูรณาการรวมกับโปรแกรมการพัฒนาวิชาชีพครูเพื่อให้เกิดการเข้าถึงความรู้ ความคงทนและถ่ายโอนความรู้มากขึ้น งานวิจัยนี้เป็นการนำร่องด้วยการพัฒนาระบบในรูปแบบเว็บแอปพลิเคชัน ชื่อว่า Ubon Ratchathani University Applied Science Learning Center (UBU-ASLC) ซึ่งใช้เป็นช่องทางการถ่ายทอดองค์ความรู้ของโปรแกรมพัฒนาวิชาชีพครู เพื่อสร้างความรู้ความเข้าใจเกี่ยวกับแอสเพอร์เกอร์ซินโดรมให้กับนักการศึกษาในประเทศไทย เนื่องจากการขาดแคลนงานวิจัยและแหล่งเรียนรู้ จึงทำให้แอสเพอร์เกอร์ซินโดรมยังไม่ได้เป็นที่รู้จักมากนักในประเทศไทยเมื่อเทียบกับโรคออทิสติก จึงเป็นความท้าทายให้ครูต้องฟูมฟักนักเรียนที่มีอาการแอสเพอร์เกอร์ซินโดรมของตนเองให้มีศักยภาพที่สมบูรณ์ ระบบนี้พัฒนาด้วยซอฟต์แวร์ที่หลากหลายเพื่อสนับสนุนวิธีการเรียนรู้ที่แตกต่างกัน การวิจัยดำเนินการที่จังหวัดอุบลราชธานี ในภาคตะวันออกเฉียงเหนือของประเทศไทย กลุ่มตัวอย่างของการวิจัย ได้แก่ ครูประจำการ และนักศึกษาที่เรียนวิชาชีพครู ซึ่งมีความสนใจอย่างมากในการเรียนรู้เกี่ยวกับแอสเพอร์เกอร์ซินโดรม ผลการวิจัย พบว่า ระบบ UBU-ASLC เป็นองค์ประกอบที่สำคัญในโปรแกรมพัฒนาวิชาชีพครู สามารถส่งเสริมความคงทนในการเรียนรู้ และยังสนับสนุนการสร้างชุมชนการเรียนรู้อย่างมืออาชีพของครูด้วย

คำสำคัญ: การฝึกอบรมวิชาชีพ การพัฒนาวิชาชีพครู การถ่ายโอนความรู้ เว็บแอปพลิเคชัน แอสเพอร์เกอร์ซินโดรม

Introduction

In recent years, the use of information and communication technology (ICT) has been widely observed in education settings. ICT is an acknowledged tool for enhancing the pedagogical experiences of teachers and students, and has been found to optimize students' learning outcomes (Istenic Starcic and Bagon, 2014; Jung, 2005). When educating students with exceptionalities, ICT has been found to be an effective means and information transfer and engagement. Primary uses of ICT reported in past literature in this context included the provision of assessment aids, skill development tools, and interventions (Drigas and Ioannidou, 2013). ICT has been widely used with students with Asperger's syndrome as a pathway to skill development for individuals affected by the condition (Istenic Starcic and Bagon, 2014; Konstantinidis *et al*., 2009; Lewis *et al*. 2005).

Asperger's syndrome (AS), a form of high-functioning autism, is a developmental disorder characterized by challenges with social interactions, emotional recognition and regulation, executive functioning, and problem-solving (Gallagher and Gallagher, 2002; Griffin *et al*., 2006; Smith Myles and Simpson, 2002). It was a distinct diagnostic label until the current edition of *the Diagnostic and Statistical Manual of Mental Disorders* (DSM-V) became available in 2013 (Cassidy *et al*., 2014). In the current classification, AS is amalgamated into the autism spectrum disorder, or ASD (Cassidy *et al*., 2014; Kite *et al*., 2013; Linton *et al*., 2013). However, in spite of the change, the term "Asperger's Syndrome" is still widely used due to the fact that the affected individuals were concerned with the dispossession of their identity as "persons with AS," and with the changes in eligibility to existing services and support systems (Kite *et al*., 2013; Linton *et al*., 2013).

Despite these adversities, these individuals are fully capable of achieving their higher potential with appropriate guidance (Grandin, 2002). Their talents and abilities can be well-nurtured through proper understanding of their strengths and challenges by the supporters of affected individuals - educators, parents, guardians, and friends. In order to create a nurturing community, ongoing educational opportunities for these stakeholders are imperative. However, research has identified a lack of resources and support system as barriers (Lindsay *et al*., 2013; Rodríguez *et al*., 2012). In Thailand, for example, research studies and intervention resources regarding AS are very scarce. The condition is under-recognized among educators, and as a result, these educators are deprived of educational support to properly nurture their students. These issues were acknowledged in the past studies; however, establishing a comprehensive set of data regarding this area of research was compromised due to the differences in perception of the condition and inequitable access to the existing services (Khaiman *et al*., 2015; Little *et al*., 2014; Vibulpatanavoug, 2018).

Educators' use of ICT in relation to professional development is well-documented in the literature (Istenic Starcic and Bagon, 2014). In the United Kingdom, a web portal was developed to encourage teachers' continuous professional development by allowing them access to the world's best teaching practices (Jung, 2005). This portal supported teachers' local and global networking and acted as a central means for a teacher professional development (TPD) program (Jung, 2005).

ICT can be incorporated in TPD programs and its benefits have been widely acknowledged. A systematic review of ICT uses in education indicated the effectiveness of ICT-incorporated TPD programs to prepare novice teachers to be able to manage students with exceptionalities tactfully in the regular classrooms (Istenic Starcic and Bagon, 2014; Jung, 2005). This kind of ICT usage was reported as favorable as a means to improve the compliance to the program and retention of knowledge when the ICT-supported program was developed with the principles of learning and instructional design (Kobak *et al*., 2011). Compared to the traditional learning, ICT-supported TPD programs contain "the multimedia-enriched visual appeal that has the potential to integrate various supportive materials for personalized learning" (Huang *et al*., 2012, p. 704). Without these innovative features, TPD programs can be a less intellectually- and emotionally-engaging

learning experience for educators. Consequently, these educators could become passive learners who would evaluate TPD programs less favorably (Gregson and Sturko, 2007).

In order to overcome challenges reported in past literature and to promote knowledge retention about AS among Thai educators, the current ICT-supported TPD program was developed. This TPD program consists of two major elements: a teacher training session and a web application (the *UBU Applied Science Learning Center)*. The teacher training session is designed as a career development course. The contents of the training include a PowerPoint presentation to review essential information about AS, professional presentations by a psychologist and a guest speaker, case studies, and role-playing activities. The *UBU Applied Science Learning Center* (UBU-ASLC), a primary focus of this paper, is introduced at the end of the teacher training session. It is emphasized that neither the teacher training session nor the *UBU Applied Science Learning Center* is intended for the purpose of diagnosing AS.

Purpose of the study

This paper will discuss the development and implementation of a web application named "the Ubon Ratchathani University (UBU) Applied Science Learning Center," for building understanding of AS in Thailand. The UBU Applied Science Learning Center (UBU-ASLC) was developed as a primary component of a teacher professional development (TPD) program for AS in Thailand. The goals of the UBU Applied Science Learning Center were:

1. To serve as a valuable component of the TPD program in order to build knowledge of AS.
2. To provide sufficient information for educators to enhance knowledge retention following a teacher training session.
3. To support diverse modes of learning by increased accessibility and the promotion of a professional learning community.

Research method

Design and development of the web application

The *UBU Applied Science Learning Center* is named after the affiliated university of the first and second authors (the Ubon Ratchathani University, or UBU). Initially, the application was a resource-based platform. This center was intended to be expandable to support the present of any kind of subjects. This preliminary version was implemented to the in-service teachers of Ubon Ratchathani, Thailand. Based on the feedback from these teachers, the application was upgraded to include interactive learning features. The current version of the web application, as indicated in Table 1, was implemented to the pre-service teachers at the local teaching college of Ubon Ratchathani.

Each of five modules is organized and placed in sequence as a linearly-related unit of knowledge in an attempt for knowledge building, and ways that educators can assist their students. The first three modules are intended to induce micro-level, individual-based learning. Module 1 presents the history and overview of AS. Particularly, Modules 2 and 3 are designed as corresponding modules. In Module 2, educators are engaged in cognitive-based learning. When they proceed to Module 3, they will learn effectively through integrating the theory into practice. Module 4 contains topics that are more intended for classroom management and administration. This module aims to generate macro-level, organization-based learning. Module 5, open-learning for professional communities, is an upgraded, interactive module. It is a connector module between the micro- and macro-level learning occurring with the preceding modules. Indeed, the *UBU-ASLC* system aims to produce both top-down and bottom-up educational transformation by incorporating two levels of learning. The framework of the *UBU-ASLC* system is shown in Figure 1.

Table 1 The contents of the *UBU Applied Science Learning Center*

Module number and the title	Contents
1. The History and Overview of AS	The history and overview of AS; famous persons with AS in the world; and effects of having AS
2. Common Characteristics of AS and Brief Overview of Differences and Similarities between Autism and AS	A flow-chart-type instrument for educators to understand the manifesting differences between Autism and AS
3. Short Case Studies	Four to five short case scenarios to aid in integrating theory into practice; these scenarios are based on the true experiences of the first author interacting with an individual with AS for many years
4. Extending Knowledge – Inclusive Education Overseas	Practices from New Brunswick, Canada, which is considered to be one of the world's leader in inclusive education, to widen educators' knowledge of supporting students with AS in regular classrooms
5. Open-Learning for Professional Communities	Video chat, online discussion, and conference calls in order to support the interactive learning

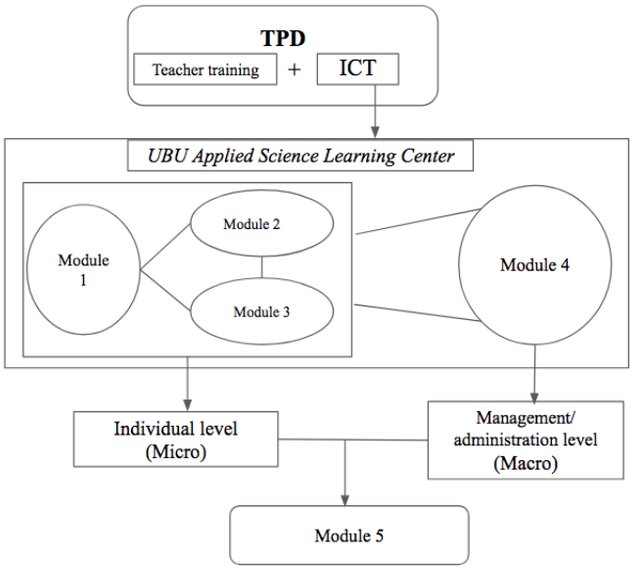


Figure 1 The framework of the *UBU Applied Science Learning Center*

Modules 1 to 4 can be directly accessed via the web application. Module 5 is a form of applied, interactive open-source. Therefore, this module can be accessed either directly via the application or social networking services to allow improved accessibility. Figure 2 provides a visual organization of the *UBU-ASLC* system.

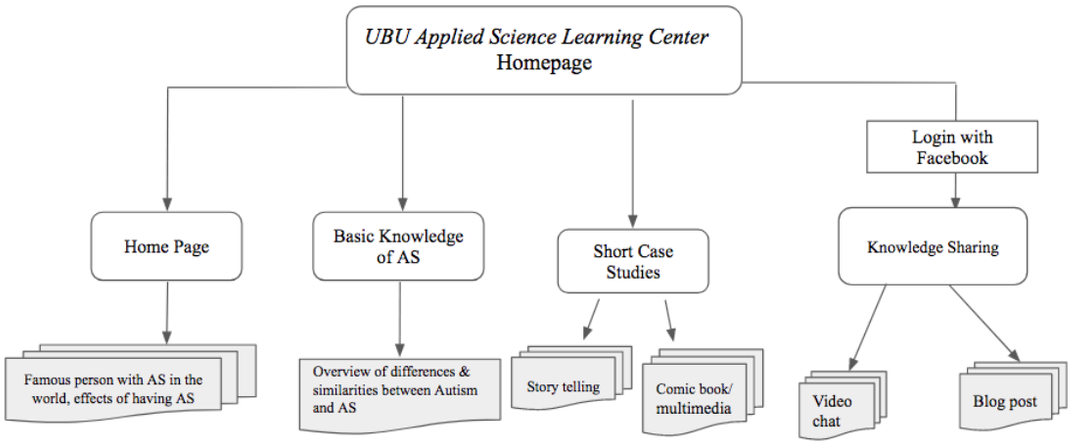


Figure 2 The visual organization of the *UBU Applied Science Learning Center*

Multiple software was employed to develop the *UBU-ASLC* system. Table 2 shows the software development tools used for the structure of the *UBU-ASLC* system and their purposes.

Table 2 Details of the software development tools used for the structure of the *UBU-ASLC* system

Purpose of use	Software development tools	Description
Language	PHP, HTML, CSS, JAVA Script	Language processors
Database management	MySQL	An open source, enabling the management of relational database (Oracle Corporation, 2019)
Text coding	Sublime Text	Enables the coding and editing of the text (Sublime, 2019)

In order to support multiple learning modes, the *UBU-ASLC* system also employs multimedia features. Table 3 shows the details of the software used for the contents and their purposes.

Table 3 Details of the software used for the contents of the *UBU-ASLC* system

Contents	Software used	Purposes of use
Expert presentation (Module 1)	YouTube videos	Increasing cognitive and affective learning
Cartoons in case studies (Module 3)	Microsoft PowerPoint, Adobe Photoshop, Adobe Illustrator	Visual effects and increasing readability
Interviews (Module 4)	Smartphone, iMovie	Recording and editing
Video chat (Module 5)	Skype	Increasing accessibility
Blog posts (Module 5)	Facebook	

Participants and implementation

The study employed a quasi-experimental, one-group post-test only design. Participants were recruited via purposive sampling. The program implementation occurred in Ubon Ratchathani, Thailand. First, two groups of in-service teachers from varied grade levels and school sizes participated in the preliminary implementation of the *UBU-ASLC* system. It was requested in their feedback that an interactive feature was included in the application to enhance knowledge sharing among users. Subsequently, the application was

modified and upgraded accordingly. Thereafter, the sample group of 32 pre-service teachers from the local teachers' college were recruited to participate in the TPD program. They would be shortly at their final teaching practicum. These pre-service teachers were chosen with an intention that this program could aid in establishing their teaching philosophy and practice as novice professionals. Table 4 provides a summary of the demographic characteristics of participants.

Table 4 Demographic characteristics of participants

Recruitment methods	Type of implementation	Group (*N*)	Demographics	Location of the TPD program
Purposive sampling	Preliminary	1 (*N* = 6)	In-service classroom teachers and administrative staff; From primary and secondary schools	Facility at University
		2 (*N* = 6)	In-service classroom teachers; From primary schools and the Early Childhood Education Center	
	Major	3 (*N* = 32)	Pre-service teachers (Local teachers' college students); Early Childhood Education major and at the start of the final practicum	Teachers' college

The implementation of the *UBU-ASLC* system occurred on three independent occasions. The first two sessions with in-service teachers were considered as preliminary implementation, due to the novelty of the learning subject and the learning tool. The third session, with pre-service teachers, was a major implementation to examine the effectiveness of this innovative application.

Both the first and the second groups attended the teacher training session held at the university facility. The *UBU-ASLC* system was introduced at the end of the session. Participants were asked to evaluate the design and contents of the application after the trial period. One to two weeks following the training session, 50% of the participants were randomly selected for follow-up interviews. For the first group, the preliminary application was in English. Participants requested language to be changed to Thai for more familiarity. Likewise, inclusion of diverse multimedia features was requested. For the second group, the application was modified to be bilingual (English and Thai). Participants suggested that the application should be a platform for interactive learning and contain more culturally competent information. Given the feedback from both groups, the application was further modified prior to the major implementation.

The third group of pre-service teachers were invited to attend the teacher training session held at a facility of their college. The *UBU-ASLC* system was introduced at the end of the session. They were able to use the updated application with the interactive learning features. After the trial period, they were asked to evaluate the design and contents of the application. One to two weeks following the training session, 50% of the participants were randomly selected for follow-up interviews.

Data collection and analysis

For the quantitative evaluation, Likert-scale style questionnaires were employed. Participants were asked to rate the most suitable answer on a scale of 1 (Strongly disagree) to 5 (Strongly agree). The questions were divided into two major categories of the general contents and the design. Table 5 summarizes the category, focus, and sample questions of this questionnaire. Mean and standard deviation were observed to determine the effectiveness of the *UBU-ASLC* system in enhancing knowledge building and retention.

Table 5 Summary of the evaluation questionnaire

Category	Focus of questions	Sample questions
General contents	The amount, appropriateness, and suitability of the information provided in the *UBU Applied Science Learning Center*	"Did the *UBU Applied Science Learning Center* provide useful and resourceful information to help understand students with AS?" "Did the *UBU Applied Science Learning Center* provide sufficient knowledge in enhancing understanding of AS?"
Design	The usability, color, layout, and the language used in the *UBU Applied Science Learning Center*	"Was the *UBU Applied Science Learning Center* user-friendly?" "Do you think all the information on the *UBU Applied Science Learning Center* appeared credible and reliable?"

For the qualitative evaluation, the open-ended, semi-structured interviews were designed to allow participants to freely evaluate the *UBU-ASLC* system. These questions were also based on two categories of general contents and design of the application.

The construct validity, which measures the proper intention of the research instruments (Haele and Twycross, 2015), was examined through the statistical analysis of the evaluation questionnaire. Cronbach's alpha was calculated to examine the internal consistency of the research instruments (see Table 6). The descriptor in Table 6 was adapted from Taber (2016).

Table 6 Cronbach's alpha value and the descriptor

Data Collection Instruments	Cronbach's alpha value	Descriptor
Evaluation Questionnaires	0.93	Excellent/High

Results and discussions

By taking the results and comments from the precursory version of the UBU-ASLC system into account, the modification has been made. The examples of screenshots of the modified version of our *UBU-ASLC* system was illustrated in Figure 3 and Figure 4.

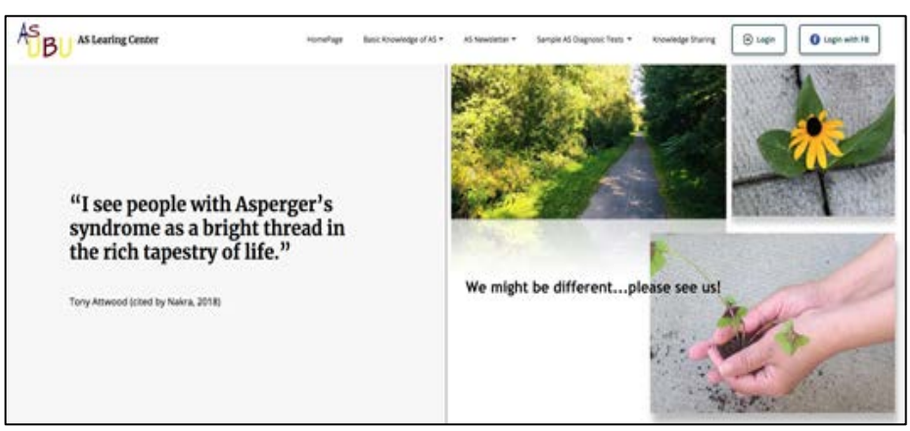
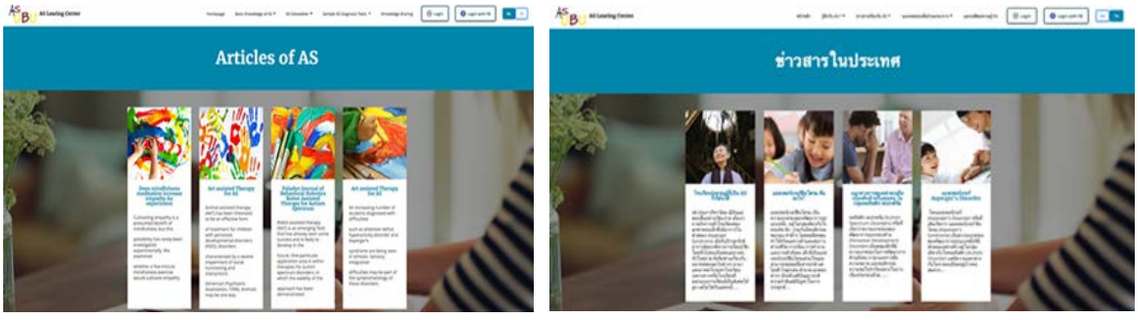


Figure 3 The screenshots of the *UBU-ASLC system* : Homepage



(A) (B)

Figure 4 The screenshots of the *UBU-ASLC system* (Module 3): Research articles in English (A) and in Thai (B)

The overall mean score of the *UBU-ASLC* system evaluation was 4.65 (SD = 0.52) (see Table 7 for item descriptions). For both content and design questions, participants regarded and rated this system highly.

Table 7 Statistical item descriptions for the evaluation questionnaire

Questions		Mean	SD
General contents	Did the *UBU Applied Science Learning Center* provide useful and resourceful information to help understand students with AS?	4.53	0.62
	Did the *UBU Applied Science Learning Center* increase the knowledge of teaching and learning with regard to educating students with AS?	4.72	0.53
	Did the *UBU Applied Science Learning Center* provide sufficient knowledge in enhancing understanding of AS?	4.66	0.48
	Do you think you can apply knowledge learned from this application to the classroom setting?	4.62	0.55
	Do you think the amount of information provided on the *UBU Applied Science Learning Center* was enough to build understanding of AS?	4.63	0.55
	Overall, do you think all the contents appeared well-organized?	4.69	0.54
Design	Was the *UBU Applied Science Learning Center* user-friendly?	4.63	0.49
	Were all the images and media related to the contents of AS learning?	4.69	0.47
	Do you think all the information on the *UBU Applied Science Learning Center* appeared credible and reliable?	4.72	0.46
Overall		**4.65**	**0.52**

(N=32), SD = standard deviation

All the interviews were transcribed, and the contents were analyzed based on two major categories - the contents and the design of the web application. Table 8 provides a summary of the questions and answers from these interviews.

Table 8 Summary of interviews with selected participants

Interview questions		Contents **How did you think the contents of the web application helped you to understand AS better?**	Design **Was the information easy to follow, use, or understand?**
Summary of responses	Participant #1	"I learned a lot, but I would like to see more case studies in different contexts (age, gender, life experiences)."	"The design was easy to follow."
	Participant #2	"I felt the information was well-supported by the past literature."	"The layout helped me learning better."
	Participant #3	"Even I read briefly about AS in the textbook, I never knew that there were more to learn about it."	"I was excited to learn that I will be able to share my knowledge with others and learn from others."

The results of this implementation suggested that the web application was an effective means to enhance knowledge building and retention of AS. Participants regarded that the web application contained sufficient, resourceful information to increase their knowledge of AS, and build confidence that they could apply their learning to their teaching practice. In addition, participants evaluated the web application as a critical component of the TPD program. Commonly shared comments indicated that this web application aided in knowledge retention, concrete understanding of the condition, and knowledge application to practice. The first and second objectives of this study - the web application would serve as a valuable component of the TPD program in order to build knowledge of AS and to provide sufficient information to enhance knowledge retention - were fully achieved.

Particularly, the interactive learning features in Module 5, open-learning for professional communities, were received with much enthusiasm. Participants were immensely engaged in these features and actively participated in the online discussions. The comments for this module included, "The interactive features were very helpful for knowledge sharing," and "very accessible and fantastic." It is interesting to note that a few participants in the pre-service teacher group mentioned that they had read a paragraph about AS in their textbook. However, the chapter of that particular paragraph was not the required reading for the class. Therefore, not all the participants were aware of the availability of information. Nonetheless, these keen participants played a major role in motivating the entire group and as a result, their learning outcomes were positively affected. Even though these participants were pre-service teachers, they have already formed their own professional learning community successfully. This fulfilled the third objective of this study: that the *UBU-ASLC* system supported diverse modes of learning by increased accessibility and the promotion of a professional learning community.

An initiation of forming the professional learning community was also observed in the preliminary implementation of the TPD program. One in-service teacher in the preliminary session regarded that the *UBU-ASLC* system would benefit not only Thai educators, but also those in the neighboring countries. Additionally, after the session, this participant connected the first author with the Dean of Medicine Faculty for a project meeting. In the near future, it is intended that instructional programs be developed to assist students with AS.

Conclusions

This study was regarding the development and the implementation of a web application to Thai educators to build understanding of AS. As a primary, valuable, and accessible component of the TPD

program, the *UBU-ASLC* system offered a wealth of knowledge for educators to promote awareness and knowledge retention, as well as the creation of a professional learning community by incorporating diverse learning modes into their teaching practice. High satisfaction was reported by the participants.

Feedback from this study highlighted several issues needing improvement for the future. First, the study was conducted in a relatively small, homogeneous, rural area of Thailand. Therefore, the future replicated studies may need to be conducted in urban areas of the country to include more diversity. Second, as the discussion indicated, the *UBU-ASLC* system was offered in only one language (Thai). The need to have the English version was suggested in order to benefit the neighboring countries of Thailand and expand our own knowledge further. Lastly, participants suggested that the case studies be more diverse and inclusive in order for them to be able to apply their knowledge to face-to-face teaching with students of different ages and grade levels.

AS presents wide ranges of strengths and challenges for each person. As educators, we support and guide these individuals to empower themselves. This current TPD program aims to be a pioneer in the effort to raise AS awareness in Thailand. Effective education is valuable for educators who are willing to nurture their students' strengths. In the near future, the benefits from this suitable means can be extended to the neighboring countries and could be applied for any kind of subjects. Ultimately, it is researchers' hope that this web application can be a stepping stone to increase information literacy for educators.

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