

***Development of Learning Modules for Enhancing Classroom Action Research  
Skills of Student Teachers***

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**Abstract**

Classroom action research (CAR) skills are a crucially important quality that student teachers should possess in order to facilitate their own learning and career. This study aimed to design learning modules for enhancing the CAR skills among student teachers, and was divided into three phases. The first phase was the development of the design principle in order to form the conceptual basis for arguments in the learning modules. The second phase involved implementation of the learning modules on five groups of student teachers in diverse contexts. Data were collected using observation and assessment of CAR reports. After that, the data content was analyzed. The final phase dealt with the presentation of the new design principle by adopting lessons from the learning modules. There were six learning modules for CAR, and 14 weeks of treatment adaptation. The design principle of the learning modules created knowledge and skills for CAR as well as improving awareness, attitudes, self-awareness and research commitment. Second, the learning modules revealed that student teachers held the opinion that CAR was not difficult and they understood its benefits. The assessment revealed that student teachers had the right knowledge and products to follow the principles of CAR. Third, the new design principle was the interaction between students and the CAR activities, where consistency was necessary throughout the whole process.

Keywords: classroom action research skills, learning modules, student teachers

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## **Introduction**

Classroom action research (CAR) is an important tool for teachers to solve problems that occur in the classroom and develop learning management efficiency (Phillips & Russell, 1994; Wongwanich, 2010). It should be performed along with learning management, but nowadays teachers tend to conduct research only when they want to apply for academic positions and think that doing research is not their duty. They also view CAR as an additional workload (Hemsley-Brown & Sharp, 2004).

This problem reflects that teachers have a bad attitude towards doing research as they still do not realize its real benefits. Although relevant organizations, including schools and offices of the educational service area, have continuously carried out training courses on CAR skill development for teachers, those training courses only focus on providing knowledge and skills but pay no attention to instilling a positive attitude towards research. There are research findings that indicate that teachers have a negative attitude towards CAR (Borg, 2007). Therefore, supporting teachers to develop CAR skills alone is not enough to make them effectively use CAR to improve their learning management. Rather, it is necessary to make teachers develop a positive attitude towards CAR and also have the confidence to conduct it (McSherry, Artley, & Holloran, 2006).

In the context of Thai teacher training institutions and universities, student teachers need to be provided with CAR knowledge because it is considered as a basic knowledge for those who are going to be teachers in the future. Student teachers are trained in CAR both during instructional courses and teaching practice in educational institutions. During instructional courses, student teachers are educated in CAR through lectures, activities, and research exercises. During teaching practice, they will be trained to use CAR to solve problems in learning management. The present research on the development of learning modules for enhancing CAR skills aimed to develop the student teachers' research skills and abilities, make them aware of the value of doing research, and encourage them to continuously conduct research on learning management in the future when they work as teachers after graduation.

Based on a review of related research, it was found that learning modules for CAR used in Thailand and other countries mostly focus on developing knowledge and skills and are presented according to CAR procedures. There are only a few learning modules that suggest the importance of implementing CAR (Nugent, Malik, & Hollingsworth, 2012; Phillips & Russell, 1994; Rust, & Clark, n.d.). Thus, the use of activity sets can lead to the development of research knowledge and skills, but may not inspire student teachers to conduct research on a continuous basis thereafter.

The learning modules that were developed in this study can be divided into two parts. The first part focused on making student teachers aware of the consequences of their research and have a positive attitude towards research, which will make student teachers recognize their own research abilities and engage with their research (Adedokun, Bessenbacher, Parker, Kirkham, & Burgess, 2013; Brog, 2007; Dale, Fowler, Adhikari, Pinto, & Rose, 2010). The second part dealt with developing CAR knowledge and skills as well as other relevant characteristics in order to make student teachers able to use CAR to continuously improve their learning management in the future.

In order to design learning modules that focus on developing CAR knowledge, skills, and expected characteristics, it is important to apply both learning and psychological theories, such as social development, transformative learning, and motivation theories. Unlike traditional learning modules, it is impossible to design a new learning module with the use of CAR procedures alone because the expected characteristics are associated with psychological variables. Thus, in this research a design-based research approach was mainly used to develop the learning modules together with various research methods based on theoretical and actual contexts. Some theoretical principles and activities used in designing the learning modules were appropriately adjusted during the experimental process (Wang & Hannafin, 2005; Wongwanich, 2013). The design-based research approach requires a collaboration between researchers, as the designers, and practitioners, as the learning module users, in order to develop effective learning modules that are suitable for actual contexts (Alghamdi & Li, 2013; Wang & Hannafin, 2005).

The present research on the development of learning modules for CAR mainly expected to enable student teachers to gain CAR knowledge and skills, have the abilities to perform learning and teaching management through the research process, recognize the benefits of doing research, develop a positive attitude towards research, have research self-efficacy and research engagement, and use research to continuously improve their learning management in the future.

### **Research Objectives**

This research aimed to design and develop learning modules for enhancing the CAR skills among student teachers as well as to present learning modules adapted from the results of the design-based research.

### **Definition of Terms**

Learning module refers to a set of instructional activities developed for use in learning management about CAR. It was designed and developed using a design-based research approach in accordance with the relevant learning and psychological theories. The content of a learning module is about CAR, which can be called classroom research. Each learning module and relevant activities aimed to make the student teachers achieve CAR skills based on the design principle.

The set of CAR skills refer to the knowledge and understanding of CAR principles and methods as well as the ability to apply the theoretical knowledge to define CAR topics, design research methodology, and implement all CAR procedures until achieving the determined goals.

### **Characteristics Enhancing CAR Skills**

According to the relevant research and documents, there are many factors, both personal and environmental, that can enhance CAR knowledge and skills. These are summarized below.

Continuous research of teachers and scholars is associated with various factors, including external factors, such as support from related agencies, and personal factors, such as attitude towards research, research awareness, research understanding, and confidence in conducting research (McSherry, Artley, & Holloran, 2006). Therefore, in order to encourage teachers or individuals to do research, related parties should not only provide them with research knowledge and skills, but also give them the required support and make them have confidence and motivation to do research.

At present, related organizations mainly provide research knowledge to teachers with the aim to make them able to use research process to improve their teaching and learning. However, the problem is that teachers have no motivation or time to do research. They also think that research is not their duty but the responsibility of external organizations (Borg, 2007; Hemsley-Brown & Sharp, 2004; Wongwanich, 2010). This reflects that teachers are not aware that the research process can be used to develop their teaching and learning, but rather they still think that doing research and instructional development are separable from each other. Thus, supporting teachers to develop research knowledge and skills alone is not enough. Related organizations should also raise research awareness among teachers and make them recognize the importance of doing research. When teachers are aware of the benefits of doing research, they will seek more research knowledge, have motivation to conduct research, and develop a more positive attitude towards research (Dale, Fowler, Adhikari, Pinto, & Rose, 2010).

A positive attitude towards research refers to recognizing the importance of doing research and believing that doing research is interesting and can be applied to work, including feelings that occur when doing research. When researchers feel that doing research is interesting, fun, and useful, it indicates that they have a positive attitude towards it (Rezaei & Zamani-Miandashti, 2013).

Evaluation of the relationships between attitudes towards research and related variables, such as research self-efficacy, research anxiety, and research effort, revealed that when individuals have a positive attitude towards research, they will be more confident and believe that they can successfully conduct research (Li, 2012; Rezaei and Zamani-Miandashti, 2013). Therefore, in order to make teachers have the confidence to conduct research, it is essential to support them to develop a positive attitude towards research and feel that doing research is fun and interesting.

Research self-efficacy indicates a person's perception of his or her own research ability (Forester, Kahn, & Hesson-McInnis, 2004; Lambie, Hayes, Griffith, Limberg, & Mullen, 2014), which does not depend on his or her actual research ability. Some people may have a high research ability but low research self-efficacy. On the other hand, some people may have low research ability but high research self-efficacy (Griffioen, Jong, & Jak, 2013).

Research self-efficacy, or self-confidence in research, is a factor that affects the researchers' interest in and engagement with research (Lambie, Hayes, Griffith, Limberg, and Mullen, 2014; Rezaei and Zamani-Miandashti, 2013) and also contributes to the development of research knowledge and skills (Adedokun, Bessenbacher, Parker, Kirkham, & Burgess, 2013). Teachers or those who are continuously involved with research activities, including reading research papers,

conducting research, and utilizing research results, are likely to have engagement with research (Borg, 2007).

Based on a review of the relevant research and documents, it can be summarized that in order to develop people to have research skills and abilities to improve their own profession, it is necessary to not only provide them with knowledge, but also pay attention to their psychological characteristics and research awareness, which will enable them to have a positive attitude towards research, enjoy doing research, have self-confidence in doing research, and continuously engage in research activities. If related organizations can develop people to possess desirable characteristics for enhancing research skills, they will be able to improve their professional skills and research knowledge in a sustainable way.

### **Concepts and Theories Used as the Guidelines for Developing Learning Modules**

Before developing learning modules, the researchers studied the concepts, theories, and documents about characteristics that can enhance CAR skills and also explored the components and development process of learning modules. Moreover, learning modules on CAR in foreign countries were synthesized to be guidelines for developing learning modules in this study. These are detailed as follows.

### **Components of Learning Modules**

The development process of learning modules for CAR is similar to the process of learning design (Richey, 2000). This is because learning modules can be used as a medium to create CAR knowledge and skills. Previous theoretical concepts and research revealed that the main components of learning modules consist of (i) objectives, (ii) knowledge, (iii) media or activities that can enhance the students' learning, and (iv) assessment tools to measure the students' achievement based on determined objectives in each learning phase (Brown and Eberwein, 2010; Danks, 2011; Richey, 2000). Teachers are required to facilitate and provide guidance to students and allow them to fully show their potential, during the implementation of learning modules.

Regarding the learning modules for CAR used in foreign countries, it was found that most learning modules aimed to develop CAR knowledge and skills of teachers and relevant personnel based on the CAR process. For example, the learning modules of Nugent, Malik, and Hollingsworth (2012) are comprised of three main modules; (i) background and significance of CAR, (ii) duties and roles of administrators regarding CAR, and (iii) five CAR procedures, comprised of (a) identification of problems and research questions, (b) operational planning, (c) implementation and data collection, (d) report and feedback, and (e) improvement planning and execution. This is similar to the learning modules of others (McNiff, 2010; Rust & Clark, 2006), which are composed of the definition and characteristics of CAR, CAR procedures, important things to pay attention to, and CAR and professional development.

In addition, based on the synthesis of all published learning modules, it was found that the content of most learning modules are organized by adhering to CAR procedures. Yet, there are only a few learning modules that introduce the importance of CAR implementation. Moreover, no learning module pays attention to

systematically building a positive attitude towards research and research self-efficacy in order to develop research knowledge and skills. Many research studies suggested that it is essential to encourage students to develop desirable characteristics, such as a positive attitude and awareness towards research, research self-efficacy, and engagement with research. Thus, the CAR learning modules in this study were mainly developed based on the concepts and theories about those desirable characteristics, which included (i) the social development theory of Vygotsky (1978; cited in Khammani, 2002), (ii) transformative learning theory of Mezirow (1978; cited in Prajankett, 2014), and (iii) the motivation theory of Shunck, Pintrich, and Meece (2008).

The social development theory of Vygotsky (1978; cited in Khammani, 2002) places importance on building interpersonal interactions, which is the basis of learning, and fulfilling the gap between the actual learning level and expected goals by creating learning groups that are conducive to group learning. In addition, the learning groups help in designing the means for earning stimulation according to the content that focuses on developing the students' knowledge and skills.

The transformative learning theory of Mezirow (1978; cited in Prajankett, 2014) emphasizes that students' behavior can be changed if there are changes in their beliefs and frames of references. Teachers have to investigate the students' misunderstandings and find ways to solve those misunderstandings. Moreover, teachers need to ensure if their students' beliefs and understandings are correct or not and try to correct their false beliefs.

The motivation theory of Shunck, Pintrich, and Meece (2008) indicated that motivation resulting from goal-directed actions can control behavior. Every student has motivation, but the form of their motivation varies according to the situation. Thus, the behavior of each student is driven by different motivations. This theory focuses on conducting activities that are in line with the students' interest, making the students develop learning and work goals, giving students chances to participate in creating learning initiatives, enhancing self-efficacy, developing students' internal motivation, and encouraging students to have curiosity and to participate in learning activities. Once students have learning motivation, it will contribute to the development of awareness, self-efficacy, and a positive attitude.

## **Research Framework**

The development of CAR learning modules in this study gave importance to making the students develop their research knowledge and skills through various variables. This was because many previous research studies and related documents suggested that learning management should focus on supporting students to have a positive awareness and attitude towards research as well as research self-efficacy and research engagement. Once students possess these characteristics, they will be able to develop knowledge and skills in a sustainable way.

To enable the students to develop research knowledge and skills in a sustainable way, the researchers applied the theories and concepts about desirable research characteristics, such as research awareness, positive attitude towards research, research self-efficacy, and research engagement, to design and develop learning

modules in order to confirm the reliability and ensure that each developed learning module was different from the existing learning modules in the field. The details of the research framework are summarized schematically in Fig. 1 and outlined below.

## Research Methodology

The learning modules in this study were developed according to an educational design-based research approach. The research methodology was divided into the three phases of (i) the development of design principle and prototype of learning modules, (ii) the experimental implementation of the prototype, and (iii) the presentation of the adjusted design principle.

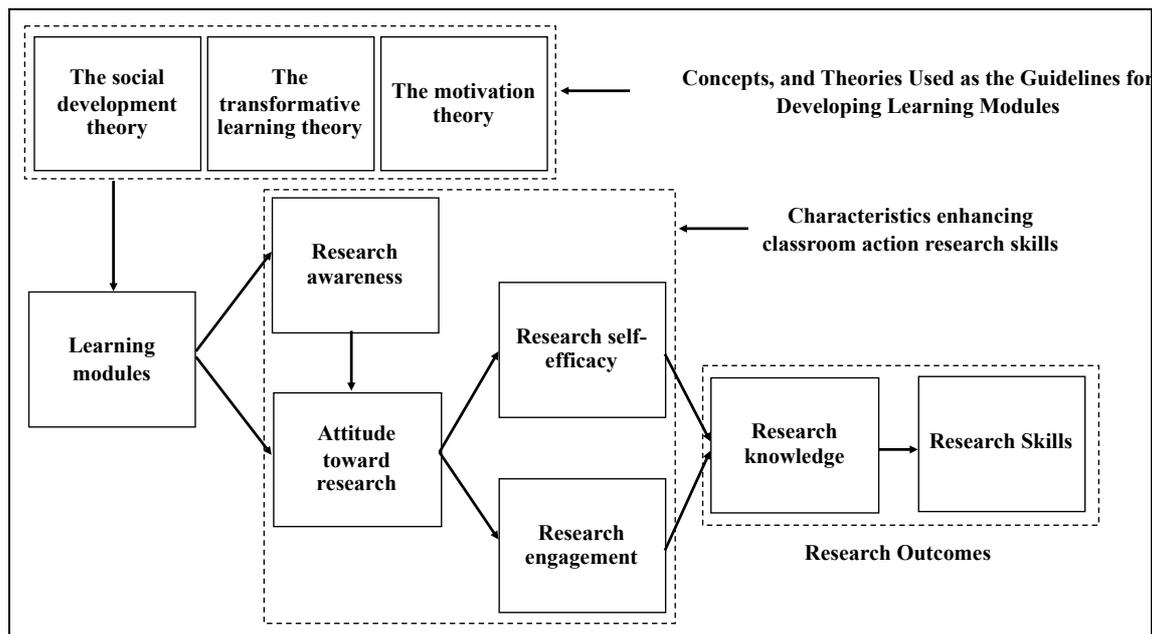


Figure 1: Research Framework.

### Phase 1: Development of the design principle and prototype learning modules

In this phase, the design principle was initially developed to form the conceptual basis for arguments in learning modules. Then, the prototype learning modules were created based on the drafted design principle. This phase took about 3 months, covering brainstorming of ideas among the research team that consisted of lecturers from the Faculty of Education, Chulalongkorn University, and experts in design-based research. The research procedures were as follows.

1. Synthesize the theories, documents, and research related to the development of CAR skills in Thailand and other countries.
2. Develop a draft design principle, including all related elements based on the concept of Van den Akker (1999).
3. According to Van den Akker (1999), a design principle must consist of the characteristics of innovations or learning modules, students' results, and arguments.
4. The arguments in the learning modules were composed of substantive and procedural design principles.
5. Adjust the draft design principle by brainstorming ideas about the arguments or the beliefs of the researchers, based on related theories, including the social development, transformative learning, and motivation theories.

6. Develop the six prototype learning modules for enhancing CAR skills. This process took 14 weeks to complete.
7. Verify the appropriateness, content validity, and usage possibility of the prototype of learning modules through brainstorming the ideas among experts in research, learning activity management, and innovative learning media as well as the reflection and discussion about the prototype in order to make it suitable for use in actual situations.

## **Phase 2: Experimental implementation of the prototype**

The results of Phase 1, about the structure, principle, concept, and activities of the prototype CAR learning modules were experimentally evaluated in different contexts within three semesters (18 months). The prototype CAR learning modules were tried out on the third-year students taking the CAR course. The students were divided into experimental and control groups. During the experiment and at the end of each semester, meetings and brainstorming sessions were held among the researchers in order to adjust the prototype learning modules before continuing the experiment in the next semester.

### **Participants**

In the first round (the first semester of the academic year 2016), the prototype learning modules were evaluated during August–December 2016 (4 months) on 17 fourth-year students majoring in early childhood education.

For the second round (second semester of the academic year 2016), the prototype learning modules were evaluated during January–May 2017 (5 months) on two groups of students. The first group was eight fourth-year students majoring in secondary education (science). The second group included five fifth-year students majoring in special education.

In the third round (first semester of the academic year 2017), the prototype learning modules were evaluated on three groups of students. The first group included 27 fourth-year students majoring in primary education. The second group was four fourth-year students majoring in special education. The third group included two fifth-year students majoring in educational psychology.

### **Research Instruments**

In this study, an observation form was mainly used to collect the students' outcomes, comprising their research awareness, attitude towards research, research self-efficacy, and research engagement. The obtained results were used to improve the prototype learning modules. The students' end result of using the prototype learning modules, which was their research knowledge and skills, was examined using a knowledge and performance assessment form (classroom research report). In order to ensure the validity of the research instruments, three research experts were asked to examine the congruence between the content of the research instruments and the predetermined definitions as well as the appropriateness and accuracy of language.

## **Data Analysis**

The quantitative data were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation). The content analysis method was used to analyze the qualitative data.

## **Phase 3: Presentation of the New Design Principle**

The lessons learned from the three evaluation rounds during the academic year 2016–2017 (Phase 2) were synthesized to improve the design principle based on the implementation of learning modules.

## **Developing the New Design Principle**

The results of the three evaluation rounds, the theories and principles used in designing instructional activities and media, and the students' outcomes were used to discuss the effectiveness of applying learning theory and other relevant theories to design learning modules, the problems and obstacles in the implementation, the precautions, the recommendations for teaching and learning management, and the process and outcomes resulting from the implementation of learning modules in each period. This was performed in order to analyze and synthesize the implementation of learning modules in different contexts and present a new design principle according to the design-based research approach.

## **Research Results**

The research results were divided into the three parts of (i) the design principle and prototype CAR learning modules, (ii) the students' outcomes when using the prototype learning modules for enhancing their CAR skills, and (iii) the lessons learned for the presentation of the new design principle of learning modules for enhancing CAR skills.

### **Part 1: Design principle and prototype of learning modules**

The researchers initially developed the design principle and prototype learning modules to try out with different subjects and situations. The details of the drafted design principle and prototype of learning modules are as follows.

### **Drafted design principle and prototype of learning modules**

At the first stage of the development of learning modules, the researchers jointly drafted a design principle according to the concept of Van den Akker (1999), which consisted of the following elements: 1) characteristics of innovation (learning module), 2) students' results, and 3) arguments that were composed of substantive design principles and procedural design principles. The details of the drafted design principle are summarized in Table 1.

Table 1: Drafted design principle of learning modules for classroom action research

	Arguments	Processes
<b>1</b>	<b>Building positive awareness and attitude toward CAR</b>	
	Students will have positive awareness and attitude toward CAR, when they are aware of its benefits and importance.	
	<b>Samples of activities</b> <ul style="list-style-type: none"> <li>▪ Showing examples and outcomes of CAR.</li> <li>▪ Setting common goals.</li> </ul>	<b>Steps</b> <ul style="list-style-type: none"> <li>▪ Let students consider the processes and outcomes of CAR.</li> <li>▪ Analyze and criticize CAR by focusing on key points.</li> <li>▪ Set common goals of conducting CAR in the current and future courses.</li> </ul>
<b>2</b>	<b>Building research self-efficacy</b>	
	Students will develop self-efficacy in CAR when they have opportunities to think about and practice doing research under the guidance of teachers on a continuous basis.	
	<b>Samples of activities</b> <ul style="list-style-type: none"> <li>▪ Investigating and adjusting CAR understandings.</li> <li>▪ Practicing doing a systematic CAR.</li> </ul>	<b>Steps</b> <ul style="list-style-type: none"> <li>▪ Use activities to analyze and adjust CAR understandings.</li> <li>▪ Give students opportunities to determine goals and design CAR on their own.</li> <li>▪ Teachers provide systematic and continuous guidance.</li> </ul>
<b>3</b>	<b>Building research engagement</b>	
	Students will have engagement with CAR, when they get to do research under circumstances that are conducive to problem-solving and continuous development.	
	<b>Samples of activities</b> <ul style="list-style-type: none"> <li>▪ Continuously practicing each step of CAR.</li> </ul>	<b>Steps</b> <ul style="list-style-type: none"> <li>▪ Teachers set up problems and scenarios for students to design CAR procedures that are logically linked to each other.</li> <li>▪ Add more scenarios to make students further develop their CAR design.</li> <li>▪ Teachers provide continuous guidance at every step.</li> </ul>
<b>4</b>	<b>Providing knowledge and skills in conducting research</b>	
	Students will gain knowledge and skills in conducting research and teaching specific sciences when they have opportunities to learn through real experiences that are related to their contexts and interests.	
	<b>Samples of activities</b> <ul style="list-style-type: none"> <li>▪ Continuously practicing each step of CAR.</li> <li>▪ Assigning students to conduct CAR on a topic that is related to their contexts.</li> </ul>	<b>Steps</b> <ul style="list-style-type: none"> <li>▪ Teachers set up problems and scenarios for students to design CAR procedures that are logically linked to each other.</li> <li>▪ Determine CAR topics based on students' contexts and interests. Encourage students to build on existing knowledge through CAR.</li> <li>▪ Teachers provide continuous guidance at every step.</li> </ul>

## Part 2: Students' outcomes on the implementation of the prototype learning modules

The results obtained from the three evaluation rounds in different contexts were synthesized in order to find the students' outcomes and the problems and obstacles in the implementation of the prototype learning modules, which would be used to further improve the learning modules. The results gained through the observation and performance assessment are summarized below.

From the post-teaching reports on the three evaluation rounds, there were many aspects concerning the activities and the usage of the prototypes that needed to be adjusted, such as insufficient implementation time, inconsistency between the students' contexts and the determined plan, and the students' lack of prior knowledge. Thus, many activities were adjusted to be able to enhance the students' knowledge. Moreover, online activities were additionally emphasized in order to fasten the implementation of the prototype among a large group of students and quickly provide feedback to the students. The details of the adjustments are summarized in Table 2.

Table 2: Synthesis of the adjustment of the prototype learning modules after the three rounds of experiments

	Things to be adjusted	Causes	Adjustment
<b>1</b>	<b>Unsatisfied outcomes</b>		
	1.1 Activities that emphasize the connection of ideas.	From the observation of the animation media created by the students, it was found that the students have insufficient abilities to link problems and connect related ideas together.	As the linking of ideas is very important to conducting CAR, the researchers set up questions for the students to brainstorm their answers and create a diagram connecting all related problems.
	1.2 Students' lack of prior knowledge.	Students had misunderstandings about the concept of variables, which led to a problem in determining research variables.	The researchers added crossword games in order to encourage the students to analyze each variable through various hints.
<b>2</b>	<b>Classroom Implementation problems</b>		
	2.1 Adjust the examples and activities in each module to be relevant to the students' field of study.	At the beginning of the development of learning modules, the instructional videos selected by teachers were prepared for use. However, some students were found to have experiences in that area. Thus, the activity was changed to letting the students create their own scenarios.	Let the students reflect on what they have learned about the problems in classroom through animation media.
	2.2 Adjust the activities in each learning module to be more online.	In order to enhance continuous learning, the researchers adjusted the activities in some modules to be more online.	Adjust the activities in the practice of treatment and data collection module and the data analysis and report writing module to be more online.

### Part 3: Lessons learned for the presentation of the design principle of learning modules

The outcome of this research includes both the development of the students' CAR knowledge, skills, and attitude as well as the design principle resulting from the lessons learned during the research process. The details are summarized as follows.

Based on the synthesis of the activities that were adjusted during the three evaluation rounds in different contexts, it was found that the design principle of learning modules for CAR should focus on creating interactions among individuals and between students and activities. All activities should be connected from the beginning to the end and also implemented based on continuous feedback of teachers in order to make the students develop the ability to connect ideas. The design principle should pay attention to creating connections or linkages of knowledge and learning content in each course so as to make the students understand the whole process. In addition, the design principle should place importance on giving the students motivation to conduct CAR, develop purpose-based actions, and recognize that doing research is not an additional burden. Both teachers and students should be encouraged to develop knowledge, creativity, innovative ideas, and problem-solving skills in order to successfully conduct CAR. Relevant media and documents should be prepared and

provided. There should be activities to change the beliefs and understandings of related persons into the same direction. The details of the synthesis are shown in Table 3.

Table 3: Synthesis of the adjusted design principle of learning modules

Existing design principle (before using the learning modules)	Methods	New design principle (before using the learning modules)	Data source				
			1	2	3	4	5
<ul style="list-style-type: none"> <li>Focus on methods or activities that help create interactions between individuals.</li> </ul>	<ul style="list-style-type: none"> <li>Use activities that enhance interactions among students and encourage students to think and perform.</li> </ul>	<ul style="list-style-type: none"> <li>Enhance continuous interaction between students and activities from the beginning to the end in order to develop the ability to connect ideas.</li> <li>Focus on teachers' continuous feedback.</li> </ul>	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>Fulfill a gap between existing learning level and expected learning ability.</li> </ul>	<ul style="list-style-type: none"> <li>Explore prior knowledge in each subject and provide new knowledge through systematic guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Focus on creating connection or linkage of knowledge and learning content for students.</li> </ul>	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>Create motivation for conducting CAR.</li> </ul>	<ul style="list-style-type: none"> <li>Use activities that emphasize the importance and benefits of CAR.</li> </ul>	<ul style="list-style-type: none"> <li>Apart from emphasizing the benefits of CAR, it is necessary to highlight that conducting CAR is not an additional burden.</li> </ul>	✓	✓	✓	✓	
<ul style="list-style-type: none"> <li>Create motivation for conducting CAR.</li> </ul>	<ul style="list-style-type: none"> <li>Organize activities that suit students' interest and encourage students to select a topic that they are interested in.</li> </ul>	<ul style="list-style-type: none"> <li>Support teachers and students to develop knowledge, creativity, innovative ideas, and problem-solving skills in order to successfully conduct CAR.</li> </ul>	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>Design to suit individuals with good attitude toward CAR or those who are interested in conducting CAR but do not know how to start.</li> </ul>	<ul style="list-style-type: none"> <li>Focus on knowledge sharing process.</li> <li>Use activities that not make students afraid of conducting CAR.</li> </ul>	<ul style="list-style-type: none"> <li>In each learning module, relevant media and documents should be prepared and provided to students. Allow students to exchange ideas about the strengths and improvement of activities.</li> </ul>				✓	
<ul style="list-style-type: none"> <li>Change the previous belief that doing CAR is difficult and time consuming.</li> </ul>	<ul style="list-style-type: none"> <li>Change the previous belief that doing CAR is difficult and time consuming.</li> </ul>	<ul style="list-style-type: none"> <li>Change the previous belief that doing CAR is difficult and time consuming.</li> </ul>	✓	✓	✓	✓	✓

Note: 1 = fourth-year students (early childhood education), 2 = fourth-year students (secondary education), 3 = fifth-year students (special education), 4 = fourth-year students (primary education), 5 = fourth-year students (special education).

## **Discussion**

The results of the present study can be summarized in the three parts of the development of learning modules for CAR, the differences between the developed learning modules and other learning modules, and the characteristics of activities in the learning modules for CAR. The details are as follows.

### **Development of Learning Modules for CAR**

The learning modules for CAR, which were developed, tested in different contexts, and adjusted according to the design-based research approach, was composed of the six modules of: (i) introduction to CAR, (ii) problems and variables, (iii) development of research problems, framework, and design, (iv) research procedures, practice of treatment, and data collection, (v) data analysis and report writing, and (vi) discussion, reflection, and treatment adaptation. Each module consisted of activities, objectives, beliefs or theories that were the basis of each activity, learning media, and usage process. This is considered consistent with the main components of learning modules proposed by Richey (2000). Relevant beliefs or theories were used as the basis of activities, such as a group discussion that enhanced interactions among the students and between the students and teachers in order to fulfill the gap between the existing learning ability and expected goals according to the social development theory (Vygotsky, 1978; cited in Khammani, 2002). In addition, when implementing the activities in different contexts, it was found that most activities were similar to the prototype learning modules. However, some examples and discussion topics between the students and teachers needed to be adjusted in accordance with the students' background in order to boost their understanding.

### **Differences between the developed learning modules and other learning modules**

Other learning modules for CAR, which have been published since 2000, mostly focus on providing core knowledge of CAR and adhere to the CAR procedures, starting from identifying problems to adjusting research design, which is basically similar to the developed learning modules. However, the thing that makes the developed learning modules different from other learning modules is that the activities were designed based on the contextual background of students, apart from the relevant beliefs and theories. For example, there was an activity that supported the students to exercise their analytical thinking skills using simulated scenarios in order to motivate the students to have a positive real experience according to motivation theory (Shunck et al., 2008). In addition, unlike other learning modules, the developed learning modules place importance on the students' end result, which includes not only research knowledge and skills but also research awareness, a positive attitude towards research, research self-efficacy, research engagement, and knowledge and skills in teaching.

### **Characteristics of activities in the learning modules for CAR**

Each developed learning module consisted of both offline and online activities. The online activities can be performed to enhance learning beyond the classroom and facilitate knowledge sharing among students and between students and teachers

through diverse programs and applications. Moreover, there are some activities that focus on face-to-face learning and need to be fully conducted offline.

In addition, online activities in the developed learning modules were also a medium for learning and exercising analytical and critical thinking skills with the teachers acting as facilitators of learning. Another highlight of the developed learning modules was the variety of online and offline activities, such as Plicker Coggle Charade and Realtimeboard applications. Therefore, teachers can apply these activities to learning management in a creative and diverse way. This is considered in line with the motivation theory that aims at creating a positive learning atmosphere to enhance the students' self-efficacy.

### **Recommendations**

1. The research results indicated that both the students and teachers could apply the obtained knowledge and skills to their own context. Therefore, the developed learning modules should be further implemented at university and school levels in order to enhance the research skills of students and encourage teachers to continue conducting CAR.
2. The learning modules in this study used contextual background and relevant beliefs as the basis in designing and developing activities. Thus, in order to effectively implement these learning modules, teachers should study the characteristics of each activity, contextual background, and beliefs about the online and offline learning media that are introduced in the learning modules prior to their actual implementation.

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