DEVELOPMENT OF A TRAINING COURSE FOCUSING ON TEACHERS' ANALYTICAL THINKING SKILLS IN MEASUREMENT AND EVALUATION

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Abstract

This research and development aimed to organize a training course focusing on teachers' analytical thinking skills in measurement and evaluation. The three phases of the study were as follows: 1) The current state of the teachers' problems and needs of teachers in analytical thinking skills; 2) A training course was developed; and 3) Designing a course trial and efficacy assessment were implemented through one-group pretest-posttest design during May 11-12, 2017. The sample was 440 teachers teaching at elementary and secondary schools level from five regional regions in large schools, Thailand. They were chosen via multi-stage random sampling for phase 1. Five experts were selected by purposive sampling in phase 2. A total of 30 teachers from the sample volunteered to take part in the research. Research instruments included interview, questionnaire, test, assessment form and training course. Each instrument had a content validity value between .80 -1.00 and Cronbach's alpha coefficients reliability were equal to .93 - .97 The test had difficulties ranging .30 - .77 and discrimination powers ranging .27 - .60 Data analysis employed mean, standard deviation, percentage, paired samples test. The Priority Needs Index ($PNI_{modified}$) was used and content analysis used for the interview data.

Findings indicated the following:

1. Under actual conditions, the mean of overall measurement and evaluation in teachers' analytical thinking skills was moderate ($\bar{x}$ =2.03, SD=.66). The mean of overall desired condition was high ($\bar{x}$ =2.91, SD=.30).

The $PNI_{modified}$ values of priority needs, for all measurement and evaluation in all developments of teachers' analytical thinking skills, were between 0.40 and 0.48 and the overall mean was 0.43.

2. The developed training course consisted of six aspects, i.e. principles and reasons, objectives, course contents, learning activities, learning materials, and measurement and evaluation. The experts viewed the course were the high appropriate and consistent level ($\bar{x}$ = 3.94, SD = .90; $\bar{x}$ = 4.09, SD = .79) respectively.

3. The results of the course trial and efficacy evaluation revealed that the trainees' knowledge before and after training differed significantly at a statistical level of .05. The trainees viewed the course as one at the highest satisfied level ($\bar{x}$ = 4.36, SD = .62).

***Keywords*:** course development; training; measurement and evaluation; analytical thinking

Introduction

Education is groundwork for human development. It fulfills the need for knowledge, morality, and integrity obligations. A nation will thrive only when its citizens are given proper education. Teachers play a key role in education as they are persons who pass on knowledge to students. The quality of teachers is critical to quality education development. (Quality educational study, 2017). Teachers with distinction harvest students with superiority. Thus, the role of teachers in perfect human development - in terms of physical, mental, intellectual, knowledgeable, moral, ethical, and socially well-balanced life -is important. Teacher quality is a vital factor that influences students' learning dynamics (Pinsuda Sirirungtasri, 2014), especially since the 21st century is a period of change in all social aspects. All stakeholders in education must therefore adapt the learning processes to fit global dynamics. Learning in the 21st century involves practical lessons. Students living in this century are required to have one key attribute, which is problem-solving skills. Analytical thinking is one of the foundations that will shape such skills, enabling students to develop their skills through the educational process.

Measurement and evaluation is a part of the educational process that determine student quality. In providing education to students, teachers are directly responsible for transfering knowledge, organizing learning experiences, evaluating learning processes, and applying learning assessment to improve student quality in accordance with the course targets, thus teachers must be knowledgeable as well as able to measure and evaluate with a focus on advanced thinking skills. Traditional measurement and evaluation methods emphasize the memorization of information over critical thinking and application. This causes tardiness in students. Education development in the future requires humans to be nurtured in qualities such as knowledge, skills, communication, modern technology, creativity, and complex problem solving (Chaiyasit Siladej, 2001: 57). This is in line with the literature review and synthetic research related to the states of the problems with measurement and evaluation from a Thailand perspective between 1990 and 2011, by Pinda Varasunun (2011). The findings indicated that the most important problem was the lack of skills in measurement and evaluation processes among teachers. They were short of knowledge in making well-defined questions. Moreover, the national

problem regarding measurement and evaluation of students revealed that test scores were low in all subjects. In this study, teachers were given a chance to make tests in an attempt to compare them with the ordinary national educational test (O-NET). Overall results showed that the O-NET measured the levels of understanding and analysis equally, at 35.90 percent. They were followed by the level of knowledge at 25.64 percent and evaluation at 2.56 percent. Overall results of the tests by teachers indicated levels of knowledge at 58.64 percent, understanding at 42.27 percent, analysis at 6.08 percent, synthesis at 0.95 percent, and applications at 0.24 percent. Tests created by teachers mainly focused on assessing knowledge and memory. Consistent with data gathered on April 2, 2015, when the researcher participated in the Sa Kaeo provincial meeting of teacher representatives and school administrators (teacher representatives and school administrators, 2015), it was found that the majority of teachers had only acquired skills for making tests which assess memorized knowledge and understanding. They had not acquired the skills required for making analytical types of exam. This resulted in students' lack of analytical skill development. Therefore, teachers need development in measurement and evaluation which focuses on analytical thinking skills, in order to help students' development.

Obviously, the development of teachers' analytical thinking skills in measurement and evaluation is essential and urgent. It contributes to the development of students' analytical thinking abilities. Analytical thinking defines issues or problems to compare them with data. It classifies and disintegrates elements of things - which can be objects, items, events, or situations and specifies reasons or relates and validates data. It also seeks out necessary information for decision making, problem solving, and more creativity (Pinsuda Sirirungtasri, 2014; Kriengsak Chareonwongsak, 2010). Analytical thinking enhances intelligence as well as regards sample size reasoning. It helps reduce personal experience claims for general conclusion, authenticate assumptions based upon a prior knowledge base, examine facts from personal experiences as a basis of thinking for other facets, solve various problems, assess and make decisions on matters, sensibly innovate, and understand issues clearly (Kriengsak Chareonwongsak, 2010). Therefore, development in teachers' analytical thinking skills for measurement and evaluation can facilitate students' development. It is also a part of promoting immunity and managing

risks so students can sustain themselves strongly amid a course of change. It helps foster sustainable lifelong learning. For that reason, the researcher was interested in developing a training course focusing on teachers' analytical thinking skills in measurement and evaluation. A study of the potential and priority needs of teachers in measurement and evaluation, a course corresponding to those needs, and a course trial were developed. In addition, a follow-up on course efficacy was conducted. Results from the research could help teachers gain better knowledge, understanding, and abilities in analytical thinking skills for measurement and evaluation. Furthermore, people who are interested can apply the training course focusing on teachers' analytical thinking skills in measurement and evaluation to use as a directive that helps improve the quality of Thai education.

Research Objectives

1. To study the competency and priority needs of teachers with regard to analytical thinking skills in measurement and evaluation

2. To develop a training course focusing on teachers' analytical thinking skills in measurement and evaluation

3. To try out the training course and follow up on the efficacy of the training course focusing on teachers' analytical thinking skills in measurement and evaluation

Conceptual Framework

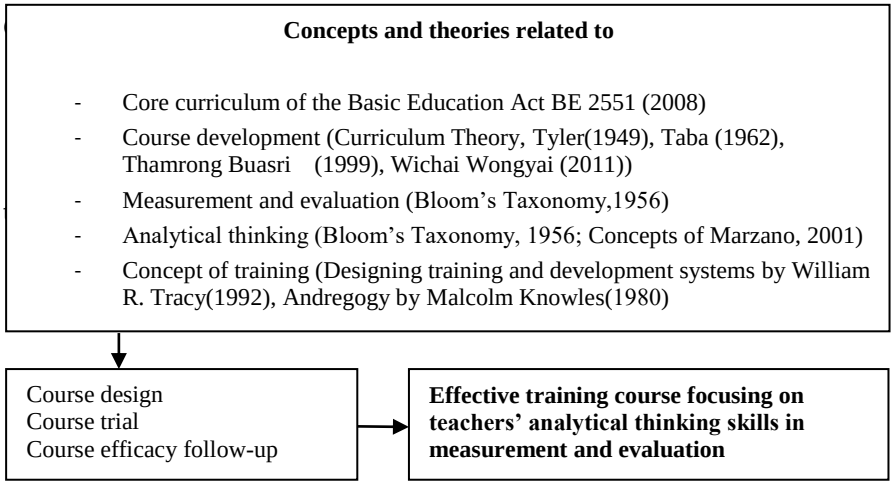
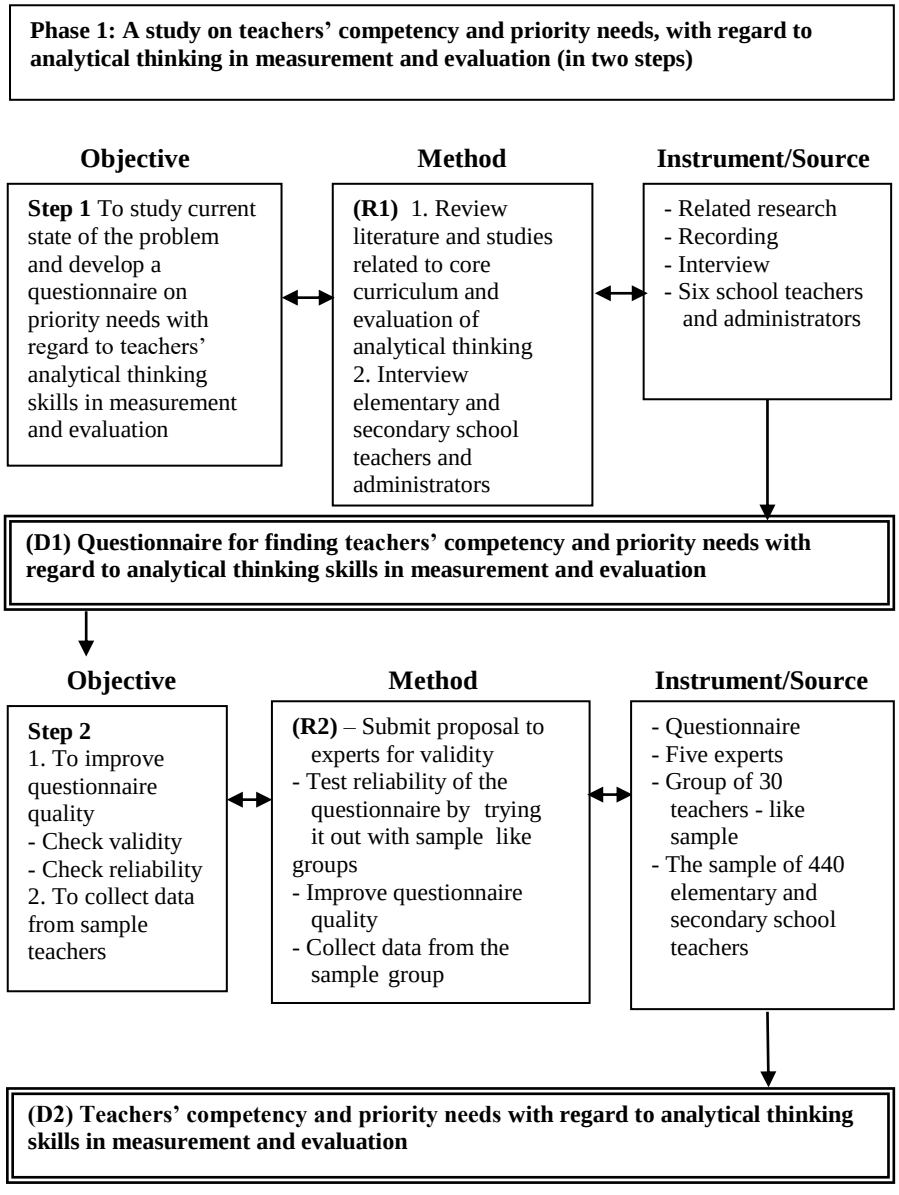


Diagram 1: Conceptual Framework

Research Methodology

The research and development were conducted in three phases, as shown in the diagram 2.



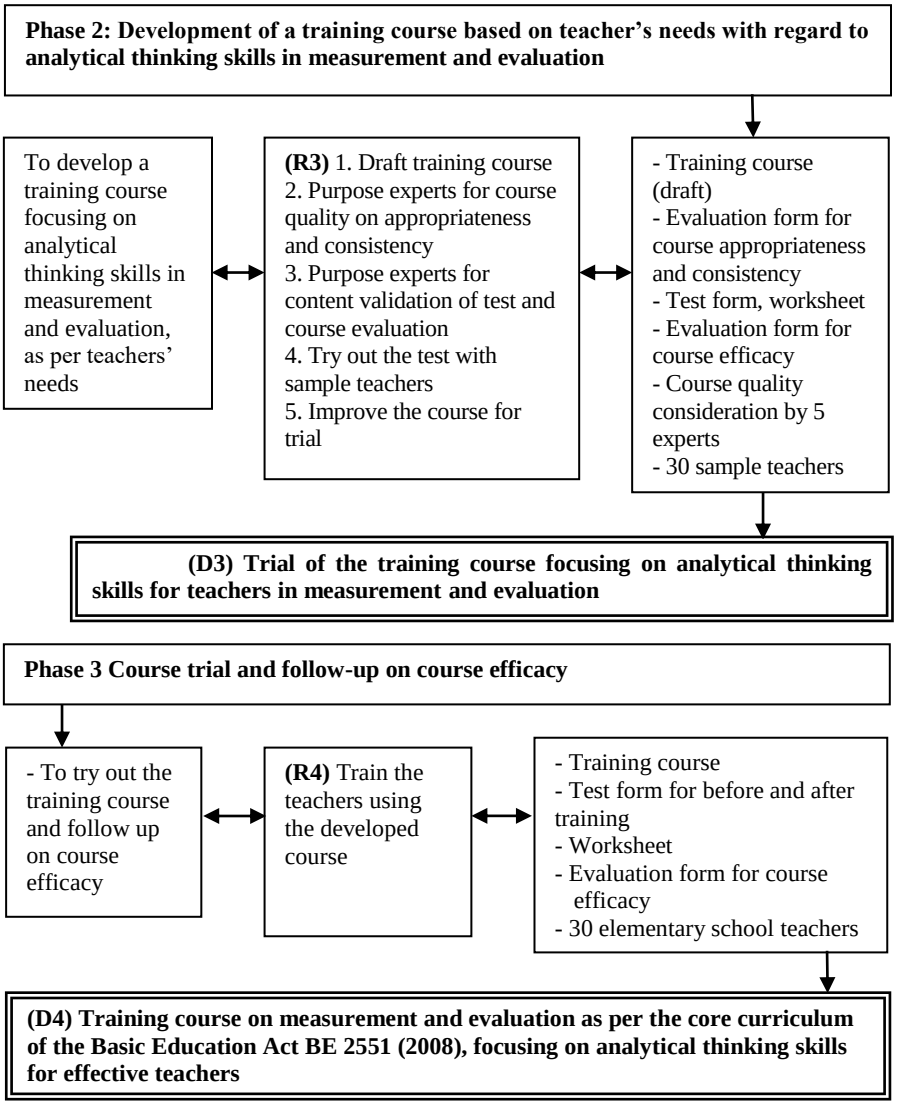


Diagram 2: Process of the research and development

Population and Sample

The population for phase 1 was 73,125 teachers hired for large public elementary and secondary schools in Thailand. (data as of 2015, from https://www .m-society.go.th/ewt_news.php? nid).

Sample and Sampling Method

Participants in this research were selected in three phases, as follows.

Phase 1 utilized multi-stage random sampling, which resulted in a sample consisting of 440 teachers. The six school teachers and administrators chosen through simple random sampling. In phase 2, the expert group was comprised of five experts chosen through purposive sampling. In phase 3, the course-trial group of 30 teachers consisted of 30 volunteers.

The multi-stage random sampling method was carried out as follows.

1. Divided the population into five regions, i.e. north, central, south, northeast, and Bangkok. Cluster random sampling provided one province was selected for each of the five regions to give a total of five provinces namely Nan Province, Nakhon Pathom Province, Surat Thani Province, Chaiyaphum Province and Bangkok Province.

2. Simple random sampling provided one large public elementary and secondary school for each province to make a total of 10 schools.

3. Simple random sampling provided 40 teachers from each selected school to make a total of 400 teachers.

In most cases, only around 70-90 percent of respondents return the questionnaire (Wipa Bumrhoechit, 1999; Kanyarat Sombutteera and Yupa Thavornpitak, 2015), so the researcher therefore handed out 20 percent more questionnaires, making a total number of 480 questionnaires were sent and 440 questionnaires were returned.

Determination of the Studied Sample Size

In determining the sample size, the following Yamane (1973: 125) formula was used to determine the exact number of the sample.

$$n = N/1+ Ne^2$$

Where n means sample size

N means population size = 73,125 persons

e means sampling errors = .05

The computation of sample size was carried out as follows:

$$73125/1 + 73125(.05)^2 = 397.83 = 400 \text{ persons}$$

Research Instruments

1. Unstructured interview was used for school administrators, elementary school teachers and secondary school teachers on issues regarding the state of the problems and priority needs with regard to teachers' analytical thinking skills in measurement and evaluation.

2. Questionnaires for teachers on the competency and priority needs regarding analytical thinking skills in measurement and evaluation consisted of two parts. Part 1 was regarding the respondent's general information. Part 2 was comprised of 16 questions in a dual-response format, about teacher's competency and priority needs, with a three-level rating scale of answers.

3. The assessment form on the appropriateness and consistency of the training course focusing on teachers' analytical thinking skills in measurement and evaluation contained 6 components questions with a five-level rating scale of answers.

4. An objective-type, multiple-choice exam (four choices) - consisting of 20 questions - was used.

5. A worksheet for exam review was included.

6. Course efficacy was covered by an evaluation form of 28 questions with five-level rating scale of answers.

7. A training course focusing on teachers' analytical thinking skills in measurement and evaluation was developed.

Development Procedure of Instruments

1. Review literature and studies related to the core curriculum of the Basic Education Act BE 2551 (2008), measurement and evaluation, analytical thinking and course development, and the state of the problems highlighted in interviews with school administrators as well as elementary and secondary school teachers.

2. Create the instruments: 1) a questionnaire in a dual-response format with a three-level rating scale of answers, with 16 questions about teacher's competency and priority needs regarding teachers' analytical thinking skills in measurement and evaluation, 2) a course draft consisting of six parts, 3) an assessment form comprised of 6 components questions on the appropriateness and consistency of the course, with a five-level rating scale of answers, 4) an

objective-type multiple-choice (four choices) exam with a total of 20 questions, 5) a worksheet, 6) an evaluation form for course efficacy, covered by 28 questions with a five-level rating scale of answers.

3. Conduct content-validity testing by submitting these six instruments to five experts for consideration. The calculated index of item-objective congruence (IOC) values were .80-1.00.

4. Perform a reliability test of the questionnaire on competency and priority needs regarding teachers' analytical thinking skills in measurement and evaluation, by trying it out with a sample-like group of 30 people (Cronbach's alpha coefficients was .97), the assessment form on the appropriateness and consistency of the training course (Cronbach's alpha coefficients was .97) and satisfaction evaluation form of course (Cronbach's alpha coefficients was.93).

5. Find the difficulty and discrimination power of the test. The calculated difficulty values of 30 sample teachers were in the range of .30 - .77 and the discrimination power values were in the range of .27 - .60.

Data Collection

To protect the rights of the sample group, the researcher sent out a consent letter to all respondents and asked them to answer all questions freely and truthfully. Information gathered would not negatively affect the respondents. The researcher performed overall data collection as follows.

1. A consent letter was submitted by the agency to sampled-school administrators for data collection.

2. The questionnaire on competency and priority needs, regarding teachers' analytical thinking skills in measurement and evaluation, was mailed to schools in rural provinces. Each school's academic department was responsible for data collection. With regard to schools in Bangkok, data were collected by the researcher.

3. The researcher asked for a trial of the course with sample teachers between the 11th and 12th of May, 2017.

Data Analysis and Statistics Used

The researcher performed data analysis on each instrument by employing statistics as follows.

1. Data from the questionnaire on competency and priority needs were analyzed using mean and standard deviation. Score ranges were defined as high = 2.34-3.00, moderate = 1.67-2.33, and low = 1.00-1.66. The actual condition and desired condition were tested via modified priority needs index ($PNI_{Modified}$) through the formula $PNI_{Modified} = I-D/D$.

Where	$PNI_{Modified}$	means	modified priority needs index
	I	means	level of desired competency
	D	means	level of actual competency

2. Data from the assessment of appropriateness and consistency of the course focusing on teachers' analytical thinking skills in measurement and evaluation were analyzed using mean and standard deviation. Score ranges were defined as highest = 4.21-5.00, high = 3.41-4.20, moderate = 2.61-3.40, low = 1.81-2.60, and lowest = 1.00-1.81.

3. Dependent samples t-test was performed on the data from the trial. Differences in mean were tested before and after the training.

4. Qualitative data obtained from open-ended questions, interviews, and the worksheet was employed in content analysis.

Research Findings

Results of the study purposed by the researcher as per the objectives are as follows

Phase 1 Study results from teachers' competency and priority needs regarding analytical thinking skills in measurement and evaluation

Data from the interviews with six school administrators, elementary school teachers and secondary school teachers concerning competency and the state of problems with teachers' analytical thinking skills in measurement and evaluation, as per the core curriculum of the Basic Education Act BE 2551 (2008), can be presented as the following three aspects:

1. The knowledge aspect revealed that most teachers with over five years experience in teaching had acquired knowledge on the principles of measurement and evaluation at moderate to high levels. It was found that they

created exams according to the test metrics, but most of them focused only on behavioral tests measuring the levels of knowledge and understanding. However, they demonstrated a lack of knowledge in measurement and evaluation, especially in analytical thinking and advanced behaviors.

2. The attitude aspect revealed that the majority of teachers seemed to have a positive attitude toward measurement and evaluation. Some might have a negative attitude toward measurement and evaluation nonetheless.

3. The practical tests on behavior in analytical thinking indicated that most teachers were short of this skill. They were able to create tests that measured behavioral levels of knowledge and understanding.

4. Data from the questionnaire on competency and priority needs regarding teachers' analytical thinking skills in measurement and evaluation are shown in the following table.

Table 1: Teachers' actual and desired levels of competency regarding analytical thinking skills in measurement and evaluation (n=440)

	dimension	level of actual competency			level of desired competency			PNI
		$\bar{X}$	SD	level	$\bar{X}$	SD	level	
1	Concepts of learning measurement and evaluation	2.00	.57	moderate	2.9	.32	high	0.45
2	Educational measurement	2.06	.54	moderate	2.89	.31	high	0.40
3	Selection of measurement tools and evaluation of learning assessment as per educational behaviors	2.09	.61	moderate	2.92	.29	high	0.40
4	Advantages and limitations of test-type and non-test-type measurement tools	2.03	.57	moderate	2.89	.32	high	0.42
5	Plan of test making	2.04	.62	moderate	2.90	.29	high	0.42
6	Properties of good measurement tools	2.02	1.16	moderate	2.90	.30	high	0.44
7	Creation and operation of measurement tools and evaluation as per learning goals	2.09	.61	moderate	2.92	.28	high	0.40
8	Score and score interpretation	2.05	1.13	moderate	2.92	.31	high	0.41
9	Educational behaviors	2.02	.58	moderate	2.96	.32	high	0.47

Table 1: (Continued)

	dimension	level of actual competency			level of desired competency			PNI
		$\bar{x}$	SD	level	$\bar{x}$	SD	level	
10	Concepts of learning measurement and evaluation according to the core curriculum of the Basic Education Act BE 2551 (2008)	2.07	.58	moderate	2.90	.30	high	0.40
11	Concepts and principles of analytical thinking	2.01	.59	moderate	2.91	.29	high	0.45
12	Nature of analytical thinking	1.96	.59	moderate	2.90	.29	high	0.48
13	Measurement tools and evaluation of analytical thinking	2.01	.61	moderate	2.90	.30	high	0.44
14	Creation of measurement tools and evaluation of analytical thinking	1.96	.59	moderate	2.90	.29	high	0.48
15	Application of measurement tools and evaluation results for students' development	2.05	.59	moderate	2.90	.30	high	0.41
16	Practical skills for creation of measurement tools and evaluation of analytical thinking	2.04	.63	moderate	2.91	.29	high	0.43
	Overall mean	2.03	.66	moderate	2.91	.30	high	0.43

The table shows that the overall mean of teachers' actual level of competency in measurement and evaluation in analytical thinking skills is at a moderate level ($\bar{x}$=2.03, SD=.66). When considering individual aspects, the two items with the highest mean were selection of measurement tools and evaluation of learning assessment as per educational behaviors, and creation and operation of measurement tools and evaluation as per learning goals. Both items had the same mean ($\bar{x}$=2.09, SD=.61). Items with the lowest mean were nature of analytical thinking, and creation of measurement tools and evaluation of analytical thinking. Both items had the same mean ($\bar{x}$=1.96, SD=.59). Meanwhile, the overall mean of teachers' desired level of knowledge was high ($\bar{x}$=2.91, SD=.30). When considering individual aspects, the item with the

highest mean was educational behaviors ($\bar{x}$ =2.96, SD=.32) and the item with the lowest mean was educational measurement ($\bar{x}$ =2.89, SD=.31).

Evaluation of the sample's priority needs gave a $PNI_{Modified}$ of 0.40-0.48. The overall $PNI_{Modified}$ was equal to 0.43. The items with the highest priority needs (the highest $PNI_{Modified}$) were nature of analytical thinking, and creation of measurement tools and evaluation of analytical thinking. Both had a $PNI_{Modified}$ equal to 0.48.

Phase 2 Results from Development of the Training Course Focusing on Teachers' Analytical Thinking Skills in Measurement and Evaluation

The researcher proposed the development of a training course, focusing on teachers' analytical thinking skills in measurement and evaluation, to five experts for their consideration regarding appropriateness and consistency. The expert judgment that the overall mean of a training course was at a high level ($\bar{x}$ =3.94, SD=.90; $\bar{x}$ = 4.09, SD=.79) respectively. It was then revised according to their advice. The training course was composed of six aspects, as follows.

Table 2: Composition of the training course focusing on teachers' analytical thinking skills in measurement and evaluation

Component	Content/Activity
1. Principles and Reasons	Teachers play a key role in education. The quality of teachers is critical to the development of quality education. Teachers with distinction harvest students with superiority. The traditional measurement and evaluation method emphasizes the memorization of information over critical thinking. Some teachers have only acquired skills for making tests which assess memorized knowledge and understanding. They have not acquired skills in making analytical types of exam. Therefore, teachers need development in measurement and evaluation which focuses on analytical thinking skills, in order to help students' development as it is also a part of promoting immunity and managing risks that promote students' sustainability.

Table 2: (Continued)

Component	Content/Activity
2. Objectives	1. To help teachers develop a positive attitude toward analytical thinking skills in measurement and evaluation. 2. To develop teachers' potential regarding analytical thinking skills in measurement and evaluation. 3. To foster teachers' capability in applying their knowledge of analytical thinking skills in measurement and evaluation.
3. Course Contents	Unit 1 Basic concepts of learning measurement and evaluation Unit 2 Educational behaviors and selection of measurement tools as per educational behaviors Unit 3 Test-making plans for learning achievement Unit 4 Principles of test making Unit 5 Quality of test Unit 6 Learning measurement and evaluation according to the core curriculum of the Basic Education Act BE 2551 (2008) Unit 7 Concepts and principles of analytical thinking
4. Learning Activities	Activities on the first day included course-content narration as a theoretical part of the training. Participants were then assigned homework, which was making a test that measured the level of analytical thinking in their class, based on the core curriculum of the Basic Education Act BE 2551 (2008) at least one item. The second day involved a workshop on creation of measurement and evaluation tools for analytical thinking as well as discussion and review of tests made by all participants.
5. Learning Materials	1) Exercise form on measurement and evaluation in analytical thinking skills; 2) document, assessment form, and test; 3) presentation used for lectures and 4) worksheet
6. Assessment and Evaluation	1) Pre- and post-training test 2) exam-making workshop

Phase 3 Results from the Course Trial and Course Efficacy Follow-up

The developed training course was tested by the researcher with 30 sample teachers at Wat Udomrangsri school between the 11th and 12th of May, 2017 before and after the training. Results are shown in the following table 3.

Table 3: Comparison of knowledge results before and after the training

Knowledge	**n**	$\bar{X}$	**SD**	$\bar{d}$	**S_d**	**t**	**p**
Before training	30	5.33	1.54	7.54	3.18	12.97*	.000
After training	30	12.87	2.87				

*P<.05

The table shows that the sample group of teachers showed differences in acquired knowledge before and after the training program focusing on teachers' analytical thinking skills in measurement and evaluation, at a statistical significance level of .05.

An evaluation of overall course efficacy, based on teachers' opinions regarding course satisfaction are shown in the following table 4.

Table 4: Mean, standard deviation, and level of opinion on the satisfaction of the course focusing on teachers' analytical thinking skills in measurement and evaluation (n = 30)

	Satisfaction of the course	$\bar{X}$	**SD**	**level**
	Appropriateness of the training course			
1	course principles and reasons for the course	4.41	.56	highest
2	proper objectives	4.41	.56	highest
3	course contents and number of training hours	4.28	.58	highest
4	learning-activity management	4.25	.67	highest
5	fit of the activities to the contents	4.47	.62	highest
6	knowledge and understanding of promotion activities	4.44	.62	highest
7	knowledge and understanding of promotion through the test - making process	4.34	.60	highest
8	lines on appropriateness of measurement t and evaluation.	4.41	.66	highest
	total	4.38	.60	highest

Table 4: (Continued)

	Satisfaction of the course	$\bar{x}$	SD	level
	Appropriateness of contents			
9	proper classification of contents	4.41	.62	highest
10	simplification of contents	4.31	.69	highest
11	consistency between contents and objectives	4.47	.57	highest
12	consistency among content units.	4.47	.62	highest
	total	4.58	.54	highest
	Appropriateness of time duration			
13	number of days in training	4.49	.78	highest
14	time for theory discussion	4.22	.75	highest
15	time for practice	4.25	.62	highest
16	time duration of the contents	4.16	.78	high
	total	4.42	.63	highest
	Appropriate training media, materials, and equipment			
17	proper documents for training	4.44	.68	highest
18	suitable documents for trainees' better understanding of contents	4.34	.65	highest
19	practical worksheet for trainees' better understanding of contents	4.34	.60	highest
20	proper media for training	4.38	.66	highest
21	effective materials for trainees' better understanding of contents	4.38	.66	highest
	total	4.28	.73	highest
	Benefits gained included			
22	knowledge for task development	4.56	.56	highest
23	knowledge for test development	4.59	.56	highest
24	more skills in test-making,	4.62	.55	highest
25	more skills in test-making focused on analytical thinking	4.69	.53	highest
26	more knowledge in analytical thinking,	4.66	.54	highest
27	appropriate trainers' level of knowledge	4.72	.52	highest
28	level of overall satisfaction with this training.	4.59	.56	highest
	total	4.38	.65	highest
	Overall mean	4.36	.62	highest

The table shows that mean, standard deviation, and degree of satisfaction of the program, based on the trainees' opinions in the training course focusing on teachers' analytical thinking skills in measurement and evaluation. As a whole, the mean scores were at the highest level ($\bar{x}$ = 4.36,

SD = .62). The appropriateness of contents ($\bar{x}$ = 4.58, SD = .54), followed by the appropriateness of time duration ($\bar{x}$ = 4.42, SD = .63) appropriateness of the training course ($\bar{x}$ = 4.38, SD = .60) Benefits gained included ($\bar{x}$ = 4.38, SD = .65) appropriate training media, materials, and equipment ($\bar{x}$ = 4.28, SD = .73), respectively.

Discussion

The researcher designed a training course focusing on teachers' analytical thinking skills in measurement and evaluation in accordance with the curriculum theory developed by Tyler (1949), Taba (1962), Thamrong Buasri (1999) and Wichai Wongyai (2011). Taba proposed procedures on curriculum development including diagnosis of needs, formulation of objectives, selection of content, organization of content, selection of learning experiences, organization of learning experiences, and determination of what to evaluate and of the ways and means of doing it. Steps were taken by the researcher to make sure that the course was effective and efficient. The state of problems was studied and teachers' priority needs regarding measurement and evaluation in analytical thinking skills were investigated. Findings suggested that teachers' competency was moderate and they wanted to improve their competency to a high level. When considering the individual aspects, it was found that nature of analytical thinking, and creation of measurement tools and evaluation of analytical thinking acquired the lowest scores corresponding to Nuntiya Chaimatchim, Oranuch Seesaard, and Tatsirin Sawangboon (2014) were studied the needs assessment for science teachers development in measurement and evaluation of critical thinking competency in the secondary school Kalasin Province, which indicated that teachers' knowledge and understanding in analytical thinking skills were at the lowest. Consistent with interview elementary and secondary school teachers and administrators in this study, it was found that the majority of teachers had only acquired skills for making tests which assess memorized knowledge and understanding. They had not acquired the skills required for making analytical types of exam. This resulted in students' lack of analytical skill development. Consistent with the findings of Incecay and Incecay (2010) were studied a case study on needs assessment of English language teachers, which indicated that it is apparent

that the needs of the teachers are also important in the design and the implementation process of the syllabus and the program. At the same time, $PNI_{Modified}$ analysis was conducted by the researcher. Results with the highest $PNI_{Modified}$ showed that nature of analytical thinking, and creation of measurement tools and evaluation of analytical thinking were the two needs most wanted by teachers, which drew attention to Suwimon Wongwanich's (2 0 0 7) proposal. In her modified priority needs index, measurement and evaluation in analytical thinking skills was called teachers' priority need. Prior to trying out the course, the researcher tested appropriateness and possibility of the training course as required by the curriculum development process, with advice from five experts. Congruence was valued at .8 0 -1 .0 0 . Means of appropriateness and consistency for each aspect were high. All indicated that the developed course attained the quality standard, and was appropriate and consistency for deployment.

Results from the Course Trial and Course Efficacy Follow-up

The first day's training was theoretical and teachers were required to make one question of a test. The second day focused on a workshop where teachers could practice by themselves. Training activities promoted the sharing of test review knowledge among teachers. The trainer provided feedback so teachers could use it to improve test making. Mutual exchanges of knowledge, discussions, presentations, and feedbacks were employed. Teachers had the opportunity to review their existing knowledge as well as gain new knowledge. This enabled them to better understand and acquire more skills in analytical thinking as part of measurement and evaluation. Moreover, results from this study also revealed that sample teachers had different levels of knowledge before and after the training course focusing on teachers' analytical thinking skills in measurement and evaluation at a statistical significance level of .05 consistent with the research by Suhail Mahmoud, Al-Zoubi Majdoleen, Sultan Bani and Abdel Rahman (2011) which investigated the effects of a training program in improving instructional competencies for special education teachers in Jordan and the study by Marut Patphol (2014), who examined practical learning in the development of learning ability that promoted cognition and happiness in teachers. This ensured teacher's

continued advancement. The research found that teachers remained positive about course appropriateness and analytical thinking skills in measurement and evaluation. The overall mean was at the highest level ($\bar{x}$ =4.36, SD=.62), which demonstrated the efficacy of developed course.

Recommendation

1. Results showed that the aspects with the highest priority needs for training had the highest $PNI_{Modified}$; they were nature of analytical thinking, and creation of measurement tools and evaluation of analytical thinking. Therefore, related parties can use the information provided in this research to develop teacher's competence in measurement and evaluation by focusing on analytical thinking skills, especially with regard to proficiency in test making which focuses on analytical thinking skills as part of measurement and evaluation.

2. Further research should be pursued for sustainable development. It should be focused on the development of teacher's competence in using analytical thinking skills as part of measurement and evaluation.

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