PLC model for science teacher development at the basic educational level

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Abstract. This research involves the development of community to improve educational quality standard for Science teachers at the basic education institutions participating in the Chevron Enjoy Science. The aim is to study effective PLC elements contributing to the success of the selected educational models. Methodology included educational research process has been divided into three stages. These included 1) stage one is to study element factors, 2) stage two is to develop and to test PLC model suitable for the targeted PLC program, and 3) stage three is to analyze the effects of using the PLC model. The participants included 27 science teachers, 11 school administrators and 120 students from 11 school models. The research instruments consist of a) PLC Manual, b) Academic Quality Assessment Form, c) Science Classroom Observation Form, d) Model Satisfactory Questionnaires, and e) Science Classroom Management Survey. The content analysis includes both quantitative and qualitative studies; using median (̅X) and S.D. analysis. Findings revealed that the PLC developed the Science Classroom PLC model has been called “ATARE Model.” The ATARE Model represents five different stages including 1) Assessment of Needs (A); 2) Team Sharing (T); 3) Action (A); 4) Reflection (R); and 5) Evaluation (E). The ATARE Model has contributed to the success of science classroom pedagogical practices in the following issues. Firstly, the increase educational quality is in the “very much” response category with the statistical significance is at .05. The model science teachers were able to use the “active learning” strategy in conducting inquiry based scientific pedagogy in classroom through the friendly PLC atmosphere. Secondly, the educational school administrators were satisfied with the PLC model in the “very much” response rate. The students were motivated to learn science in the teamwork manner. Thirdly, students believe that the science teachers were able to create the friendly learning atmosphere for the classrooms.

Keywords: Academic Quality Education, Pedagogical Competency, Professional Learning Community (PLC)

1. Introduction
The Educational Acts emphasizes the reform in basic education curriculum as well as the learning processes to better accommodate the ever changing globalization. The procedure stresses the importance of teacher’s quality development through students centered education [9], [10]. The teacher training is focused on the pro-active professional development tailored made for specific educational area where teachers won’t be pulled away from their schools to attain professional learning skills. The educational decree also mandated the proper professional development strategies
to increase teachers’ qualities and pedagogical competencies. The plan aims for its professional learning sustainability as well as the authentic learning processes and life-long learning endeavors [8], [11].

Professional Learning Community (PLC) is one of the ways Thai Ministry of Education considers to strategize the effective learning plans for Thai teachers and practitioners. PLC activities can be carried out through the coaching team in the field of their residences. The universal best practices conducted for the 21st century education are considered; including the Japanese “Lesson Study,” Shanghai “Lesson Group and Research Group” and Finland “Problem Solving Group” and the Singapore’s model on “Teach Less Learn More.” Particularly, the previous studies reveal that Thai educational status is at the level of unsatisfactory standard. The improvement plan needs to be implemented to increase students’ knowledge, thinking skills, leadership capacity as well as the competencies for ethical and moral mindsets. The critical thinking and reasoning skills of the students need a special improvement. The ONET score in science and mathematics subjects continue to decrease. Thai educational practices will need to be focused on the community based collaboration to maximize the educational quality. The efforts will need to be initiated through the collaboration among the concerned local communities. Thus, the appropriate educational solutions shall be in the form of the bottom up management practice; not from the centralized government controls.

The study focuses on the collaboration among teachers to ensure the standard quality of the lessons plans to be in proper alignment of the national curriculum and academic criteria through the PLC teachers’ development practices. The teachers’ project participants also are the professional STEM academics involved in the Chevron Enjoy Science project. The result of the study is further evaluated to implement quality role model schools.

2. Research Objectives

2.1 To examine pertinent aspects and criteria relating to the Professional Learning Community (PLC) designed for science teachers at the basic education level.

2.2 To develop the quality science academic education for lower secondary school levels through the implementations of the PLC model.

2.3 To examine the effectiveness of PLC program implementation designed to increase the Thai science teachers’ pedagogical practices.

2.4 To establish assessment procedure for PLC method of practice.

3. Research Methodology

The aim is to study effective PLC elements contributing to the success of the selected educational models. Educational research process has been divided into three stages. 1) Stage one is to study element factors involving in the teachers development program. Literacy involved in the program has been collected and analyzed. The process also includes the interviewing sessions with the relevant teacher participants and corresponding educational administrators. 2) Stage two is to develop and to test PLC model suitable for the targeted PLC program. 3) Stage three is to analyze the effects of using the PLC model through assessing the level of educational quality and evaluating science skill competencies. The evaluation process includes satisfactory questionnaires generated to teachers, administrators and students in the PLC science educational development program. This study focuses on Research and Development practices including the four following steps:

Step 1: Factor analysis of the science teachers’ development practices (Research 1: R1). Analyze relevant educational research and theories. Conduct pertinent interviews sessions with teachers and selected school administrators.

Step 2: Model Development (Development 1: D1). Connect the data from R1 to construct PLC model for science teachers’ development practices.
Step 3: Implement D2 Model Experimentation to see the how the constructive activities actually work to improve the science teachers’ development practices.

Step 4: Adjust Research 2: R2 model through PLC focused group discussions.

4. Scope of Research Participants:

4.1 Research participants include science teachers in the Thai public schools in Songkhla province joining the Chevron Enjoy Science project during the second part of the academic year 2019. The total number of schools participating in the research is 57.

4.2 Research samplings are collected from the total of eleven science teachers participating in the Chevron Enjoy Science during the second academic semester of 2019. The names of the schools participated in research process includes: Thessaban 5 Wathuapomnok School, Bahn Nernmit School, Bahnbangrieng School, Khandoanwitaya School, Patongpatankiriwat School, Janachoopatham School, Mahawachirawat School, Mattayomsirirawan School, Ranotwittaya School, Sadaokanchaikamplananusorn School and Kampangwittaya School.

5. Scope of the Research Variables:

5.1 Independent variables includes PLC model that the researcher has constructed to improve the quality of the Thai science teachers.

5.2 Dependent variables includes the effectiveness of the PLC program implementation factors pertaining:

5.2.1 The educational quality of the selected model schools.
- Level of educational leadership skills of the school principles.
- Science curriculum used.
- Nature of team work and collaboration practices in schools.
- Organization culture of the school.
- Teachers’ development practices.
- Students learning behaviors.

5.2.2 Science teachers pedagogical skills.

5.2.3 Classroom learning atmosphere.

5.2.4 The level of satisfactory of the science teachers and educational administrators in the use of the PLC model.

6. Conclusion and Discussions:

The success factor for PLC includes five elements: a.) Shared development value b.) Teamwork c.) Work scope and determination d.) Teacher’s development process and e.) Assessment and evaluation. Particularly, there are four (4) PLC model processes: a.) Model structure and goals determination b.) Developmental model c.) Condition of use and application and d.) Direct and indirect program evaluation process.

Predominantly, the quality of the PLC model development to improve the educational standard through the Professional Learning Community (PLC) must generate five critical factors namely; 1) Strategic Leadership 2) Teamwork 3) Work scope 4) Teachers Development Practices 5) Development Evaluation.

1) Strategic leadership in learning and teaching development procedure is one critical aspect in improving professional quality standard for science teachers and the school’s administrators. The process needs to be collaboratively organized with the mutual consensus on the final academic decision made in regards to the school improvement initiatives. The teacher development practices need to be systematically managed in accordance to the establishment’s goals and visions. This is in accordance with the study result found that stating the educational management and quality assurance practices need to be managed accordingly. [2]. The pertinent skills schools’ leaders must possess.
include the wise policy decision making as well as constructing the visions and goals for the schools as well as providing effective professional training programs for teachers and relevant educational staff.

2) Teamwork is critical for teacher to work effectively in the PLC model. Teacher must consistently develop their knowledge and pedagogical practices. One of the best ways is to schedule the time to consult with their academic and professional colleagues to ensure the efficiency of the needed professional development strategies. Academic team could also be generated the growth mindset professional development atmosphere. The knowledge sharing can result in the best pedagogical improvement practices. The teamwork could become the new paradigm shift in creating the culture of professionals within the educational institutions. The team must come with the open-hearts and the readiness to listen and work things out together to solve problems in schools; particularly in area of improving the outcome of students’ academic learning achievement.

3) The scope of the quality of the academic development practice needs to be in alignment with the students’ learning goals and the overall schools’ standard curriculum [4]. Particularly, assessment factors have a direct contribution to the quality education standard. PLC Teacher training practices need to be systematically organized and consistently reveal teachers’ classroom practices issues and pedagogical reflections.

4) Teachers development practices are designed to improve the quality academic standard which leads to the success of the educational institutions. Deming’s PDCA should be considered in implementing the cycle of quality assurance control. Members of the educational establishment need to manage the Plan, Do, Check, Act processing collaboratively. The standard measurement needs to be systematically operated and the improvement plans need to be consistently [6]. Every part of the team members must be empowered to join in the school’s administration initiatives.

5) Development evaluation is needed for program evaluation for further continual pedagogical improvement. Ongoing professional self-reflection and PLC program improvement processes can be generated through PLC consultation sessions. The revision of the lesson plan must be regularly evaluated and revaluated to adjust learning activities to meet the students’ ongoing academic needs. The bottom up work evaluation process is called for among the academic team to ensure the quality of learning outcome for the students target [1].

The five aforementioned methods generated the desired PLC model for the selected 11 school. Specifically, the name of the Science Classroom PLC model for the study is called “ATARE Model.” The model is designed to develop science teachers’ pedagogical competency in five different stages. Stage one is to determine Assessment of Needs: A; Stage two is Team Sharing: T; Stage three is Action: A; Stage 4 is Reflection: R; and Stage 5 is Evaluation: E

Stage 1: Assessment of Needs: A
Stage 2: Team sharing: T
Stage 3: Action: A
Stage 4: Reflection: R
Stage 5: Evaluation: E

Stage one is to analyze the need assessment. This is the most important step to determine the scope of work and PLC program implementation processing activities. The activities will be in correspondence with the educational needs that the PLC team must together evaluate. Science teachers must reflect on the need awareness and evaluation to determine specific goals and further implementation plans.

Stage two includes the element for teamwork and sharing sessions. Science teachers must join together in the PLC lesson study to design pedagogical work-plan that would best fit the needs of the students and in accordance with the required curriculum. The sharing session among the team member is critical to ensure success for the overall educational plans and academic management vision [7].
Stage three involves the actual action that would need to take place in accordance to the consensus strategies. The third step requires the science open-classroom sessions where PLC academic team must join and take action on the classroom research. PLC members will schedule the time and place where the open-class shall be organized. The lesson plans are evaluated by the action team in advance to further consult in details before classroom implementation. Once the science open-classroom has been generated, the team shall return to reevaluate the learning outcome of the students and implement further action plan to correct and fill in the learning gaps. The action research conducts through the PLC strategies will deepening the quality of the achievement evaluation processes [5].

Stage four specifies the needs for the process of feedback and reflection. The reflection process aims at the improvement of the science teachers pedagogical practices. The reflection must begin with the science teachers and then consult together with the PLC team and mentors for further lesson plan adjustments processes. Teachers must reflect on the students’ individual work and classroom management as a whole to determine the level of the learners’ achievement through the planned PLC activities. As Murphy and Timmie [5] confirmed that the pedagogical reflection processes must first derived from the teachers themselves and then further evaluated with the team to find possible solutions for further classroom development plans and strategies.

Stage five includes the evaluation process of the overall PLC academic success. The step involves ways to evaluate whether the action plan has been generated as planned and to determine the extent through which the goals have been realized. DuFour et al [3] has emphasized the fact that the heart of the PLC success is whether or not it has ultimately served the students learning needs.

Altogether, ATARE Model has contributed to the success of science classroom pedagogical practices per the following details: a) the increase educational quality is in the “very much” statistical level. b) The model science teachers were able to use the “active learning” strategy in conducting inquiry based scientific pedagogy in the classroom through the friendly PLC atmosphere. The students were motivated to learn science in the teamwork manner. Students believe that the science teachers were able to create the friendly learning atmosphere for the classrooms. Students were able to discuss science experimentation with the ability to accurately structure scientific knowledge. Moreover, the schools administrators are “very much” satisfied with the PLC model used. The school leaders plan to integrate the constructed PLC model to improve the learning standard of the classrooms in other subject areas. Educational administrators realize ways to encourage and motivate PLC activities in the school to solve students learning problems. The administrators generate a consistent monitoring and follow-up schedule to further inspire and encourage the joint spirit of PLC collaborative practices.

In conclusion, the study has generated an ATARE model which has greatly contributed to the quality development of the Thai science teachers in the target school areas. The ATARE PLC model has significantly increased competency for the selected Chevron Enjoy Science teacher professionals; and in turn contribute to the increase of the fulfillment of the students learning needs in accordance to the scope of national quality development plans.

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