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Applying Program Theory-Driven Approach to Design and Evaluate a Teacher Professional Development Program

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Abstract
This study was the first year of a two-year project which applied a program theory-driven approach to evaluating the impact of teachers' professional development interventions on students' learning by using a mix of methods, qualitative inquiry, and quasi-experimental design. The current study was to show the results of using the method of theory-driven approach to program planning to design and evaluate a teachers' professional development program (TPDP). The Manabu Sato's learning community theory was applied to structure all components of a 54-hour workshop. The participants consisted of seven secondary school science teachers from two schools. The major findings indicated that program design was suitable to participants. More than 70% of the participants were satisfied with program implementation. They revealed that TPDP was beneficial to their instruction and promoted their professional capacities. The TPDP had marked impacts on participants' teaching beliefs, knowledge, and skills were promoted by the program.
Keywords: Program theory-driven approach, Learning community, Teacher professional development program, Program evaluation

1. Introduction

Manabu Sato, Japanese Scholar, has advocated applying the Learning Community (LC) approach in educational field. Since three decades ago, LC approach has been implemented by more than three thousand primary and secondary schools and has set off the changes in the Japanese fundamental education. Using LC approach in Japan was part of schools' autonomic reform movement, so it was called as "Quiet Revolution". Manabu Sato initiated the LC because he observed schooling phenomenon: schools' assessment system encouraged individual competition and test scores; teachers' teaching emphasized on memorizing instead of practicing; students were isolated and didn't have much interaction with peers in learning activities. Besides, the students didn't understand the meaning and values of the learning and lost the learning motivation and interests, some, even, gave up studies (Sato, 2013; Huang, 2013a). In order to overcome the crisis of the students' "escape from learning", Manabu Sato thought that schooling should be changed and proclaimed that learning is a sustainable process of "constantly weaving the relationship and the significance" which constructs the world by meeting and having dialogues with subjects, builds the companions by meeting and having dialogues with other people, and builds self by meeting and having a dialogue with oneself (Sato, 2012).

For a long time, the junior high school education in Taiwan has been impacted by the Credentialism. In order to meet requirements of entrance examinations, junior high schoolers have to stay in school late to do more practices including a lot of repeating, reciting, and memorizing learning, which make them lack learning motivations. Peers' interaction, exploratory, corporative and reflective learnings in the class are also limited (Pan, 2013). Therefore if the Taiwanese junior high schools would want to promote students' learning motivation, it is necessary to change current schooling educational practices. As Manabu Sato claimed, it is very important for students to have dialogues with learning materials, with peers, and with themselves to promote continuous meaningful learning. This process is also the spirit of LC. Originally, many fundamental schools in Japan encountered the problems of students' giving up learning. After they applied LC approach in classroom teaching, the students enjoyed their learning. Along with the long period of implementation, students in those schools enhanced their learning capabilities, enjoyed learning, and reached higher academic achievement (Sato, 2012). It is obvious that LC has been implemented very successfully in Japan.

Besides, LC emphasizes that teachers are no longer the center of transmitting knowledge. Instead, they are knowledge media, education specialists, and learning experts. Classroom should be open to other teachers for teaching observation. Teachers should learn from each other and should build a support network together. By constant reflection on their teaching practice, it would promote teachers' professional development (Sato, 2012, 2013a). If Manabu Sato's LC approach could improve the phenomenon of students' giving up learning in Japan,

is it suitable to be applied in Taiwan? Will LC improve students' learning problems and enhance students' learning quality? Will LC promote teacher's professional development?

Physical Sciences (Physics and Chemistry, taken as one subject in Junior High School in Taiwan) have been regarded as important subjects in the schooling. Students would learn patience, carefulness, logical reasoning, and problem resolution from the scientific inquiry. However, to most of junior high school students, these are difficult subjects to learn. They easily feel frustrated in the learning process, so it's very important to make these subjects more interesting. According to Manabu Sato(2012, 2013a), applying LC approach would train students' abilities in observing, questioning, planning, experimenting, concluding, judging, and problem solving.
Therefore, this project applied Manabu Sato's LC approach to teach Physics and Chemistry subject in junior high schools.

This is a two-year project which applied a program theory-driven approach to evaluate the impact of teachers' professional development interventions on students' learning used a mix of methods, qualitative inquiry and quasi-experimental design. Participants include both Physics and Chemistry teachers and their students. The current study examines the first year, focusing on investigating how theory-driven approach has been applied to planning and evaluating the teachers' professional development program (TPDP).

2. Literature review

2.1Manabu Sato's Perspectives of LC

A specialist in curriculum reform, Manabu Sato, points out that LC is a paradigm shift for teaching and learning. While traditional paradigm focuses on how teachers teach, LC put more attention to how students learn. The nature of learning is a "sustainable process of constantly weaving the relationship and meanings". The teachers have to provide the guidance to the students so they would improve the learning qualities in sharing experiences, dialectics, and connections of their lives (Sato, 2013a). He thinks the goal of education reform cannot be reached by reducing the learning contents or relieving the exam stress. The priority is to make sure the students understand the relevance and value of learning, and not to leave any students behind (Sato, 2012).

The teachers are the "media" of the knowledge. They are "Educational Specialists" as well as "Learning Experts". They must leave the classroom door open so that the other teachers can watch the class, learn from each other, build up supportive network, reflect on practice which could promote the teacher professional development (Sato, 2012). Manabu Sato (2013a) suggests three steps to operate teachers' professional LC. First, prepare the teaching materials together before lesson starts. Discuss and share teaching material analysis, teaching strategies, assessment, and feedback sheets based on students' learning advantages and disadvantages. For the second step, observe classroom teaching together. The purpose of teaching observation is not to criticize how well the teachers teach but to understand how the students learn. For example, in which condition the students learn successfully? What kind of learning barriers students encounter? How else can teachers guide students to learn deeply? Last but not the least, discuss class together after teaching observation. Discuss the following issues, such as "Does the learning happen on the students in the class?"; "What are the difficulties and successes in learning?" In the learning process, the teachers must base on their understanding of students' diversity and individual traits, and learning pace to develop teaching materials and instructional philosophy. Therefore, at the classroom teaching meeting, don't provide any appraisals, make any judgments, or suggest on those good and bad in the classes, but learn from each other based on what happened in the classes.

Manabu Sato (2013b) encourages the teachers to initiate revisions of their instructional strategies and totally change their own logic of teaching material design. They no longer think of how to teach, but consider what key concepts the teaching units must have, and how the students can learn and understand those concepts. Sato proposes three key factors when the teacher designs and implements collaborative learning (Sato, 2013a). First is authentic learning where students meet the nature and learning spirit of discipline in which the teacher should determine which dialogue is suitable based on the field of learning. For example, it is more important to have the dialogues with the teaching materials than to have discussions with the peers when students learn in reading class. It focuses on the dialogues with the teaching material (return to textbooks) and uses it as the learning center in those classes. However, it is more important to observe, establish assumptions, and test verification in the sciences class. Therefore, it takes inquiry learning, understanding, and building up the theories through observations and experiments (Sato, 2013a). The second is building learning relationship. The purpose of learning among the students is to improve active "listening" instead of "publishing speeches" to each other. The third is the extensive learning. Every student must master "core concepts" and use them as the foundation to challenge the extensive learning materials. In addition, Sato (2013a) also mentions about the technical issues of the collaborative learning, such as how to group, arrange seats, design discussion guideline, make students proactively preview the classes, and etc.

2.2. Theory-Driven Evaluation

Social scientists usually define "theory" as a set of interrelated propositions that explain and predict a phenomenon,

which is related to descriptive theory (Chen, 1990; Kerlinger, 1986; Lave & March, 1975). Program theory is basically descriptive, aiming at describing or explaining facts and relationships. For example, Lipsey(1987)defines program theory as "a set of propositions regarding what goes on in the black box during the transformation of input into output; that is, how, via treatment inputs, a bad situation is transformed into a better one"(p.7). However, Chen (1990) indicates that descriptive theory is not the only type of theory related to program evaluation. Another type of theory is prescriptive theory, which may be relevant to program evaluation. Prescriptive theory suggests what ought to be done or how to do something better (Chen, 1990). Because program evaluation entails not only describing what the program is but also suggesting what should be done, program theory needs to combine prescriptive theory and descriptive theory. Chen (1990) further submits three approaches to construct program theory including stakeholder approach, social science approach, as well as integrative approaches. Donaldson (2001, 2007) has described four potential sources of program theory including prior theory and research, implicit theories of those close to the program, observations of the program in operation, and exploratory research to test critical assumptions in regard to a presumed program theory.

Theory-driven evaluation which is based on program theory is defined as the systematic application of social research procedures in assessing conceptualization and design, implementation, and utility of social intervention programs (Rossi & Freeman, 1985). Theory-driven evaluation involves the construction of a detailed program theory that is then used to guide the evaluation (Alkin & Christie, 2004). Program theory in evaluation is formulated in many different ways and applied for a variety of purposes. Program theory in evaluation can be developed before a program is implemented or after the program has been running for some time (Astbury & Leeuw, 2010). Lipsey (1993) identified six elements of a program theory consisting of problem definition, mediating processes, expected output, exogenous factors, critical inputs, and implementation issues. Identifying the elements of a program theory is an important step. It guides the design and conduct of an evaluation study in terms of delimiting the target population who would benefit from the services offered by the program, developing procedures that guide the program operations and monitoring, and selecting the concepts or variables to be measured and the timing or occasions for their measurement (Shadish et al., 1991).

The purposes of the program theory-driven evaluation are thus to answer causal questions about a program, to explain how it works, and to provide recommendations for improvement. Based on normative theory and causative theory, Chen (1990) suggests six basic types of theory-driven evaluation: (1) normative treatment,(2) normative implementation environment, (3) normative outcome, (4) impact, (5) intervening mechanism, and (6) generation. Theory-driven program evaluation is a comprehensive approach which involves three general steps including developing program theory, formulating and prioritizing evaluation questions, and answering evaluation questions (Donaldson, 2007). Based on the program theory, an evaluator can explicate or test the following: (a) the size of the program effect, (b) the program outcomes that yield the largest as well as the smallest effects, (c) the consistency of effects across subgroups, models, and analyses, (d) the causal mechanisms or pathways through which the estimated effects are manifested, and (e) the factors that may influence selection into the program and implementation quality. Thus, a major assumption of this approach is that causal inference is strengthened if the empirical patterns of results are consistent with the program theory and hypotheses about the effects (Reynolds, 1998).

2. 3. Logical model

Logic models have proliferated over the past several decades through their use in the planning and evaluation of various types of programs. Logic modeling is an adaptable tool that is used across theories of evaluation practice. Furthermore, logic modeling is not only used to develop program theory. It is often used to map out other program activities such as allocation of funds, management strategies, information systems, marketing and publicity, staff recruitment, and the like (Funnell, 1997). One early proponent of program theory, Weiss (1972) recommends using path diagrams to model the sequence of steps between a program's intervention and the desired outcomes. This kind of causal model helps the evaluator identify the variables to include in the evaluation, discover where in the chain of events the sequence breaks down, and stay attuned to changes in program implementation that may affect the pattern depicted in the model (Weiss, 1972).

The logic model displays these statements in a simple flow chart that outlines the needed resources, intended activities, expected outputs, and desired outcomes. According to Millar, Simeone, and Carnevale (2001), logic models are useful to any person trying to plan, manage, account for, audit, evaluate, or explain the connections between what a program requests in terms of resources and what it seeks to accomplish. Thus, the logic model can act as a tool to guide program design and development at many levels. Therefore, this project serves a logical model to design, implement, and evaluate TPDP.

3. Methodology

The participants consisted of seven secondary school science teachers from two schools. Data was collected from a number of different sources, including TPDP checklist, activity responses of workshop, teachers' e-portfolio,

course design documents, and teachers' belief survey. The research procedure was comprised of: 1)Constructing logical model of whole Program framework; 2) Establishing logical model of TPDP framework; 3) Designing workshops; 4) constructing logical model of SDPP framework; 5) Establishing logical model of TPDP framework; 6) Designing evaluation questions; 7) Implementing and evaluating TPDP, which were presented as follows.

3.1. Defining the problems and participants' need

For a long time, the junior high school education in Taiwan has been burdened by entrance examinations. Students have to stay in school late to practice more reciting learning. In the class, peers' interaction, exploratory, corporative and reflective learnings are also limited. Students lack learning motivations in many subjects, including Physics and Chemistry (Physical Sciences). In order to improve students' learning problems, the teachers should change their teaching strategies through attending TPDP. TPDP intervention for the short-term outcome expects to change teachers' teaching beliefs and strategies and for the mid-term outcome to impact the students' learning behaviors and motivations.

3.2. Establishing logical model of TPDP framework

Based on the above, the current study developed the logical model of TPDP framework (see fig. 1) consisted of 5 elements including theory sources, components, activities, factors, and outputs. Details are provided below:

3.2.1 Theory sources

Four potential sources of program theory include Manabu Sato's LC theory and research, implicit theories of those close to the LC program, observations of the LC program in operation, and exploratory research to test critical assumptions in regard to an LC presumed program.

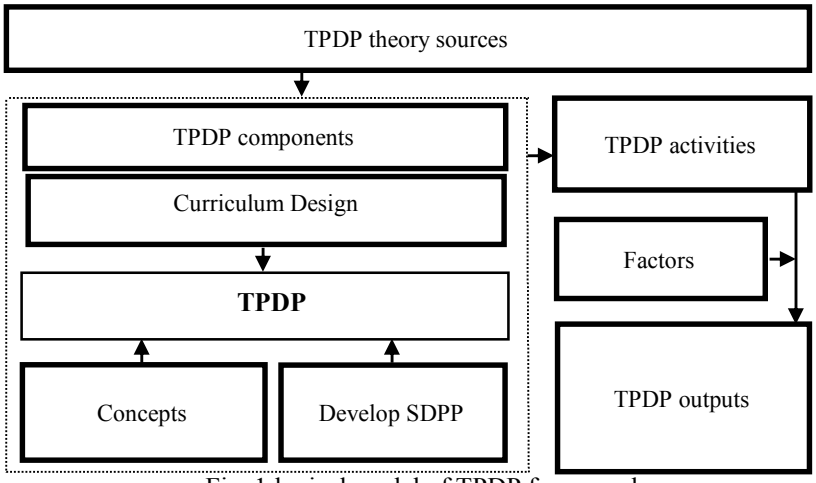

Fig. 1 logical model of TPDP framework

3.2.2 TPDP component

TPDP consisted of three parties: LC core concepts, the principles of LC curriculum design, as well as development of SDDP

3.2.3 TPDP activities

TPDP activities include the cross operation of "Inter-school PLC" (professional development community) and "Intra-school PLC". In the first year, participants attended three-hours "Inter-school PLC" twice a month. It majorly included various activities, such as seminars, lectures, self-directed learning, professional dialogues, course design, and etc. "Intra-school PLC" will be held in the second year during experimental teaching. It will include three major activities, preparing the teaching materials together, observing classroom teaching together, discussing class together after teaching observation.

3.2.4 TPDP Outputs

In the first year, the TPDP expected outputs included strengthening teachers' core concepts of LC, increasing abilities to develop SDPP properly based on Sato's LC theory.

3.2.5 TPDP External Factors

Those influences of TPDP included participants' background, environment contexts of implementing program, Pros and Cons of the program itself, as well as what extent of program implementation, required time and resources.

3.3. Design TPDP workshops

The current study based on the logical model of TPDP framework designed a 54-hour workshop. Times, topic,

and activity of TPDP are shown in Table 1.

Table 1 Theme and activity of TPDP

Times	Theme	Activity
1-2	Reflection on the problems of Schooling	Professional dialogues
3-4	The Core Concepts of LC	Self-directed learning, films , professional dialogues
5-6	Share the practices of LC	Practitioners share their experiences, professional dialogues
7-8	The concepts of curriculum design and instruction related to LC	seminars, experiences share, case study, and professional dialogues
9-10	The concepts of applying LC principles on teaching units design	self-oriented learning, case study, and professional dialogues
11-12	Design LC teaching units	curriculum design and professional dialogues
13-14	Assess the appropriateness of LC units	Presentation, professional dialogues
15-18	Develop SDPP program	Develop 3 to 5 experimental teaching units through curriculum development

The participants consisted of seven secondary school science teachers, 4 male and 3 female, from two schools. TPDP was conducted by PLC approach including various activities such as seminars, self-directed learning, professional dialogues, course design, and etc. However, these activities were balanced with workshops that were not lecture based but constructivist designed and offered teachers opportunities to interact through group work by discussion and hands on experience with LC curriculum design.

3.4. Based on logical model of the framework develop SDPP

In final part of TPDP, participants developed SDPP based on the logical model of the framework. Therefore, the study constructed the logical model of SDPP framework (see fig.2) before program implementation. SDPP consisted of the following elements, such as principles, sources, components, activities, factors and expected outputs. The details are as follows:

3.4.1 SDPP Principles

The core concepts of curriculum design include the dialogue with teaching materials, the dialogue with the peers, and the dialogue with oneself.

3.4.2 SDPP Components

SDPP components majorly include three kinds of learning activities, learning by doing, collaborative learning, and reflective learning. Learning by doing refers to activities of exploration, explanation, induction, assumption, verification, and knowledge construction. Collaborative Learning refers to grouping students. Each group learns to listen to each other, to discuss with peers, and to construct knowledge during peer' sharing their opinions aside from cooperating with peers during doing individual assignments and extensive learning. Reflective Learning refers to activities of questioning the teaching materials, reflecting on the processes of learning experiences, and clarifying confusing concepts.

3.4.3 SDPP Activities

SDPP activities will include lesson previews, experimental operation, discussion among the peers, filling out the worksheets, providing reflection and feedback, and activity records.

3.4.4 SDPP Outputs

The expected outputs will include changing students' learning style, promoting academic achievements in Chemistry and Physics, enhancing learning motivation in the said subjects, improving interpersonal relationships, and critical thinking skills.

3.4.5 External Factors

The potential external factors may include experimental units and content, teachers' professional ability, teaching time and resources, resource allocation, assessment methods and tools, and parents attitude, etc.

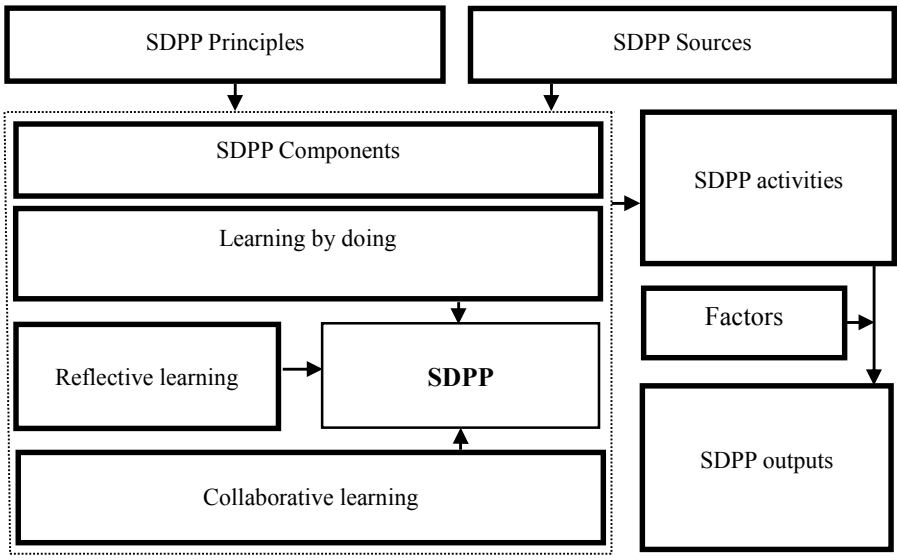

Fig. 2 logical model of SDPP framework

3.5. Constructing logical Model of TPDP theory-driven evaluation framework

The logical model of TPDP Theory-Driven Evaluation Framework (see fig. 3) included environmental context, evaluation purposes, evaluation contents, evaluation tools and information resources. See explanation below:

3.5.1 Environment Contexts

For a long time, Taiwanese junior high schooling has been impacted by the Credentialism, and has emphasized on reciting and memorizing rather than exercising. Peer interactions, explorative, cooperative, and reflective learning activities are also limited. Besides, the Chemistry and Physic science is regarded as a difficult subject in junior high schools. Most of students lacked the learning motivation to learn the subject. In order to resolve above problems, in first year this project design the programs, TPDP to help science teachers to do pedagogy shift.

3.5.2 Purposes of TPDP evaluation

TPDP evaluation is to answer causal questions about a program; to explain how it works; and to provide recommendations for improvement. TPDP in this study focused on assessing the following aspects: program design, program implementation, outcomes, impacts and external factors.

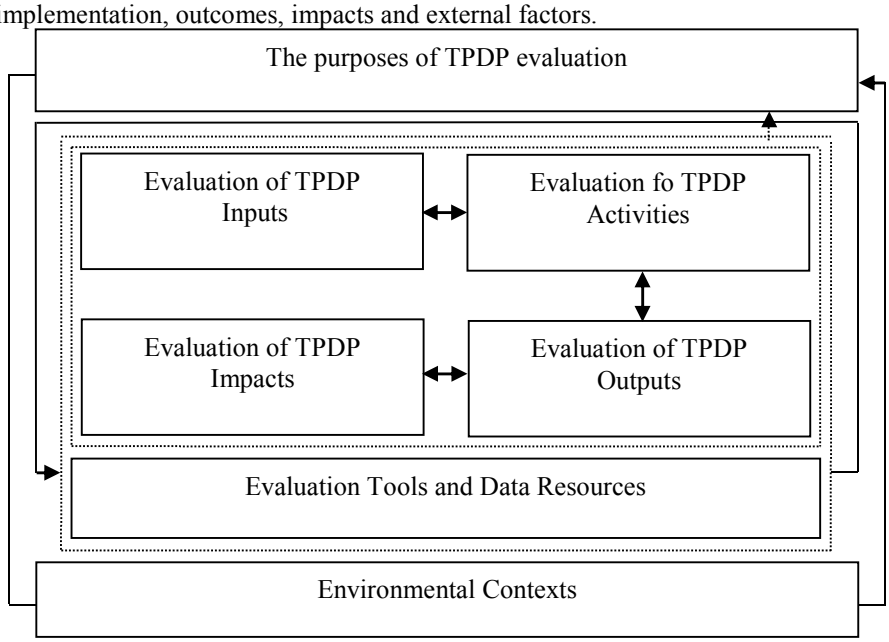

Fig. 3 logical model of TPDP framework

3.5.3 PTDE dimensions

The evaluations included the input, activities, outputs, impacts, and evaluation topics of TLCP and SDPP. The details are described below: (1) Inputs and Evaluation: TPDP inputs include building up study team, design and involvement on the program, operation of the Inter-School PLC organization, holding seminars, establishing Information platform, and etc. The input evaluation is to evaluate the relevance of TLCP design. (2) Activities and Evaluation: TPDP activities include self-oriented learning, teaching observation, professional dialogues, development e-portfolios discussion, experience sharing, watching videos, curriculum development, experimental teaching, preparing class, teaching records as well as case studies. The activity evaluation includes teachers' reaction, analyzing the successful and challenging factors of the activities. (3)Outputs and Evaluation: The TPDP expected outputs consist of the extent of change of participants' LC belief, knowledges and skills, and the abilities of LC program design, SDPP. (4) Impact and Evaluation: The TPDP expected impact to change teacher-center pedagogy into student-center pedagogy. (5) Evaluation Tools and Data Resources: TPDP evaluation applied the following tools to collect data, such as TPDP checklist, activity responses of workshop, teachers' e-portfolio, course design documents, and teachers' belief survey.

3.6. Design evaluation questions

Based on logical model of TPDP theory-driven evaluation framework, the current study designed the evaluation questions shown as Table 2.

Table 2 the stages, focuses and questions of TPDP Evaluation

Stages	focuses	questions
Inputs	Evaluate the pertinence of the plans	Are topics of the plan adequate? Are the frequencies, length and types of the activities proper? What kind of pertinence is it between the planned topics and activity patterns? What relationship is it between expected results and planned topics? What relevance is it between expected results and planned activities?
Activities	Evaluate the reaction of Inter-School PLC and Intra-School PLC operations	What feedbacks do the teacher participants have for the activity contents? What are the process reactions? What kind of reaction to the environments? Any suggestions? What are the factors which cause the successes and challenges?
Outcome	Evaluate the learned knowledge from the learning community and the pertinence of SDPP plans	What core concepts do the teachers learn from the learning community program? What key elements of the curriculum design? What are the teaching tactics? What kind of situation is it in the implementation of learning community principle design teaching units? What kind of situation does the revised lesson plan get from the outcomes of the exploratory teaching? What is the pertinence of developed SDPP?
Impacts	Evaluate changing status of the teacher participants' principles, knowledge and skills	What changes do the teacher participants have in the principles? What changes do the teacher participants have in the knowledge? What changes do the teacher participants have in the skills?

3.7. Implement and evaluate TPDP

In order to improve the teacher participants' practical profession skill in LC, TPDP applied "Inter-School PLC mode" to execute interventions in the first year. First, this program focused on how to raise the awareness of the teacher self-role, review the core subjects of education qualities as well as the meaning and values of learning through and sharing teaching practices and professional dialogues. Second, this program enriched the teachers' knowledge through seminars, professional dialogues, case study, and self-directed learning; which would make the teachers more familiar to the tactics of asking questions, listening, conversations, thinking, and designing basic and extended curriculum. It will benefit to teachers in guiding the students into a deeper leaning based on the SDPP study in next year experimental teaching.

In the final part of TPDP the participants collaboratively designed SDPP based on three kinds of dialogues (to materials, to peers, to self) through experiential learning, collaborative Learning, and reflective Learning. The steps of SDPP design are: 1.Creating experimental units. 2. Reviewing and modify experimental units based on pilot study. 3. Developing complete structure of SDPP that consists of 3 to 5 experimental teaching units for each semester. The experimental teaching will continue one school year, two semesters.

During the period of program implementation, the authors based on evaluation questions applied several tools to collect data in order to assess results and impacts of the program.

4. Results

During the program implementation period, in order to evaluate the program the researchers continually collected the data by using program design checklist, activity responses of workshop, teachers' e-portfolio, course design documents, and teachers' belief survey.

4.1 TPDP design evaluation

The participants provided the evaluation and recommendations based on the questions of Checklist. The result shown in Table 3 indicated that program design was appropriate to participants. More than 70% of them agreed with the suitability of the program. Nearly 30% agreed that program design was strongly suitable.

Table 3: Summary of the evaluative result of TPDP design (N=7)

Check List	SU %	U %	S %	SS %
1. Are the topics suitable?	0	0	71.5	28.5
2. Are the frequencies of the activities suitable?	0	0	71.5	28.5
3. Is the duration of the activities suitable?	0	0	71.5	28.5
4. Is their conformity between the topics and activities?	0	0	85.8	14.2
5. Is there relevance between expected results and topics?	0	0	71.5	28.5
6. Is the relevance between expected results and activities adequate?	0	0	71.5	28.5
7. Other recommendations: Build up a web site to share the learning archives of each teacher. The program is well designed; it is recommended to invite the instructors who have teaching experience to attend the monograph seminars in the future. The videos related to this program can be used as the teaching materials.				

Notes: SU=strongly unsuitable, U=unsuitable, S=suitable, SS=strongly suitable

4.2 TPDP implementation evaluation

Participants were asked to fill out the activity survey which consisted of four dimension questions including topic, activity, content, and professional development after each workshop. The result of program activity satisfaction analysis was shown in Table 4.

Table 4 Result of the TPDP satisfaction analysis (N=7)

dimension	SU (%)	U (%)	N(%)	S(%)	SS(%)
topic	0	0	42.8	0	57.2
activity	0	0	28.5	0	71.5
content	0	0	28.5	14.2	57.3
Professional development	0	0	0	14.2	85.8

Notes: SU=Strongly Unsatisfied, U= Unsatisfied, N= Normal, S= Satisfied, SS=Strongly Satisfied

With exception of closed-ended questions, activity survey also included open-ended questions related to what the participants learned the most or what impressed them the most in the activity. Most of the participants provided very positive feedbacks on how those activities were handled. For examples:

> "The most important thing that I learned from the workshop this week is that a teacher should not be afraid of change and should continuously reflect on his/her own teaching belief and practices" (Teacher Lee's Activity response 1)
>
> "From the workshop this week, I am very impressed by the instructor's LC teaching strategies which bring me professional growth and improve my teaching in the class." (Teacher Lee's Activity response 3)
>
> "The most important thing that I learned from the workshops this week is understanding core concepts of LC. I'm a great believer in the benefits of this teaching approach. " (Teacher Huang's Activity response 2)
>
> "From the video we watched in this week's workshop, the best thing I learned is how to effectively build up the knowledge construction through collaborative learning. This teaching experience greatly benefits me and provides me a lot of thoughts and patterns in teaching design." (Teacher Liao's Activity response 2)
>
> "From this week workshop, the most impressive part is that the instructor designed wonderful questions, which were able to guide students engaging themselves in discussions. It helps me to think of how to improve my curriculum design." (Teacher Wu's Activity response 2)

> "In curriculum design workshop, the most impressive thing is the grouping process. It is important to collaborative learning activities, because it is a key factor of bringing peers' dialogues. It is better to have 4 students in one group, which is suggested by Sato." (Teacher Ho's Activity response 2)

More than 70% of the participants were satisfied with program content. 100% of them pointed out that TPDP bring them professional development. They attested that TPDP was beneficial to their instruction and promoted their professional capacities. However, more than 40% of them thought that the program topics were common. However, due to heavy teaching loadings during the project a participant was unable to attend all workshops. To resolve this problem, the authors provided her options by watching DVD or reading articles offered by the research team.

4.3 TPDP outcome and impact evaluation

4.3.1 Teachers' change of teaching belief

Teacher Belief Scale (TBS) was administered to measure teachers' teaching belief change in order to assess the impact of TPDP. TBS consisted of 3 dimension questions including curriculum design (9 items), teaching and assessment (16 items), and student learning (9 items). Each dimension included two approach questions: teacher-centered (TC) and learner-centered (LC). The data indicated TPDP brings teachers' belief change after attending a 54 hour workshop. The *pre*-test means of the TC approach in TBS was lower than the *post*-test means, meanwhile the pre-test means of the LC approach in TBS was higher than the post-test means. The result was shown in Table 5 which indicated teachers' belief is changing and is growing trend towards to learner-center approach

Table 5 The M and SD of pre-test and post-test in TBS(N=7)

dimension	approach	Items	Pre-test M	SD	Post-test M	SD
Curriculum design	TC	5	4.57	1.28	3.95	1.14
	LC	4	4.88	0.72	5.70	0.46
Teaching & assessment	TC	8	4.65	1.28	4.53	0.84
	LC	8	4.63	0.83	5.63	0.53
Student learning	TC	6	4.53	1.44	4.42	0.72
	LC	3	4.67	0.49	5.67	0.48

4.3.2 Teachers' knowledge change of LC core concept and curriculum design

LC Subject Matter Test (LCSMT) developed by the research team was administered to measure teachers' knowledge change in order to assess the impact of TPDP. LCSMT was comprised of two part contents: core concept (10 items) and curriculum design (10 items). The data indicated TPDP brought teachers' knowledge change after attending a 54-hour workshop. Each teacher's post-test correct percentages were higher than pre-test percentages in both core concept and curriculum design. The result was shown in Table 6 which indicated TPDP intervention brought about teachers' knowledge change. They had more understanding of LC core concepts and how to design LC curriculum after they attended workshops.

Table 6 Pre-test and post-test correct percentages (N=7)

Teacher Code	Core concept Pre-test correct %	Post-test correct %	Curriculum design pre-test correct %	Post-test correct %
A	40	100	20	60
B	60	100	20	60
C	60	100	20	60
D	60	80	20	80
E	20	100	60	80
F	20	80	20	80

During TPDP operating period, in order to understand what knowledge participants leaned from the program, the authors asked each participant to make individual professional development e-portfolio and to share it with each other in web platform. The summarized contents are as follows:

> "Give the learning initiative back to the students; the children would have a lifetime capability if they have the less memorizing but more thinking capabilities." (Teacher Lee e-Portfolio 5)

> "The teachers should record the details when they have the opportunities to review classes. By doing so, they would have more chances to discuss the classes later." (Teacher Lee e-Portfolio 7)

> Teachers should be able to use textbooks as raw materials, start with students' prior knowledge, and then re-build the teaching materials and also increase the difficulties of the materials so the

> students would have the bigger challenges. Also, teachers can apply collaborative learning, which values the equal relationship among peers in the classes, to increase the dialogues among the students so they can think more thoroughly. Through the students' dialogue discussions, teachers can covert the lesson knowledge in the classes to own knowledge. (Teacher Ou e-Portfolio 5)
>
> The students should not passively listen to the teachers. They should catch and determine what notions are important in each unit. Therefore, making students find the points of the topics before the classes, watch internet videos, and record ideas of the units would trigger the students' curiosity. Having the students sort out the charts, preview the course and make notes is the first thing the students should do before the classes. Meanwhile, the teacher could use the different teaching resources to show the students a view outside the textbook. (Teacher Liao e-Portfolio 6)
>
> Always offer the students the best education contents and resources. Do not reduce the educational contents or lower the teaching qualities because they have bad scores or their family has financial issues. Always pursue the perfect and best educational contents. We should always set the highest educational goals, select the best textbooks and teaching materials, challenge ourselves even though the overall performance of the school is poor and its academic ranking is low in the district. (Teacher Wu e-Portfolio 4)
>
> Manabu Sato believes there is no SOP in "Learning Community"; which means the teachers should find their own strategies based on the learning environment and the students' learning motivation. The concepts of "Learning Community" can foster the students' enthusiasm in learning. It seems to get very good effects but requires some of basic conditions. For example, the size of the school cannot be too big; the amount of students cannot be too many. The most important is that the school and the parents can trust each other, and also fully support the teachers. (Teacher Ho e-Portfolio 6)

4.3.3 Teachers' skill change of curriculum design

In final part of TPDP, participants developed SDPP based on the logical model of the framework. The TPDP had marked impacts on participants' teaching opinion. They believed that learning should be a sustainable process of "constantly weaving the relationship and the meanings" by having dialogues with learning materials, with peers, and with oneself. Having learned from TPDP, they applied a "learner-centered" approach and instructional strategies to design their courses, such as learning by doing, collaborative learning, and reflective learning. To conclude, participants' beliefs, knowledge, and skills were promoted by the program instructions. The main characteristics of the course design documents provided by the participants were: a) Design the activities as precondition to students' learning and its meaning construction; b) The activity design should focus on bringing up the students capabilities in exploration, cooperation and expression; c) If it is necessary, be flexible in recycling the "development" and "challenge" procedures; d) Use the different levels of questions as scaffolds to guide the students to understand knowledge, meaning constructions and learning transfer; e) In the teaching process, it is better to conduct three tasks: listening, cooperating and collaborating, and construction meaning.

5. Conclusion

This study applied program theory-driven approach to design and evaluate a teacher professional development program (TPDP) based on Japanese scholar Manabu Sato's LC approach. The study used program design checklist, activity responses of workshop, teachers' e-portfolio, course design documents, and teachers' belief survey to evaluate the program.

The data analysis yielded the following results. First, more than 90% of them agreed with the suitability of the program design, including agreed and strongly agreed. Second, more than 70% of the participants were satisfied with the activities of program implementation, although due to the individual factor, a participant was unable to attend all workshops. This finding supported the demographic variable as an inextricable factor that impacts teachers' attendance in the workshop. Third, the result indicated TPDP intervention changed teachers' teaching beliefs. The belief's growing trend lead towards learner-center approach. Fourth, based on the data analysis of pre and post tests, the result indicated that teachers better understood LC core concepts and designing LC curriculum after they attended workshops. Finally, there were several characteristics in the course design. The teaching activities heavily focused on students' interactions, listening, exploration, cooperation, and expression. Teaching procedures were more flexible and learning assessments were geared towards students' comprehension, meaning constructions and learning transformation.

These results supported that teacher professional development program improves teachers' performance and draws more attention to students' needs. PLC that was used in this study is a mode to promote the professional development through the ways of professional dialogue, curriculum development, peer supervision, peer coaching

and action research. Based on the result of this study, the authors believe that throughout the TPDP intervention, teachers will fulfill their pedagogy that learning should be a sustainable process of "constantly weaving the relationship and the meanings" by having dialogues with learning materials, with peers, and with oneself in the experimental teaching in the following year.

However, there was a limitation in applying theory-driven approach in program evaluation in this current study. As Stufflebeam and Shinkfield (2007) research indicated, this evaluation approach sometimes create an intrinsic conflict of interest in that theory-driven evaluators are essentially assessing the program theory that they developed or played a major role in developing. The authors also encountered the problem of being objective throughout the stages of program evaluation.

References

Alkin, M. C., & Christie, C. A. (2004). An evaluation theory tree. In M. C. Alkin (Ed.), *Evaluation roots* (pp. 12-65). Thousand Oaks, CA: SAGE Publications.

Astbury, B. & Leeuw. F. L. (2010). Unpacking black boxes: Mechanisms and theory building in evaluation. *American Journal of Evaluation*, *31*(3) 363-381.

Chen, H. T. (1990). *Theory-driven evaluations*. London: Sage.

Donaldson, S. I. (2001). Mediator and moderator analysis in program development. In S. Sussman (Ed.), *Handbook of program development for health behavior research* (pp. 470-496). Newbury Park, CA: Sage

Donaldson, S. I. (2007). *Program theory-driven evaluation science*. New York: Lawrence Erlbaum.

Funnel, S. C. (1997). Program logic: An adaptable tool. *Evaluation News & Comment*, *6*, 5-17.

Funnell, S. (2000). Developing and using a program theory matrix for program evaluation and performance monitoring. *New Directions for Evaluation*, *87*, 91-101.

Kerlinger, F. N. (1986). *Foundations of behavioral research* (3rd ed.). Fort Worth, TX: Holt, Rinehart, and Winston.

Lave, C. A., & March, J. G. (1975). *An introduction to models in the social sciences*. New York: Harper & Row.

Lipsey, M. W. (1993). Theory as method: Small theories of treatments. *New Directions for Program Evaluation*, *57*, 5-38.

Millar, A., Simeone, R.S., & Carnevale, J.T. (2001). Logic models: A systems tool for performance management. *Evaluation and Program Planning* , *24*, 73-81.

Pan, H. L. (2013). The reform clarion call sounds, make different classroom scenery. In Tian-Xia Magazine edited, *learning community - Taiwan to experience for the first time* (pp. 78-87) . Taipei, Taiwan: Tian-Xia Magazine.

Reynolds, A. J. (1998). Confirmatory program evaluation: A method for strengthening causal inference. *American Journal of Evaluation*, *19*(2), 203-221.

Rossi, P. H. & Freeman, H. E. (1985). *Evaluation: A systematical approach* (6th ed.). Thousand Oaks, CA: SAGE Publications.

Sato, M. (2012a). *The teacher's challenge: Quiet classroom revolution*. Shang Hai, China: Hua-Dong Normal University.

Sato, M. (2012b). *The revolution of study: Reform setting out from classroom*. Taipei, Taiwan: Tian-Xia Magazine.

Sato, M. (2013a). *The Learning community: Constructs and praxis*. Taipei, Taiwan: Tian-Xia Magazine.

Sato, M. (2013b). *Study on the frontline of the revolution: Find the child's happiness in the learning community*. Taipei, Taiwan: Tian-Xia Magazine.

Shadish, W. R., Cook, T. D., & Leviton, L. C. (1991). *Foundations of program evaluation: Theories of practice*. Thousand Oaks, CA: Sage.

Stufflebeam, D. L., & Shinkfield, A. J. (2007). *Evaluation theory, models, & applications*. San Francisco, CA: Jossey-Bass.

Weiss, C. H. (1972). *Evaluation*. Englewood Cliffs, NJ: Prentice Hall.

Weiss, C. H. (1998). *Evaluation: Methods for studying programs and policies* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.