Collaborative project-based learning to train students for conducting the training project for older adults

Phetcharee Rupavijetra[1], Prachyanun Nilsook[2], Jira Jitsupa[3], Tipparat Nopparit[4]
[1]Department of Vocational Education and Wellness Promotion, Faculty of Education, Chiang Mai University, Chiang Mai, Thailand
[2]Department of Technological Education, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Bangkok, Thailand
[3]Teacher Professional Group, Faculty of Education, Suan Dusit University, Bangkok, Thailand
[4]Department of Curriculum, Teaching and Learning, Faculty of Education, Chiang Mai University, Chiang Mai, Thailand

Article Info

ABSTRACT

This research aimed to study the results of collaborative project-based learning by students studying the training technique course to conduct training programs for older adults in state home care in Chiang Mai, Thailand. The population consisted of 40 undergraduate students from different faculties and years. The instruments used for data collection consisted of the lesson plan of the training technique course, student behavior form, journal form after teaching, student products, student reflection journals, the questionnaire to gauge the level of satisfaction of students, writing and presenting reflections on students' learning, and training evaluation based on the level of satisfaction of the older adults. The research separated students into two groups based on different faculties, each group was composed of 20 students, and they could learn better in a small group. Data were analyzed by using content analysis, statistical calculation, and percentage, and were presented in the form of a description and table. The findings showed the results of the collaborative project-based learning to train students for conducting training projects for older adults successful. The students had a change in their attitudes, behaviors, knowledge, skills, and experience in conducting training, their satisfaction showed at the highest level (97.50%). Students were satisfied with the project-based learning at the highest level (90%), and especially the opportunity to gain knowledge and experience from conducting training programs at the highest level (95%). The older adults' satisfaction from participating in two training programs conducted by the students was at the highest level (100%) too.

Corresponding Author:

Jira Jitsupa
Teacher Professional Group, Faculty of Education, Suan Dusit University
295, Nakhon Ratchasima Rd., Dusit, Bangkok 10300 Thailand
Email: jira_jit@dusit.ac.th

1. INTRODUCTION

The Training techniques course is open for all undergraduate students at Chiang Mai University Thailand to enroll for their elective courses. This course aims at developing students to have knowledge and skills in training content and training conducting including public speaking. Even though the course was lecture-based but the instructor had designed the students' practice section before the final examination due to fulfilling the students' experience. This course was interested in students from many faculties without training and public speaking experiences background; therefore, the instructor designed teaching and learning by using collaborative and project-based learning (PjBL). To understand the training techniques, students

have to do the assignments with a group of students in the classroom, brainstorming, sharing, and discussing to be active learners. In any courses aiming to support students in gaining knowledge and real skills for implementation in daily life, students have to practice through project-based learning as individuals or groups. Project-based learning is a method of learning how to translate theories into practice and covers both academic principles and practice [1]. To encourage to become involved with material that they are interested in through inquiry, means that students must learn by doing in order to arrive at a result or finding by questioning, exchanging, sharing, planning, designing, expecting, experiencing, data collecting, data analyzing, concluding, communicating and presenting those findings. Havice *et al.*[2] suggested that project-based learning assists learners to practice skills such as communication, presentation, collaborative working, management, data inquiry, evaluation, critical thinking, and problem-solving. Therefore, project-based learning is appropriate for higher education levels [3]. The benefits of project-based learning were found for more demanding tasks, or tasks that students likely had the least experience in performing, and that require hands-on practice. Additionally, project-based learning showed advantages in facilitating engagement with course content and outside resources [4].

Collaborative learning supports assignment tasks and activities, as well as allowing a clarification of instructor and student roles [5]. Moreover, collaborative learning supports student learning because students will work eagerly and actively and will learn with a high degree of responsibility in an atmosphere that supports learning [6]. Every element of each course, especially assignments and activities, is expected to occur step-by-step to support students to learn appropriately and gain 21st-century skills, especially in the case of online collaborative learning via online social media [7]. Le *et al* [8] pointed to the five principles of collaborative learning: i) Learning where students should engage in mutual assistance to achieve defined objectives: ii) Students working on an assignment as a team; iii) Students working on an assignment to develop skills associated with social interaction; iv) Students preparing a work process analysis; v) Students' learning outcomes both individual and the group being inspected and evaluated. Educational institutions use collaborative learning as a tool for assisting problem-solving learning and innovation [9].

To conduct project-based learning, instructors have to plan the process of teaching and learning carefully and precisely before implementation, by following these steps: i) Prescribe the content and determine the goal of the skills and issues that the instructor needs students to know and apply; ii) Develop the occurrence of the output by linking back to the process and how to present it; iii) Prescribe the planning and the scope of the project, its duration, and its evaluation; iv) Design teaching and activities plan to support project-based learning, including contents and the necessary skills; and v) Engage in project-based evaluation [2]. All designs must be relevant to promoting thinking skills and be realistic in practice. The research on the project-based learning process in vocational education suggests five steps: preparation, prescribing the topic of the project, creative designing, and testing, presenting the output, and evaluation [10].

In the previous teaching and learning, for students' practice on training program conducting, students did their training programs as role plays. As it was difficult to practice the training programs for the workplace and school because it seemed that we interrupted their working and study time. However, to practice for conducting the training programs as a role-play among students who were studying, the results of these practices even showed success, but students still need the real situation for practice experiences.

Project-based learning is appropriate for vocational education in Thailand since it develops skills in students appropriate for the 21st century (problem-solving, creativity, teamwork, critical thinking, and collaborative working including communication). As Thailand is going to be an absolutely aging society within the next ten years, all sectors in society, especially educational institutions, must pay great attention to participating in caring for and promoting the quality of life for older adults, emphasizing not only health and exercise, but also learning [11]. Project-based learning refers to learning through doing activities and producing creative products systematically and learning that supports students in self-development. The instructor designs the learning process step by step and plans the content, the objectives of learning, and the output, including outcomes. Project-based learning needs to be designed so that students do the project in groups with appropriate numbers. Students must learn together in designing the tools for data collection and engaging in data analysis in order to write the project themselves. Before implementing their projects, students must present them for approval and comment. Students must conduct their projects according to the plan, and some projects are involved with the target group, such as students at school or in communities. Students must evaluate the projects and present the results of the project-based learning. Many researchers have expressed that an instructor and researchers must collaboratively design project-based learning for students to learn from real situations by doing the project [12].

Project-based learning could be conducted by collaboratively working in normal classrooms and in communities [13]. Project-based learning is used in higher education in order to support students to develop thinking skills, problem-solving skills, and complex questioning [14] including problem-solving in the classroom. When raising the questions as the main method project-based learning can also be the method for

problem-based learning [15]. In addition, using simulation and demonstration in project-based learning seems also to be effective [16]. In a study of the effectiveness of a program to promote the competency of Thai nursing students through project-based learning involving treating elderly people in the community, the results showed that the average score after engaging in project-based learning was higher than that before the program. The results of the study also showed the effectiveness of the program in terms of developing the competency of nursing students through project-based, and it was important for the instructor to apply project-based learning to his/her teaching [17]. According to a study conducted by Kawira [18] was found that students had learned activity planning and carried out service and research projects collaboratively.

In this research, the instructor having delivered an integrated training course and been a trainer for communities and organizations, and in particular having conducted academic service projects for older adults in Chiang Mai province, the researchers viewed the importance of learning management for older adults, a large group of the world's population and need to have lifelong learning [12] including supporting students to learn better through project-based learning, and students could eventually apply the content to concepts and theories to practice in real situations. Students could understand the training material and conduct training projects appropriately. The Department of Elderly Affairs and the Ministry of Social Development and Human Security are undertaking a campaign aimed at the population in every age bracket, whether children, youths, or adults, to prepare them for a quality life in old age [19]. Developing the necessary skills in older adults in Thailand is a significant and urgent matter because Thailand will become a net ageing society [20]. The research on the education of older adults in Taiwan also indicated that the future challenge for older adult learning has become the new public teaching model, necessary for developing projects and programs which respond to older adults' needs and differences [21].

The researchers selected a state home care facility for older adults called "Banthammaprakorn Elderly Home Care Chiang Mai", located in Chiang Mai City, Thailand for the students' practice. This was chosen for the following reasons: i) A memorandum of understanding around collaborative working for developing older adults' quality of life existed; ii) There was convenient access for students, as the home care facility is located near the university; iii) Aiming to support students in working collaboratively in conducting the training project for older adults; iv) Providing an opportunity for students to realize the importance of promoting older adults' quality of life and the importance of becoming active and high-quality folder adults in the future

This designed learning supported student learning based on experience in terms of course content through project-based learning, to raise awareness on the part of the public and encourage collaborative working skills. Project-based learning supports students to be active learners. Sirisunyluck [22] found that students' readiness for living in an aging society was at a moderate level, but attitude readiness was at the lowest level because of a lack of knowledge and experience about the elderly and their attitude to society. Reflect that the education and experience of living together for Generation Z people are low.

Therefore, this research was conducted to integrate learning for older adults with project-based learning for students studying as part of a training technique course. The research aimed to examine the results of collaborative project-based learning that was specially designed for students engaged in the training technique course involving conducting a training program for older adults in state home care in Chiang Mai, Thailand. As there were 40 undergraduate students engaged in training programs for older adults at a state home care facility in Chiang Mai. Older adults in this place are older adults who are poor, homeless, and with no patrons. Mostly older adults stay here until die, the state home care will manage the funeral. This state home care manages daily life activities (including exercise) for older adults and welcomes food donations from people outside. For training programs from outside like university or school, this study was the first project collaboration between the instructor and organization. Thus, the research questions in the study were: i) What were the results of collaborative project-based learning that was designed for 40 undergraduate students?; ii) Did the students satisfy with the collaborative project-based learning that was designed?; iii) Did the older adults at state home care satisfy with the training programs that were conducted by students?

2. RESEARCH METHOD

This research aimed to study the results of collaborative PjBL special designed for students engaged in the training technique course involving conducting a training program for older adults in state home care in Chiang Mai, Thailand. The instruments used in this study were: i) Lesson plans for the 45-hour training course focusing on the meaning of the training, the objectives, the importance, the process of training, the method of training, training needs analysis, document preparation, training program writing, selecting trainers, training program evaluation, conclusion, and results; ii) An observation form on students' learning behavior, students' assignments, and questionnaires on student satisfaction with regard to collaborative project-based learning; iii) Journal form after teaching which focuses on student learning behavior, teaching problems and problem-solving; iv) Student assignments and student self-reflection journals; v) Questionnaire

on student satisfaction regarding collaborative project-based learning and learning step by step based on a five-point Likert scale (from highest to lowest); vi) Older adult satisfaction regarding the two training programs conducted by the students. All the research instruments used for data collection were based on lesson plans and student information about their ability to learn and engage in collaborative project-based learning. All research tools were approved by three experts from the Business Education Program, including trainers and staff responsible for the activities for older adults in state home care in Chiang Mai. The researchers improved the tools according to the experts' suggestions before use.

The population in this research consisted of 40 students whom undergraduates studied in different faculties and years of study. They were interested in and enrolled in the training techniques course for the elective course which teaching in the Business Education Program, Department of Vocational and Wellness Promotion, Faculty of Education, Chiang Mai University, Thailand. All students had no experience in conducting any training program, especially for the older adults, so they were pleased, excited, and volunteers that an instructor assigned and planned in the second semester of 2019. The results of this study were analyzed to conclude the research objectives that study the outcome based on collaborative project-based learning. The data were analyzed using descriptive statistics; numbers and percentages and content analysis.

3. RESULTS

To manage the collaborative project-based learning for the students, the instructor/researcher realized that 40 students enrolled in this course without training conducting background. They were from 11 faculties, namely education, engineering, political sciences, economics, sciences, humanities, agroindustry, arts media and technology, associated medical sciences, social sciences, and agriculture. None of the students had experience in conducting training programs. The instructor taught the content and skills required for the training course to be followed by lesson plans emphasizing student participation and work collaboration. The study found that, in terms of student outcomes, they could adjust well to the course and work with other classmates, even though they were from different fields and years. In addition, students still do not understand the organizational condition. The instructor explained the details and shared former experiences of working as a former business/community trainer, with the use of pictures, and encouraged students to ask questions. As the instructor used collaborative project-based learning, students had an opportunity to collect data from older adults at the state home care facility for the first step, which was training need analysis. They learned how to communicate with older adults about planning and problem solving and sharing the data analysis results in the classroom. Collaborative project-based learning in this research allowed students to work together at every step of the training process. Student outcomes showed that they gained knowledge and skills, not only from the contents of the course that aimed to develop a training program for older adults but also 21st-century skills such as communication, information and technology, critical thinking, presentation, and teamwork.

Before conducting the training programs for older adults at the state home care facility, the student volunteers were separated into two groups of 20 students each because each group could learn well, and especially for conducting the training program, each student had an opportunity to do designed duty with collaboration. They had to write the details of the training project and activities based on data that they collected from the website of the state home care facility, along with staff interviews about the situation in which the older adult. Data collection from the older adults was undertaken using a questionnaire on training need analysis. For this collaborative project-based learning process, there were several steps of students' learning presented in sub-sections.

3.1. Preparing the training program for older adults

Students worked collaboratively in each group. They selected the head of the group and divided duties among members. Furthermore, they contacted the state of older adults, and training needs analysis.

3.2. Design the topic or details of the training program for older adults

In this step, students worked collaboratively on designing the questionnaire on training need analysis by meeting to discuss and share information and ideas in order to develop the training program for older adults at the state home care facility. Students had to be careful in terms of creating activities and how they conducted themselves during data collection and carrying out the training programs, because this group of older adults is considered vulnerable. Most of them had lost their homes and family support. Students in each group had to present their draft of the training need analysis for approval and discussion with the instructor and classmates. Students collecting the data for the training need analysis presented their findings and took these discussions on board. These findings were used in writing the training program.

3.3. Writing the training program for older adults

Students in each group worked collaboratively in writing the training program. There were 14 items in each training program. Students presented the details of the training program and took suggestions on board from the instructor and classmates with regard to improving the end product.

3.4. Conducting the training program for older adults

Students in each group conducted the training program for older adults as designed. The first group conducted a training program entitled 'Nutrition for Older Adults' in the first week where full data can be seen in Table 1. Furthermore, students' satisfaction with collaborative PjBL is presented in Table 2. Hence, older adults' satisfaction with the first training program titled nutrition for older adults is included in Figure 1. Students from Group 1 conducted a training program entitled 'Nutrition for Older Adults.'

The second group of students conducted a training program entitled 'Recreation for Older Adults' the week after. The training took two hours, the data can be seen in Table 1 and Table 3. Older adults' satisfaction with the second training program titled recreation for older adults is included in Figure 2. Students from Group 2 conducted a training program entitled 'Recreation for Older Adults'.

However, students had to go to the state home care facility in advance in order to prepare and set up the room for training. Students followed the steps of project-based learning and training project management and were separated into two groups based on an analysis of the older adults' training needs. The first group was trained in health promotion through nutrition for the elderly, and the second group focused on recreation and exercise for older adults, with 2.5 hours for each program. There was then a meeting between the students, the instructor, and invited staff members responsible for the activities for older adults at the state home care facility for evaluation and reflection with regard to the training program. This meeting lasted 30 minutes. The students had to present the results and outcomes of their training programs and listen to feedback from the instructor and classmates. In this course, the instructor attempted to encourage students to be active learners, while the role of the instructor in this course was a facilitator and motivator. The instructor must support students' abilities to express themselves in the learning process [23].

Table 1. Students 'satisfaction with collaborative project-based learning

Collaborative project-based learning	Level of students 'satisfaction					Total
	Highest	High	Moderate	Less	Least	
Collaborative project-based learning	36 (90)	4 (10)	0 (0)	0 (0)	0 (0)	40 (100)
Step of teaching projected-based learning	38 (95)	2 (5)	0 (0)	0 (0)	0 (0)	40 (100)
To conduct training programs	38 (95)	2 (5)	0 (0)	0 (0)	0 (0)	40 (100)
Students 'outcomes; attitudes and behavior changes	35 (87.5)	5 (12.5)	0 (0)	0 (0)	0 (0)	40 (100)
Knowledge, skills, and experiences from conducting the training programs	39(97.5)	1 (2.5)	0 (0)	0 (0)	0 (0)	40 (100)

Table 2. Older adults 'satisfaction with the first training program titled nutrition for older adults

Items of satisfaction	Level of older adults' satisfaction				
	Highest	High	Moderate	Less	Least
1. Overall training program	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)
2. Knowledge and skills gained	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)
3. Participation	40 (95.24)	2 (4.76)	0 (0)	0 (0)	0 (0)
4. Trainers and activities	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)
5. Duration of the training program	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)

Table 3. Older adults 'satisfaction with the second training program titled recreation for older adults

Items of satisfaction	Level of older adults' satisfaction				
	Highest	High	Moderate	Less	Least
1. Overall training program	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)
2. Knowledge and skills gained	40 (95.24)	2 (4.76)	0 (0)	0 (0)	0 (0)
3. Participation	40 (95.24)	2 (4.76)	0 (0)	0 (0)	0 (0)
4. Trainers and activities	42 (100)	0 (0)	0 (0)	0 (0)	0 (0)
5. Duration of the training program	40 (95.24)	2 (4.76)	0 (0)	0 (0)	0 (0)

3.5. Student satisfaction with regard to collaborative project-based learning

The research found that student satisfaction with collaborative project-based learning was at the highest level in five areas. They are included collaborative project-based learning (90%), teaching project-based learning (95%), conducting training programs (95%), student outcomes, attitude and behavioral change

(87.50%) and knowledge, skills, and experience gained from conducting the training programs (97.50%). The details of student satisfaction with regard to collaborative project-based learning are presented in Table 1.

In addition, students reflected in their journals that they were pleased with collaborative project-based learning. Data can be seen in Figure 3. Students' activities on reflective learning of the course. Some of their statements are:

> "…. The teaching style of the instructor is like a western style because it lets students discuss and the instructor listens to the voice of the students."
> "I dare say I have changed attitude and behavior a lot. In the past, I always listened but spoke less."
> "I am happy to study with friends from many faculties, juniors, and seniors; we can learn and share; we support our team very well."
> "We usually study at our faculty; we listen to the lectures and take notes; we have little participation in group work. By studying in this course, we have changed our style of learning, and we are happy to study this course."
> "Thank you for supporting us to learn actively and preparing us to be ready for 21st-century skills."
> "I'm very excited to conduct the training program for older adults. At first, we were very scared and worried about adjusting ourselves to older adults, but finally, we worked well. We were happy to see older adults participated in our training program, they smiled and paid great attention."

In the next section, the researchers will present the section about older adult satisfaction with the training programs conducted by students. Regarding older adults in the first training program, entitled 'Nutrition for Older Adults', the results indicated that older adults' satisfaction with the overall training program in terms of knowledge and skills gained as well as trainers and activities were at the highest level (100 %), and participation in and duration of the training program were also at the highest level (95.24%). Levels of satisfaction among older adults on the second training program, entitled 'Recreation for Older Adults', were at their highest level in terms of trainers and activities (100%); knowledge and skills gained, while participation and duration of the training program were also at the highest level (95.24%).

Figure 1. Students from Group 1 conducted a training program entitled 'Nutrition for Older Adults.

Figure 2. Students from Group 2 conducted a training program entitled 'Recreation for Older Adults'

Figure 3. Students' activities on reflective learning of the course

4.   DISCUSSION

In terms of managing collaborative PjBL by group working or teamwork in this research, firstly, students in this study had no experience, knowledge, or skills relevant to conducting the training program. However, when they understood that they could learn the theory and practice by following the process in the form of a collaborative working group, the students were able to develop and conduct the training program themselves in line with the concepts of Chen *et al.* [24]. argue that collaborative learning is a part of project-based management, since it needs mutual support and collaboration to achieve success. Students shared learning during small group work, this gave students the opportunity to engage in discussion, and take responsibility for their own learning and duties, thus students became critical thinking and collaborative working [25]. Collaborative learning with older adults supports developed skills between older adults and young people [26]. When students have an opportunity to conduct a training program or project with older adults and communities, these experiences encourage students to develop social skills and teamwork [27].

Concerning the results of this project-based learning, students were divided into two groups to conduct training programs for older adults in state home care in Chiang Mai that aimed to support each student to take action in the training program. Students work together as small groups and must brainstorm, exchange, and share information and data to finish assigned tasks which are the goal of learning. In collaborative learning, instructors usually separate students into two groups and use a range of tools to support the activities [28]. Collaborative learning is a part of project-based learning because collaboration is needed among students to complete the assigned tasks [20]. Collaborative learning and project-based learning can be used together. Research conducted at the higher education level indicates that collaborative learning supports students' learning processes; however, instructors must design it in such a way as to be challenging and set the appropriate activities for the selected students [29]. Students can implement their experiences in real life and future occupations because collaboration is also affected by the modes of communication that students use to collaborate with another [30]. There are many ways to manage collaborative learning for older adults. Research that studied collaborative learning among adults in the form of online learning found success using appropriate management and activities [31].

The first group conducted the training program entitled 'Nutrition for Older Adults' and the second group conducted a training program entitled 'Recreation for Older Adults'. Student satisfaction was at the highest level because collaborative learning creates positive experiences for students [32]. Students expressed the opinion that they felt nervous at first about communicating with each other and about the learning style, but finally they found that they could collaborate well together because the instructor taught through project-based learning, step-by-step from theory to practice. Regarding older adults in the first training program, entitled 'Nutrition for Older Adults' and the second training program, entitled 'Recreation for Older Adults' the results indicated that older adults' satisfaction with the overall training programs in terms of knowledge and skills gained as well as trainers and activities were at the highest level (100%). Age level increases, the tendency to persistence which is the sub-factor of lifelong tendencies increases [33].

The instructor motivated the students in a kind manner and shared experiences about training programs at every stage of the course, while the students conducted many activities such as games, role play and brainstorming. The learning environment was one of discussion and sharing, supporting, and promoting students to learn and respond effectively to their duties in each group. It created social skills in line with the findings of Chatwattana and Nilsook [34], project-based learning is appropriate for enabling students in vocational education in Thailand to develop 21st-century skills, because this learning method helps them develop skills such as problem-solving, creativity, teamwork, critical thinking, collaborative working, and communication, especially to collaborative working with older adults organization [35]. The project-based

learning method is a suitable teaching and learning practice in line with the development of education that requires skills to solve real-world problems among students.

Students conducting the training programs for older adults in this study were especially impressed by their experiences. The training program for older adults still emphasizes supporting older adults in staying active and socializing [36]. The success of the training program for older adults is based on the lifelong learning concept, lifelong learning is an indispensable element of active aging not only because learning is good for older adults but because older adults become more active in the systemic change of their environment and in the setting goals for their lives [37].

Project-based learning supported the students in terms of working collaboratively with classmates and older adults, and when they saw the older adults smiling and laughing while participating in the programs, these behaviors encouraged positive thinking on the part of the students [38]. In general, in terms of working or learning between the two generations, there is a gap between seniors and juniors; this is the main obstacle in terms of managing activities [39]. All members of the groups worked together enjoyably, engaged in good teamwork and effective planning, and were able to solve problems together under the supervision of the instructor ,achieving all the objectives of the planned project with dignity [40].

Managing project-based learning in the classroom supports students in learning by doing, enabling them to produce results using creative thinking on the part of the individual or the group. Additionally, students can develop skills such as critical thinking, planning, management, problem-solving and practicing skills [41]. They can also transfer knowledge and skills from their learning in the classroom to the older adults participating in the training program [42].

Through conducting training programs for older adults in two groups, the student's outcomes indicated their increased awareness and willingness to volunteer in society, and students were impressed with collaborative learning and working. This is relevant to the work of Kawira [18] who studied the development of elderly people by integrating teaching, learning, and academic services. The research found that when students learned together in a project involving academic service and research, this helped students learn the content of the course from real experience based on the project. Students also gained awareness of becoming a volunteer and developed collaborative working or project-based learning that supported them in learning actively.

5. CONCLUSION

This study integrated collaborative project-based learning by students and the conduct of training programs for older adults to provide benefits for both groups of people. One aspect of collaborative learning was the decision to divide students into two groups in order to conduct the training programs for older adults or other target groups. The instructor had to let students choose group members based on varying levels of knowledge and ability under specific criteria. Additionally, to create active learning through collaboration, the instructor must also integrate other teaching methods to fulfill the aims of project-based learning. In conducting a training program for older adults, the training program for the older adults may be arranged for older adults in schools for older adults or older adults' clubs that still need more activities like this. As the present research integrates two objectives, the outcomes appear to be both efficient and beneficial, and also relevant to the real world, as nowadays there are large numbers of older adults who need lifelong learning and love with attention from the young generation.

REFERENCES

[1] I. M. Mantawy *et al.*, "Bridging the gap between academia and practice: project-based class for prestressed concrete applications," *Education Sciences*, vol. 9, no. 3, p. 176, Jul. 2019, doi: 10.3390/educsci9030176.

[2] W. Havice, P. Havice, C. Waugaman, and K. Walker, "Evaluating the effectiveness of integrative STEM education: Teacher and administrator professional development," *Journal of Technology Education*, vol. 29, no. 2, pp. 73–90, Jun. 2018.

[3] M. M. Alamri, "Using blended project-based learning for students' behavioral intention to use and academic achievement in higher education," *Education Sciences*, vol. 11, no. 5, p. 207, Apr. 2021, doi: 10.3390/educsci11050207.

[4] M. Randazzo, R. Priefer, and R. Khamis-Dakwar, "Project-based learning and traditional online teaching of research methods during covid-19: an investigation of research self-efficacy and student satisfaction," *Frontiers in Education*, vol. 6, May 2021, doi: 10.3389/feduc.2021.662850.

[5] S. Falcione *et al.*, "Emergence of Different Perspectives of Success in Collaborative Learning," *The Canadian Journal for the Scholarship of Teaching and Learning*, vol. 10, no. 2, 2019, doi: 10.5206/cjsotl-rcacea.2019.2.8227.

[6] R. P. Estébanez, "An approachment to cooperative learning in higher education: comparative study of teaching methods in engineering," *EURASIA Journal of Mathematics, Science and Technology Education*, vol. 13, no. 5, pp. 1331–1340, Dec. 2016.

[7] J. A. N. Ansari and N. A. Khan, "Exploring the role of social media in collaborative learning the new domain of learning," *Smart Learning Environments*, vol. 7, no. 1, p. 9, Dec. 2020, doi: 10.1186/s40561-020-00118-7.

[8] H. Le, J. Janssen, and T. Wubbels, "Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration," *Cambridge Journal of Education*, vol. 48, no. 1, pp. 103–122, 2018, doi: 10.1080/0305764X.2016.1259389.

[9] L. Baloche and C. M. Brody, "Cooperative learning: exploring challenges, crafting innovations," *Journal of Education for Teaching*, vol. 43, no. 3, pp. 274–283, May 2017, doi: 10.1080/02607476.2017.1319513.

[10] P. Nilsook, P. Chatwattana, and T. Seechaliao, "The project-based learning management process for vocational and technical education," *Higher Education Studies*, vol. 11, no. 2, p. 20, Feb. 2021, doi: 10.5539/hes.v11n2p20.

[11] P. J. Ruiz-montero, O. Chiva-bartoll, and C. Salvador-garc, "Learning with Older Adults through Intergenerational Service Learning in Physical Education Teacher Education," *Sustainability*, vol. 12, no. 1127, pp. 2–14, 2020, doi: 10.3390/su12031127.

[12] K. Juuti *et al.*, "A Teacher – Researcher Partnership for Professional Learning: Co-Designing Project-Based Learning Units to Increase Student Engagement in Science Classes A Teacher," *Journal of Science Teacher Education*, vol. 32, no. 6, pp. 625-641, 2021, doi: 10.1080/1046560X.2021.1872207.

[13] A. Hasni, F. Bousadra, V. Belletête, A. Benabdallah, M.-C. Nicole, and N. Dumais, "Trends in research on project-based science and technology teaching and learning at K – 12 levels: a systematic review," *Studies in Science Education*, vol. 52, no. 2, pp. 199–231, 2016, doi: https://doi.org/10.1080/03057267.2016.1226573.

[14] T. Pinto and C. Vasconcelos, "Geology and Environment: A Problem-Based Learning Study in Higher Education," *Geosciences*, vol. 11, pp. 1–14, 2021, doi: 10.3390/geosciences11040173.

[15] M. C. English and A. Kitsantas, "Supporting Student Self-Regulated Learning in Problem- and Project-Based Learning Supporting Student Self-Regulated Learning in Problem- and Project-based Learning," *Interdisciplinary Journal of Problem-Based Learning Volume*, vol. 7, no. 2, pp. 128–150, 2013, doi: 10.7771/1541-5015.1339.

[16] J. Lee and H. K. Son, "Comparison of learning transfer using simulation problem-based learning and demonstration: An application of papanicolaou smear nursing education," *International Journal of Environmental Research and Public Health*, vol. 18, no. 4, p. 1765, Feb. 2021.

[17] S. Hanklang and S. Sivasan, "Effectiveness of the project-based learning program on Thai nursing student competency for elderly care in the community," *Journal of Health Research*, vol. 35, no. 2, pp. 132–146, Mar. 2020, doi: 10.1108/JHR-07-2019-0160.

[18] S. Kawira, "The development of the quality of life of the elderly group on the integration of teaching and learning, academic services and researches: a case study of the elderly group of Bantonngio, village no. 2 Sanphakwan sub-district, Hangdong district, Chiangmai," *Academic Journal of THE Far Eastern University*, vol. 10, no. 2, pp. 209–220, 2016.

[19] UNFPA Thailand, *Impact of Demographic Change in Thailand*. Bangkok: United Nations Population Fund, Thailand, 2011.

[20] Foundation of Thai Gerontology Research and Development Institute, "Situation of the Thai elderly," Foundation of Thai Gerontology Research and Development Institute, Bangkok, 2015.

[21] Y. Lee, "Older adult education: new public pedagogy in 21st century Taiwan," *Australian Journal of Adult Learning*, vol. 55, no. 3, pp. 461–476, 2015.

[22] B. Sirisunyaluck, "Human Capital of Generation Z and Readiness for Living in Aging Society," *Journal of Community Development and Quality of Life*, vol. 5, no. 1, pp. 36–45, 2017.

[23] S. S. Putri, M. Japar, and R. Bagaskorowati, "Increasing ecoliteracy and student creativity in waste utilization," *International Journal of Evaluation and Research in Education*, vol. 8, no. 2, pp. 255–264, 2019.

[24] J. Chen, P., Hernandez, A., & Dong, "Impact of Collaborative Project -Based Learning on self_efficacy of urban minority students in engineerin," *Journal of Urban Learning Teaching and Research*, vol. 11, pp. 26–39, 2015.

[25] J. G. Camayang and R. G. Bautista, "Learning together, learning deeper: A little teacher assisted learning engagement Learning together, learning deeper: A little teacher assisted learning engagement," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 2, pp. 412–420, 2021, doi: 10.11591/ijere.v10i2.21070.

[26] M. Romero, P. Hyvönen, and E. Barberà, "Creativity in Collaborative Learning across the Life Span," *Creative Education*, vol. 3, no. 4, pp. 422–429, 2021, doi: 10.4236/ce.2012.34066.

[27] S. Ghavifekr, "Collaborative Learning: a Key To Enhance Students' Social Interaction," *Malaysian Online Journal of Educational Sciences*, vol. 8, no. October, pp. 9–21, 2020.

[28] S. H. Halili, R. A. Razak, and Z. Zainuddin, "Investigating the use of collaborative tool in an adult learning environment," *The Online Journal of New Horizons in Education*, vol. 5, no. 4, pp. 51–60, 2015.

[29] K. Scager, J. Boonstra, T. Peeters, J. Vulperhorst, and F. Wiegant, "Collaborative learning in higher education: evoking positive interdependence," *CBE—Life Sciences Education*, vol. 15, no. 4, p. ar69, Dec. 2016, doi: 10.1187/cbe.16-07-0219.

[30] L. Yang *et al.*, "The effects of remote work on collaboration among information workers," *Nature Human Behaviour*, vol. 6, no. 1, pp. 43–54, Jan. 2022, doi: 10.1038/s41562-021-01196-4.

[31] A. Abedini, B. Abedin, and Iwona Miliszewska, "Peer to Peer Adult Learning Engagement in Online Collaborative Learning: Characteristics and Learning Outcomes," in *Pacific Asia Conference on Information Systems 2017*, 2017, p. 181.

[32] S. Trongtorsak, K. Saraubon, and P. Nilsook, "Collaborative experiential learning process for enhancing digital entrepreneurship," *Higher Education Studies*, vol. 11, no. 1, p. 137, Jan. 2021, doi: 10.5539/hes.v11n1p137.

[33] Ş. Şentürk and V. Duran, "Lifelong learning tendencies of trainers in adult education," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 1, pp. 1–9, Mar. 2020, doi: 10.11591/ijere.v9i1.20365.

[34] P. Chatwattana and P. Nilsook, "A web-based learning system using project-based learning and Imagineering," *International Journal of Emerging Technologies in Learning*, vol. 12, no. 5, 2017, doi: 10.3991/ijet.v12i05.6344.

[35] Z. C. Isa and N. Azid, "Embracing TVET education: The effectiveness of project based learning on secondary school students' achievement," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 3, pp. 1072–1079, Sep. 2021, doi: 10.11591/ijere.v10i3.21392.

[36] C. Bjursell, "Inclusion in education later in life: Why older adults engage in education activities," *European Journal for Research on the Education and Learning of Adults*, vol. 10, no. 3, pp. 215–230, Oct. 2019, doi: 10.3384/rela.2000-7426.rela20192.

[37] I. Choi and S. R. Cho, "A case study of active aging through lifelong learning: Psychosocial interpretation of older adult participation in evening schools in Korea," *International Journal of Environmental Research and Public Health*, vol. 18, no. 17, p. 9232, Sep. 2021.
[38] C. Lynch, L. A. Stein, S. Grimshaw, E. Doyle, L. Camberg, and E. Ben-Ur, "The impacts of service learning on students and community members: Lessons from design projects for older adults," in *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, 2014, vol. 2015, pp. 1–9.
[39] F. Marina, "Barriers to adult learning: Bridging the gap," *Australian Journal of Adult Learning*, vol. 51, no. 3, pp. 583–590, 2011.
[40] J. E. Mitchell and L. Rogers, "Staff perceptions of implementing project-based learning in engineering education," *European Journal of Engineering Education*, vol. 45, no. 3, pp. 349–362, May 2020.
[41] P. Eckardt, M. Craig, and L. Kraemer, "The Impact of Project-Based Learning on Student Content Knowledge in an Undergraduate, Teacher Preparation, Foundations of Education Course," *Journal for Leadership and Instruction*, vol. 19, no. 1, pp. 38–42, 2020
[42] C. Granado-alc *et al.*, "Project-based learning and the acquisition of competencies and knowledge transfer in higher education," *Sustainability*, vol. 12, no. 23, p. 10062, Dec. 2020, doi: 10.3390/su122310062.

BIOGRAPHIES OF AUTHORS

Phetcharee Rupavijetra ⓘ 🅖 SC Ⓟ is an Associate Professor at the Business Administration Program, the Department of Vocational Education and Wellness Promotion, the Faculty of Education, Chiang Mai University Thailand. She currently works in the field of Older Adults Education, Training, Project-based Learning, TVET and Education. She is a member of the East Asia Federation for Adult Education (EAFAE) and Association of Professional Development of Education Administration of Thailand (APDEAT). She can be contacted by email: phetcharee.r@cmu.ac.th.

Prachyanun Nilsook ⓘ 🅖 SC Ⓟ is the Professor at the Division of Information and Communication Technology for Education, the Faculty of Education, King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand. He currently works in the field of ICT for Education and is Head of Vocational Education Technology Research Centre. He is a member of Professional Societies in the Thai Association for Educational Communications and Technology (Thai AECT). He can be contacted by email: prachyanunn@kmutnb.ac.th, prachyanun@hotmail.com.

Jira Jisupa ⓘ 🅖 SC Ⓟ is an Assistant Professor at the Teacher Professional Group, Faculty of Education, Suan Dusit University, Bangkok, Thailand. He currently works in the field of ICT for Education and ICT for Early Childhood and Primary Education. He is a member of Professional Societies in the Thai Association for Educational Communications and Technology (Thai AECT). He can be contacted by email: jira_jit@dusit.ac.th.

Tipparat Nopparit ⓘ 🅖 SC Ⓟ is the Assistant Professor in the teaching Mathematics Program, Department of Curriculum, Teaching and Learning, the Faculty of Education, Chiang Mai University. Thailand. She is the Vice Dean for Academic Services and Strategic Support and Finance. She also is the school director for Chiang Mai University Demonstration School (Primary level). She can be contacted by email: tipparat.n@cmu.ac.th.