

4P-2E Model: Teaching and Learning Process Through ICT Integration for Private Islamic Schools in Thailand

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<https://doi.org/10.24191/ajue.v16i4.11944>

Received: 15 November 2020

Accepted: 11 December 2020

Date Published Online: 24 January 2021

Published: 25 January 2021

Abstract: The research “teaching and learning process by integrating information and communication technology for Islamic private schools in the three southernmost provinces of Thailand in the 21st Century” aimed to determine the integration of information technology for the design and development of innovative forms of teaching in line with the current situation of Islamic private schools in the three southern border provinces. The research scope focused on the development process for teachers to develop innovative forms of teaching to enable learners with lifelong learning skills. Teachers also were able to apply ICT in designing and developing innovative models for teaching to meet the 21st century skills. The participation and action research methods were used by allowing teachers to play a researcher’s role in conducting joint research with the team. Project-based learning instruction method with ICT integrated was used. The results of this research is the innovative model of teaching that integrated information technology to provide students with the 21st century skills which is the 4P-2E model. The impacts of this research to learners are: (1) Learners are creative, they enjoy the project-based learning and the integration of ICT in learning. (2) Learners are able to extend their own knowledge and are equipped with the 21st century skills and (3) Learning achievement of learners has improved significantly.

Keywords: 4P-2E Model, Teaching and learning process, ICT integration, Innovative teaching and learning, Project-based learning

1. Introduction

The three southernmost provinces of Thailand is a specific area which has 78.4 percent of Muslim population while Thailand is a Buddhist country. As a result, private Islamic schools have been very popular for parents to send their children to study. However, these schools were experiencing management problems that affected the quality of learners including the quality of education which was not standardized and the low results of the National Test and Ordinary National Educational Test (O-NET). Therefore, there is a need to improve the educational development of the private Islamic schools in this area. The objective of this research is to design a framework or model of teaching and learning

process by integrating information and communication technology in order to develop private Islamic schools in the three southernmost provinces of Thailand. The main purpose is to improve the learning process as holistic development of learners and enhancing them to be able to cope with the rapidly changing technology and can support the learning in the 21st century in which the students need learning skills by obtaining knowledge with a variety of methods for self-development in all dimensions.

2. Related Research

Innovative technology for learning in the 21st century which focuses on the use of computer network technology, wireless and broadband Internet access, melted incorporates computer telecommunications and the Internet together called *iGeneration*. This is converting a traditional classroom to a virtual classroom that can be learned via the Internet with the E-learning system. Students have the opportunity and freedom to learn at their own pace and create knowledge by themselves with higher order thinking skills (Wilson & Narasuman, 2020), while teachers are changing their roles to be facilitators.

2.1 Integrating ICT in Education

Fu (2013) described about the benefits of integrating ICT in education in many ways such as supporting student-centered and self-directed learning, providing creative learning environment to suit different types of learning and meet a variety of learning needs, offering more opportunities to students to develop thinking skills, supporting teachers to manage course content assignments and learning activities faster and assisting teachers to create or construct course contents logically and creatively. While Zahariev, Bencheva, Hristov, & Ruseva et al. (2013) and Chowdhury (2020) have found that the use of ICT in teaching is challenging because it is not easy to make teachers changed from traditional teaching style to use ICT integration and without ICT skills the ICT tools available are meaningless. Moreover, Sharma *et al.* (2014) who studied the integration of ICT in developing countries perceived in the same way that the success of the integration of ICT in the education system depends mainly on three factors which are the availability of ICT infrastructure, stakeholders' roles, and the paradigm change of learning and teaching. While Tabira & Otieno (2014) who studied the integration of ICT in the education system of Kenya where limited ICT resources were available, observed that even with the limited ICT resources, the adoption of basic ICT system such as learning through the DVD to get started in this area has caused a change in the perspective of both the teachers and learners and it has promoted the interaction between the instructors and the students as well.

2.2 Appropriate ICT integration in the private Islamic schools.

ICT utilization in schools of the three southernmost provinces is currently in little use. Only the basic devices of ICT such as desktops and notebooks are used to promote the preparation of the teaching. Some software applications like Microsoft Office applications, web browsers, and emails are used in the administration section. The computer network is also limited since most schools are not yet ready for this. However, the utilization of ICT in different areas are different, Tongia, Subrahmaniam & Arunachalam (2005) called this difference as "the digital divide ", which are: (1) awareness, people need to know what ICT can do and be open to the use of ICT, (2) availability, the ICT infrastructure consisting of hardware, software and networking must be appropriately provided, (3) accessibility, the people potential in ICT utilization and (4) affordability, the use of ICT should not be too expensive comparing to the income of the people in the area. Thus, from the integration of ICT for teaching and learning in many areas, it showed that the integration can be achieved through the use of ICT with 4 basic components which are hardware, software, network system, and people. The hardware comprises fixed PCs or mobile devices including notebooks, tablets, phablet, and smartphones. The software can be used for communication such as Facebook, Line, Skype, WhatsApp, etc. The software that is used as a learning management system (LMS) are Quipper School, Google Classroom, Class Start, Moodle, Edmodo, and many more. For the network used, it was meant to include both wired and wireless networks, an obvious example of wireless network is the Wifi and 4G. Finally people need to understand and have skills on using ICT in teaching and learning.

2.2 Project based learning (PBL)

Project Based Learning (PBL) is a teaching method designed for students to practice like working in real life systematically. PBL involves a dynamic classroom approach, which emphasizes long-term learning and interdisciplinary (Mohd Hawari & Mohd Noor, 2020). It allows students to have hands-on experiences, learn how to solve problems on their own, learn how to lead as well as to follow, create higher order thinking and conduct self-evaluation. The project based learning provides an opportunity for students to learn constructivism in gaining affective, cognitive and psychomotor competences as a whole through the project task lifted from the real problems (Jalinus, Nabawi & Mardin, 2017).

The PBL process may consist of many steps depending on the teacher's design. However, essential steps consist of six steps which are 1) preparation, that is when the teacher defines the project scope broadly in line with the course or aptitude of students, 2) project topic selection and design, that is when students are creating alternatives for designing the project themselves, 3) project proposal development, that is when students write up project proposal including a plan and concept of the project and how to operate it, 4) project implementation which is an important step where students will act as planned, 5) project presentation where students will report the project results by writing reports or presenting in other forms such as leaflets or posters, and 6) exhibitions and project evaluation where the projects should be assessed through learning outcomes with various methods such as student self-assessment, peer assessment, and external assessment. At a high level, Noble, Ferris, LaForce & Zuo (2020) explained that the PBL approach is echoed in other strategies associated with STEM practices and learning including discovery and design-based approaches. Thus, PBL should be used in teaching in the 21st century because a large number of researches accepted that PBL encourages learners to utilize critical thinking, self-exploration, knowledge creation, and teamwork (Thomas, 1998). PBL is a form of teaching that students receive the study results at a higher level in stage 3 which is the application level, compared to level 1 which is just to gain the knowledge and level 2 which is to get comprehension, as shown in Table 1.

Table 1: Learning levels with various learning methods

Level	One way –no group activity	Teacher centered activities	Group centered activities
1. Knowledge	lectures presentations reading giving individual tasks	lecture discussion laboratory work	exchange of experience brainstorming collecting previous knowledge
2.Comprehension	lecture presentation by students individual exercise	lecture discussion laboratory work debate	group work, discussion problem solving simulation, role play
3.Application	-	laboratory work tutorials practical exercises	field work project work problem solving simulation, case study
4.Transfer (analysis, synthesis and evaluation)	-	discussions experiments laboratory work	strategic games experiments problem solving

3. Research Methodology

This research focused on teaching and learning processes by integrating information and communication technology in the classroom. The research method is focused on participatory and action research by having school teachers to play a role in carrying out the research together with the research team. The research format and process are as follows.

3.1 Populations and Samples

This project focused on private Islamic schools in the three southern provinces of Thailand that teach from grade 1 to grade 6, teaching both ordinary and religion curriculums. From the private education office information center in Pattani, Yala and Narathiwat, In 2013, there were a total of 59 schools in the area for this type of schools which were divided into 16 schools in Yala, 33 schools in Pattani and 10 schools in Narathiwat. The samples were selected purposively as purposive sampling (Palinkas, Horwitz, Green, Wisdom, Duan, & Hoagwood, 2015). The aim was to select two schools from each province (one in town and one in the rural area) making all together 6 schools in three provinces. However, 8 schools were selected consisting of 5 schools from Pattani and 3 schools from Yala provinces. There were no schools from Narathiwat because of the terrorizing situation in the area.

To develop the students, the researchers chose the school subjects that should be developed urgently for the three southern provinces which are Thai and Math by using grade 3 and 5 for the samples as students in these grades will have to attend the standard national test (NT). There were 32 selected teachers from 8 schools. Throughout the project, the researchers monitored and trained teachers in the process for designing teaching and learning.

3.2 Research Method

This research was a qualitative analysis emphasizing on participatory action research by allowing teachers to play a role in carrying out the research together with the researcher's team. There were a variety of methods in order to meet the research objectives including gathering knowledge from the literature related research, creating a network of cooperation with the private Islamic schools in the area and using knowledge management (KM) to exchange experiences between schools and partners. Furthermore, the research activities also include learning from direct experiences of professional teachers, conducting focus groups and training for selected teachers. Moreover, the research team also visited the teachers for assisting or supervision of teaching through the duration of the project.

4. Results

According to the research methodology, the model of teaching and learning process has emerged from learning by the research team and teachers for the period of 2 semesters. The results of the research were as follows:

4.1 4P-2E model: teaching and learning process through ICT integration

The research team, the trainers and teachers teaching grade 3 and 5 of Thai and mathematics subjects has cooperated to design a teaching form that integrated ICT with PBL in the learning and teaching process. The project took two semesters, the first semester was used in designing the teaching process in accordance with the process of teaching and learning in PBL, the experimentation of "*learning by doing*" until the working model called 4P-2E was firstly emerged and utilized in the first semester. The model obtained was then used again in the second semester to validate and verify that it is practical. The results of the model utilization were expressed in terms of learning achievement. According to 4P-2E Model, the major steps involved 4P which are planning, project implementation, presentation, and performance assessment, while the 2E are enrichment and evaluation. The mentioned 4P-2E model is consistent and aligned to the teaching process of PBL which includes the main six stages

which are (1) preparation, (2) the selection of the project (3) writing project proposal (4) project implementation (5) presentation and (6) evaluation. Table 2 shows the consistency of such operations.

Table 2: Consistency of 4P-2E model to the PBL process

4P-2E Model	STEPS of Project Based Learning
	Preparation
Plan & Preparation	Project selection
	Project proposal writing
Project Implementation	Project Implementation
Presentation	Presentation
Performance Assessment	Assessment knowledge
Evaluation & Enrichment	Evaluation & Enrichment

From Table 2, the consistency between 4P-2E model and the PBL process was shown, each step can be explained as follows:

P1: Plan, in this process, teachers will assign a project by preparing lesson plan, resources, and sample data to guide students. Integration of the PBL teaching is the way teachers create the project work-based learning, which is already scoped by the lesson contents. At this stage, students are creating alternatives to the project design themselves and working as a team that will encourage brainstorming leading to critical thinking skills, communication skills, and building partnerships.

P2: Project Implementation, this is an important step that students will act as planned in the project proposal. In the process, teachers consult closely or join the students for problem solving.

P3: Presentation, in this process, students will report the results by writing reports or presenting in other forms such as leaflets, posters, exhibitions, or oral presentation.

P4: Performance assessment, student performance assessment in PBL is the measurement of the knowledge and skills that students gained from PBL process using rubrics based on the subject learning objectives.

E1: Enrichment, in this process, rewarding is important to students for a positive attitude towards learning activity and ready to face and remove obstacles.

E2: Evaluation, the project learning outcomes should be assessed with various methods such as student self-assessment, peer assessment, or assessment by third parties including parents. The assessment should not only measure the knowledge or the final product, but it should also look at the learning process acquiring the final result. Evaluation done by other teachers can promote an interaction and knowledge sharing among teachers as well. The utilization of ICT tools in various stages of PBL can be shown in Table 3.

Table 3: Guidelines for the application of ICT in PBL which is consistent with the 4P-2E Model

4P-2E Model	STEPS of PBL	ICT Tools for Teachers	ICT Tools for Learners
Plan & Preparation	Preparation	LMS such as Class Start, Edmodo for learning resources, self-study, work assignment and submission. Google Sheet for collecting points along the process	Internet, Writing Blogs, study report electronically with Google Docs
	Topic selection	Assignment and works delivering through the LMS	Using the Internet to research information

4P-2E Model	STEPS of PBL	ICT Tools for Teachers	ICT Tools for Learners
		Electronic comment on the presented media Rubric online scoring Google Sheet for collecting points along the process	Tools to write the cooperative outline Presentation of idea in video formats through YouTube
	Project proposal	Use electronic comment on the presented media Rubric online scoring Use Google sheet for collecting points along the process	Google Docs to write the cooperative outline mind map, diagram and Gantt chart Online presentation tools
Project Implementation	Project Implementation	Gantt chart tool used to monitor the progress of the project implementation Tools for communication and consultation during the project, such as online chat tool, email and Hangout Use Google Sheet for collecting points along the process	Gantt chart tool used to direct the operation Writing daily report with tools like WordPress, Blogger Tools to create a portfolio, e-Portfolio to store the results of operations
Presentation	Project presentation	Use electronic comment on the presented media Rubric online scoring Use Google Sheet for collecting points along the process	Tools for writing the project report Presentation tools Tools for video editing, uploading to YouTube Online presentation
Performance Assessment Evaluation & Enrichment	Assessment Evaluation Enrichment	Rubric online scoring Use Google sheet for collecting points at the final process Rubric online scoring	Presentation tools Tools to publish information online in a blog and social media

From Table 3, researchers have proposed the ICT tools that should be used for each stage, for example, in the early stage of PBL, teachers will provide learning resources on the website or through the learning management system (LMS) such as Edmodo, Class Start for students to self-study, work on assignments, and submit assignments. Teachers can also use Google Sheet to collect points according to the learning process. For the equipment used, teachers can use the devices such as PCs or mobile devices, while the data network used can be wired or wireless. Students on the other hand can use the Internet to access information and resources using LMS systems specified by teachers. Google Docs can be used for writing blogs or informing progress electronically. Students can use the devices such as PCs or mobile devices via wired or wireless network.

4.2 Teaching and Learning achievements

After the teachers applied the 4P-2E Model in teaching and learning process together with the teaching styles in the classroom in the second semester, it was found that teachers have been able to organize their teaching and learning process with PBL and integrate ICT in a more organized and better way. The teachers were asked to evaluate the benefits of using 4P-2E as a model to design a teaching and learning process together with PBL on a five-point scale of ‘high satisfaction’ (5) to ‘not at all’ (1) and the result is shown in Table 4.

Table 4: The satisfaction of using 4P-2E Model to design teaching and learning process

Description	Satisfaction level	
	\bar{x}	S.D.
Having knowledge and understanding about 4P-2E MODEL	3.65	0.493
Understanding in the principles of designing teaching and learning process using 4P-2E MODEL	3.59	0.507
Knowledge enhancement about the use of ICT tools, media and technology in teaching and learning	3.76	0.652
Being able to design the process of teaching and learning using ICT with PBL	3.85	0.656
Being able to apply 4P-2E Model for teaching and learning process	3.88	0.600
Being able to classify group of learning using 4P-2E Model together with PBL	3.72	0.590
Understanding about the performance assessment including pre-test/post-test and rubric scoring	4.00	0.632
Being able to plan and design the performance assessment using rubric	3.63	0.500
Knowledge enhancement about designing teaching and learning process is more effective using 4P-2E Model and can be adapted with other classrooms	3.69	0.704
Over all	3.75	0.593

According to Table 4, the mean score shows that teachers were highly satisfied with using the 4P-2E model to design the teaching and learning process in the classroom (> 3.5). The satisfaction level about having knowledge and understanding about the 4P-2E Model, the principles of designing teaching and learning processes using the 4P-2E Model, being able to plan and design the performance assessment including pre-test/post-test and rubric scoring is positive (between 3.59-3.70). The highly satisfaction level (between 3.72- 4.00) for teachers was being able to design and apply 4P-2E for teaching and learning process, being able to classify groups of learning and understanding clearly about the performance assessment including pre-test/post-test and rubric scoring.

In the student's side it was found that when teachers assigned students to learn as a project-based learning using ICT in the course, students were happy, active and very keen to learn and solve problems. They have learned how to work as a team and thought in a critical way. A Thai subject teacher at grade 3 from Chaopunya School, Pattani said that

"When implementing the PBL process and using ICT as a tool, it makes students fun and enthusiastic. Students can plan the work well by themselves"

Another Math teacher at grade 5 from Amanasak School, Pattani also proudly presented that

"As a traditional teacher some students never pay attention to learn the contents of the subject but after implementing a teaching process with PBL, students have changed. They are very keen to learn and are waiting to work as a team. Marks rating have improved from a score of 1, 2, 3 to 8, 9 or 10 and only a few of those who get a 4 or 5 rating."

Also the teacher from Pattana Demonstration School, Yala explained that

"After the school had a policy of implementing the 4P-2E Model in all classes, teachers seriously implemented the PBL and ICT process in the class and we found that students are changing the ways of learning and becoming a participant in the design and implementation of all activities with teachers and other related parts. The achievement of implementing this is that students get better grades. Students are energetic and eager to learn while teachers can spot their weaknesses and more open minds to develop themselves. Parents were satisfied with the work of teachers and students and provided full support in accordance with the issues that teachers asked for cooperation."

With the use of the 4P-2E Model in the process of teaching, the results appear to have better learning outcomes. Students are enthusiastic, alert, and comfortable to study. Students are creative, love to explore, search for knowledge by themselves, and challenge themselves to think, speak, and express themselves. Students are driven to think critically, work as a team, and develop problem solving skills. The empirical study about learning outcomes has been shown partly only in Math and Thai subjects at grade 3 in this paper. The results of pre-test, post-test and rubric are shown in Table 5 and Table 6.

Table 5: Scoring of Pre-Test, Post-Test, and Rubric of Math Grade 3 (15 marks)

School	Pre-test			Post-test			Rubric		t-Test	
	Min	Max	\bar{X}	Min	Max	\bar{X}	Score	n	t	P
Chaopunya, Pattani	3	12	7.52	6	15	10.83	10.0	23	6.71	0.0000
Amanasak, Pattani	2	12	6.53	8	15	11.50	11.0	40	14.61	0.0000
Darulbarakah, Pattani	2	11	7.58	5	14	10.45	10.5	40	11.45	0.0000
Pattana Demonstration, Yala	5	13	10.0 6	9	15	12.19	10.8	32	9.51	0.0000
Darul Ulum, Yala	4	12	7.57	5	14	9.83	9.3	35	8.36	0.0000
Santi Wittaya, Yala	3	13	8.33	8	15	12.27	10.5	15	8.50	0.0000

Table 6: Scoring of Pre-Test, Post-Test, and Rubric of Thai Grade 3 (15 marks)

School	Pre-test			Post-test		Rubric		t-Test		
	Min	Max	\bar{X}	Min	\bar{X}	Score	n	t	P	
Chaopunya, Pattani	2	12	7.22	8	15	10.78	10.22	23	6.69	0.000 0
Amanasak, Pattani	1	8	6.53	5	9	12.5	13.20	40	4.40	0.000 1
Darulbarakah, Pattani	2	11	6.65	8	14	10.90	13.19	40	17.95	0.000 0
Pattana Demonstration, Yala	2	12	7.53	8	15	11.5	14.03	32	25.02	0.000 0
Darul Ulum, Yala	1	6	3.54	6	15	8.97	7.89	35	16.52	0.000 0
Santi Wittaya, Yala	2	8	5.47	9	14	11.18	13.47	15	9.46	0.000 0

From Table 5 and Table 6, the scoring of post-test at each school was significantly higher than the pre-test. Also the result of rubric scoring assessed by the teachers by assessing the performance of each project and each student was also high. Although this research does not control the sample group to make a comparison between the groups taught by PBL with ICT in teaching and with traditional teaching and the test results cannot be clearly confirmed that they are different with numbers resulting from testing scores, however, in terms of behavior, every teacher confirmed that students have changed their behavior significantly as mentioned above.

5. Discussions

Throughout the duration of this research, teachers have jointly designed the use of the 4P-2E model in the teaching and learning process. Consequently, the researchers have found advantages and disadvantages of using ICT with PBL which is a must in 4P-2E Model and can be described as follows:

5.1 Advantages of using ICT integration in the context of the schools in the three southern provinces of Thailand

The benefits of using ICT integration through the process of 4P-2E Model are as follows:

- 1) Teachers were able to plan courses for teaching and learning systematically.
- 2) Teachers were well prepared by searching for information on the Internet in order to design a variety of teaching strategies and styles.
- 3) Teachers have changed teaching methods that were previously based on a single textbook to integrating ICT with PBL in a class and teaching and learning preparation and materials were well organized using the 4P-2E Model.
- 4) Students were assigned to learn using project-based learning that drives students to be more engaged with teachers, more content, and enthusiastic to learn and think. Students were able to work as a team, practice analyzing and presenting in a better way.

Regarding knowledge and teaching skills, teachers have continuously lifted up skills and processes for their own teaching in order to create better styles or methods of teaching and learning using the 4P-2E model. Teachers were able to plan, design, and organize pedagogy effectively. The teachers could design student-centered teaching and learning activities using PBL, assessment and evaluation using pre-test, post-test, and rubrics appropriately. In addition, teachers also transferred knowledge to colleagues in the school. This method has been developed to improve school curriculum that is consistent with the core curriculum and local needs and is consistent with the Islamic way. It can be said that the 4P-2E Model can enhance the knowledge of ICT integration and teaching and learning skills in the 21st century to teachers.

5.2 Disadvantages of using ICT integration in the context of the schools in the three southern provinces of Thailand

The meeting in the focus group including educators, school administrators, teachers, and parents found that the use of ICT in teaching and learning in the three southernmost provinces should be used carefully. In the overview of the application of ICT for teaching and learning in general, it must be designed and controlled appropriately. Initially, the study on class management should be conducted to explore the proper use of ICT, what devices should be used, when and where to use it, and how long should it be used. Allowing children to use communication devices or ICT equipment alone will cause negative effects on the children in terms of mental and physical health, especially the moral concern which is a sensitive issue in the three southern provinces of Thailand. Those involved in the education of young people in the three provinces should be aware that in the context of this area, parents and their children need to adhere strictly to the principles of religion, any activities that bring youth offending the sacred religious will be considered prohibited (Haram) based on religious principles. The use of ICT in teaching is the same, if used correctly, it will be beneficial for the learning of young learners enormously but if the wrong method is used, it becomes forbidden (Haram) in the religious right. Examples of the use of ICT tools to precarious with the requirements of Islam are:

- 1) Spending on communication equipment for too long until ignoring the religious requirements such as praying which is compulsory for every Muslim to perform five times a day for about 10 minutes each.
- 2) If a Muslim youth stays with ICT communication tools for too long and cause damage to nervous and body health system, it is considered that the activity is prohibited. Since the principles of Islam consider that any activities causing damage to the health system is reflected prohibited.
- 3) The use of mobile devices to access data or content that is prohibited by religion such as pornography which may take the form of text, audio, and image is considered forbidden.

4) The use of a communication device to communicate with others and have the opportunity to draw men and women to stay together in isolated environments constitutes a prohibited religious activity.

5) Obsession with communication tools that let users to behave aggressively towards others, an emotional disorder is treated as a forbidden activity as well.

6. Conclusion

The 4P-2E Model is an effective framework for designing the teaching and learning process through ICT integration in the 21st century and can be implemented in private Islamic schools in the three southernmost provinces of Thailand. At each stage, teachers and students are suggested to use appropriate ICT tools to assist learning and teaching. The project presents ICT tools that have been used and what should be used in the future. The barriers and cautions in the use of ICT in the context of this specific area which relate to faith and religion are presented.

In the case of schools in the area wanting to use the ICT integration using the 4P-2E Model, they should consider the ICT integration in their own circumstances appropriately based on resources availability. For example, in the case of some schools which the Internet access is not yet stable, the school may consider using the medium of instruction in the offline mode first and after the internet infrastructure is stable, the expansion to use of online media then can be established. If the school is not ready to allow students to use mobile devices such as tablets and smartphones outside classrooms because of the concerns in ethical and moral issues, then use PCs within the school first, after the communication with parents and children to the control agreement policy have been set up then the utilization of such equipment at home can be made. Another point is that the school does not need to use ICT to every unit of each course, but to choose the right unit ICT integration. Implementing an integration of ICT in teaching not only benefits the school in three southern provinces, but can also be applied to other areas where the context is different but just might have to deploy based on the resource availability and suitability. In the future 4P-2E Model will be implemented for further development of similar contextual teaching in higher education.

7. Acknowledgements

This research project is funded by The National Research Council of Thailand (NRCT) and the Thailand Research Fund (TRF). Throughout the period of conducting research, the research team would like to thank Prince of Songkla University for providing places, ICT equipment, and professional staff as trainers through the end. Also special thanks to Professor Dr. Kanchana Ngourungsi, and Professor Dr. Amnuay Thitaphan for being generous mentors.

8. References

- Chowdhury, S. A. (2020). *Assessing the impact of ICT integration in the classroom of secondary school in Bangladesh*. Retrieved July 9, 2020, from <https://www.researchgate.net/publication/339274962>
- Fu, J. S. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development using Information and Communication Technology*, 9(1), 112-125.
- Jalinus, N., Nabawi, A. R., & Mardin, A. (2017). The seven steps of project based learning model to enhance productive competences of vocational students. Paper presented at the *1st International Conference on Technology and Vocational Teachers (ICTVT 2017)*.
- Mohd Hawari, A., & Mohd Noor, A. (2020). Project based learning pedagogical design in STEAM Art Education. *Asian Journal of University Education*, 16(3), 102-111. doi:10.24191/ajue.v16i3.11072
- Noble, E., Ferris, K. A., LaForce, M. & Zuo, H. (2020). A mixed-methods approach to understanding PBL experiences in inclusive STEM high schools. *European Journal of STEM Education*, 5(1), 02. <https://doi.org/10.20897/ejsteme/8356>
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015).

- Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health*, 42(5), 533–544. <https://doi.org/10.1007/s10488-013-0528-y>
- Sharma, R. S., Zhang, H.G., Sun, G., & Ho, W.T. (2014). Does ICT effectively contribute to the delivery of mass education in developing countries? Paper presented at the 2014 IEEE *International Conference on Management of Innovation and Technology (ICMIT)*.
- Tabira, Y., & Otieno, F. (2014). How to implement and diffuse ICT based education in areas with limited resources in developing countries: Lessons from rural Kenya. Paper presented at the 2014 *Portland International Conference on Management of Engineering & Technology (PICMET)*.
- Thomas, J.W. (1998). *Project-based learning: Overview*. Novato, CA: Buck Institute for Education.
- Tongia, R., Subrahmanian, E., & Arunachalam, V.S. (2005). *ICT for Sustainable Development: Defining a Global Research Agenda*. Bangalore: Allied Publishers
- Wilson, D., & Narasuman, S. (2020). Investigating teachers' implementation and strategies on higher order thinking skills in school based assessment instruments. *Asian Journal of University Education*, 16(1), 70-84. doi:10.24191/ajue.v16i1.8991
- Zahariev, P., Bencheva, N., Hristov, G., & Ruseva, Y. (2013). ICT convergence challenges in education and their impact on both instructors and students. Paper presented at the *EAEIE Annual Conference (EAEIE)*, 2013 *Proceedings of the 24th*.