



Implementing Participatory Action Research as a Tool to Progress Elementary Teacher Science Instruction

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Abstract

According to science education reform in Thailand and the desire to find the way to promote pedagogical self-awareness of elementary science teachers had exposed this study that empowered the teachers in remote area to identify and critically reflect problems and needs they had in their teaching practices. Adequately action research was implemented as systematic inquiry in order to reveal the teaching situations. A spiral step of action research consisted of planning a change, acting and observing teaching process and consequences, and reflecting on the process and consequences. As two school case studies, the action research was participated by members that included five elementary teachers, two school principals, parents and the science educator. Data sources contained documents produced by the teachers and their students, classroom observations, audiotaped records of semi-structure interviews with the teachers and parent, and hand-written records of the school principals' informal interviews. Also, discourse analysis was designed to explore what the teachers personally thought about their teaching practices and then what problems they were aware of, and what they needed to change based on the participations. Results of the research project indicate a movement of the teachers from passive tradition to critical reflection and self-confidence to make alternative teaching practices actively. In addition, the principals, the parent and the science educator as the school community energized the teachers to change. As recommendation of this research project, a teacher training program significantly needs collaboration between teacher and school community. This is for sustainable development of teacher profession.

Keywords: Action research; science teacher; training; teaching; reflection;

1. Introduction

It becomes a critical issue in the educational world that the professional development from the past to the 21st century is progressing slowly. Most components of professional development, such as few-day workshops, seminars, teacher networks, research journals, and school-based programs, all emphasizing teachers' passive learning and transmission of content knowledge, values and beliefs of teaching and learning, do not encourage teachers to improve their teaching practices for their authentic classrooms [6]. Furthermore, individual elementary teachers' experiences during their student life in science classrooms, strongly affect the teachers' beliefs and behaviours in how to teach. Thus, they show teaching behaviours like the way they were taught [1]. Elementary teachers who exhibit limited content knowledge regarding science tend to have negative attitudes relating science as a subject. Consequently, the level of anxiety towards implementing teaching innovations increase [8].

2. Theoretical Framework

Action research is recognized as a special tool for teacher development. Participatory action research (PAR) intends to investigate social realities in order to discover educational practices, especially in classroom teaching that has such unexpected outcomes. PAR allows individual teachers to be researchers and to collaborate with others to make individual and collective changes. Individual teachers are challenged to 1) ask themselves critical questions in problematic situations in their classrooms and clarify the situations when teaching and learning happens, 2) engage in communicative action with other participants to construct and implement plans for changes of teaching practices or solving the problems, 3) collect and analyze data from their actions and observations on the implementations, 4) critically reflect on those changes by individual teachers and the other participants collectively. Finally, the success of PAR depends on whether or not the individual teachers can develop and change their skills, understandings, and conditions of their teaching practices [4], [7].

3. Context of the study

Within the context of science education in Thailand, most elementary teachers have undergraduate experience in non-science majors, but they are expected to be experts specialised in all disciplines,

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not only science but also mathematics, languages, social studies and art. This has overburdened elementary teachers to rapidly obtain enough knowledge and be successful in applying effective classroom teaching practices. As a result, many elementary teachers tend to avoid teaching science at all. In addition, they perceived scientific concepts as knowledge difficult to digest and hard to understand. Experimentation is the only teaching strategy for understanding science. Consequently, many elementary teachers are not confident of teaching science in authentic classroom [5].

4. Methodology

4.1 Research participants

In accordance with the commitment of the university to develop science education in the educational district association of the Lower North of Thailand the university and two remote elementary schools participated in this study. The participants of this research are shown in Table 1.

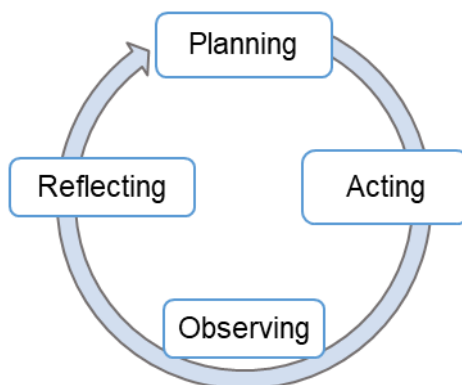
Table 1. Research participants

School	Teachers (T)	Principals (Pr)	Parents (Pa)	University Science educator (USE)
A	T1	Pr1	Pa1	USE1
B	T2, T3, T4, T5	Pr2	Pa2, Pa3, Pa4, Pa5	

4.2 Research design

Four PAR spiral cycles of planning, acting, observing, and reflecting have been operated adaptively to lead elementary teachers to develop and change their science teaching practices. Figure 1 shows a cycle of PAR.

Figure 1. A cycle of PAR



As the first step, the planning was to have the teachers engaged in a process of individual self-reflection and inquiry. Here, the researcher, i.e., the university science educator, persuaded the individual teacher to talk about their own classroom experiences and open communicative space for their deeper critical thought about issues or problematic situations related to teaching and learning in their classrooms, and what they would like to resolve or change. Then, they would write their teaching plan for change.

Second, the acting and observing were meant to encourage and support the individual teacher to be more confident in illustrating their change, alternative teaching practices, by the researcher, the school principal and/or the parents. These research participants observed the individual teachers for an hour in the classroom and provided their feedback on the teaching practices.

Finally, the step of reflecting was to collectively share the opinions offered in the observing step about how to teach science, analyse the teaching process and draw conclusions relating the classroom situations. In this step, semi-structured interviews lasting for half an hour were utilized to guide the reflection. The following are examples of guiding questions: (a) What do you think of the teaching process and consequences? (b) Which activity is good and which one is not good? Why? (c) What



would you like to change for the next teaching plan? How to do so? After that the individual teacher would summarize ideas for the re-planning of the next PAR cycle.

4.3 Data collection and analysis

A month before the PAR cycles started, the researcher conducted informal interviews with individual elementary teachers and the school principals at their schools. Their responses were realized to facilitate their understandings about how to teach science. After that, the PAR cycles were operated once a month in a semester. Data of the classroom observations and semi-structured interviews were transcribed and analysed through a coding process of discourse analysis, and documents were analyzed by content analysis. This study used various triangulations to ensure trustworthiness. For the purpose of this paper, the researcher intended to explore what the elementary teachers changed in 1) their teaching practices, 2) their understanding, and 3) their conditions of the teaching practices.

5. Results

5.1 School A

One elementary teacher (T1), who had 10-year experience in science teaching, and the school principal (Pr1) were able to view the effect of PAR on T1's teaching practices. Changes of T1 covered 1) paying more attention to challenge students to think critically, minds-on, during working on experimentations; 2) using open-ended questions and wait for students' responses; and 3) leading the students to present findings of their experimentations through both discussing and taking notes on the black board. These interactions perhaps allowed the students to be able to advance their scientific conceptions and communication skills particularly in reading and writing. At last, T1 and Pr1 perceived that cycles of PAR encourage the changes.

T1: *According to this research project I've improved many things. I learnt that teaching science should be various. If children have enough opportunities to both discuss and experiment, they will learn...I must prepare myself for them. I will continue this style of teaching.*

Pr1: *...she makes much progress. At first...she tried to say a lot...that...useless...but finally she constructs appropriate questions that lead the students to think critically.*

5.2 School B

In this research project, the researcher gained evidence that the elementary teachers (T2, T3, T4, and T5) developed teacher profession, especially T5, the youngest teacher who had just 5-month experience in science teaching. She changed her way of teaching from the passive to the active approach. Before the PAR cycle started, T5 often used the satellite learning television (TV) to give lecture for students, instead of teaching herself in the classroom. Also, T5 did not consider how to teach science to fit into the teaching plans and curriculum standards. This situation possibly caused the students to develop misconceptions in science. Along with the cycles of PAR, T5 gradually appeared to change her teaching practices. She attempted to inquire more scientific knowledge by searching on the internet and reading books provided by the researcher. Moreover, she consulted T3 (the teachers' group leader who has 20-year experience in science teaching and the ability to integrate Thai language into science) about how to write the teaching plans taking into account the curriculum standards.

Likewise, T2 and T4 composed the teaching plans based on the curriculum standards, and used open questions to increase students' higher order thinking in their science teaching classrooms. Additionally, T2 changed her perception of science teaching from "teaching with experimentation needs special equipment" to "household equipment can be used for science teaching". Interview data also indicated that all teachers and the school principal (Pr2) agreed that the PAR cycles had impact on their teaching preparation. For example:

T3: *...this helps us to be active...and receive more knowledge [about] teaching.*

Pr2: *...continuing the classroom observations enabled my teachers to learn how to construct teaching activities based on the curriculum standards... our meeting each month supported the teachers' sustainable development in science teaching.*



6. Conclusion and discussion

This study explored changes of five elementary teachers' science teaching practices in the classroom, when they had participated in four cycles of a PAR project. Data from classroom observations and interviews indicate that they transformed their prior perception of science teaching and changed their teaching practices, for example by engaging in discussions on experimentation, teaching science by integration with communicative skills or Thai language, using household tools as science equipment, and being more positive in teaching science. The interview results also confirm that PAR is a valuable process for teacher development. After all, the step of individual and collective reflections supports elementary teachers to be aware of self-development [2], [3].

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