CHAPTER 3

Research Methodology

The study on "the Evaluation Model for Developing Instruction Management of Science Teachers in Reading, Critical Thinking, and Writing of Students in Basic Education Institutes" was conducted in a manner of research and development. The researcher performed the study which could be divided into three parts, each of which was in accordance with the research objectives as follows.

(1) To explore instructional management conditions, knowledge and understanding in instructional management, and needs and necessity in developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

(2) To construct and identify the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

(3) To identify the utilization results of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

This research was divided into three major items as follows:

3.1 Exploring instructional management conditions, knowledge and understanding in instructional management, and needs and necessity in developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This item was comprised of the followings:

3.1.1 Exploring instructional management conditions which enhanced the abilities in reading, critical thinking, and writing of basic education students in teaching preparation, instructional processes, and summary records, reports, storage, and outcome utilization

3.1.2 Exploring knowledge and understanding in instructional management concepts/principles which enhanced the abilities in reading, critical thinking, and writing of basic education students

3.1.3 Exploring the needs and necessity in developing instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students

3.2 Constructing and identifying the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This item consisted of the followings:

3.2.1 Synthesis of indicators in instructional management which enhanced reading, critical thinking, and writing of basic education students

3.2.2 Constructing the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students

3.2.3 Identifying the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students, conducted by the experts

3.3 Identifying the utilization results of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This item consisted of the followings:

3.3.1 Trying-out the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This would be preliminary trying-out with major fieldwork in order to be modified prior to actual utilization.

3.3.2 Identifying the utilization results of the evaluation model for developing science teachers' instructional management via the utilization of the evaluation model for developing instructional management. This would be actually tried out with a sample group of science teachers.

3.3.3 Evaluating the quality of the evaluation model for developing science teachers' instructional management. This would be conducted by those science teachers who were chosen as a sample group.

The research operation could be summarized as illustrated in the research procedures (Figure 3.1).

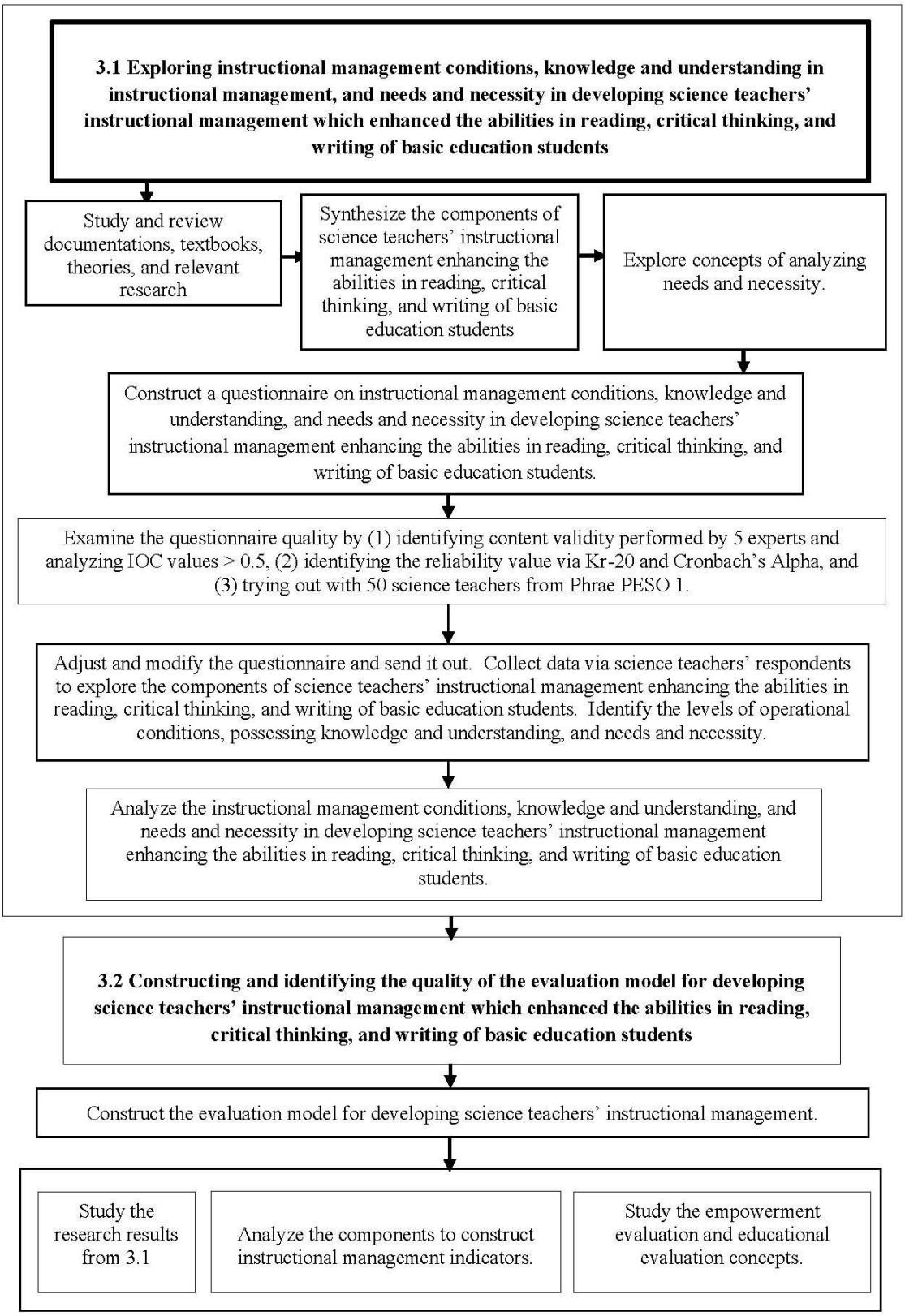

Figure 3.1 Research Procedures Based on Research Objectives

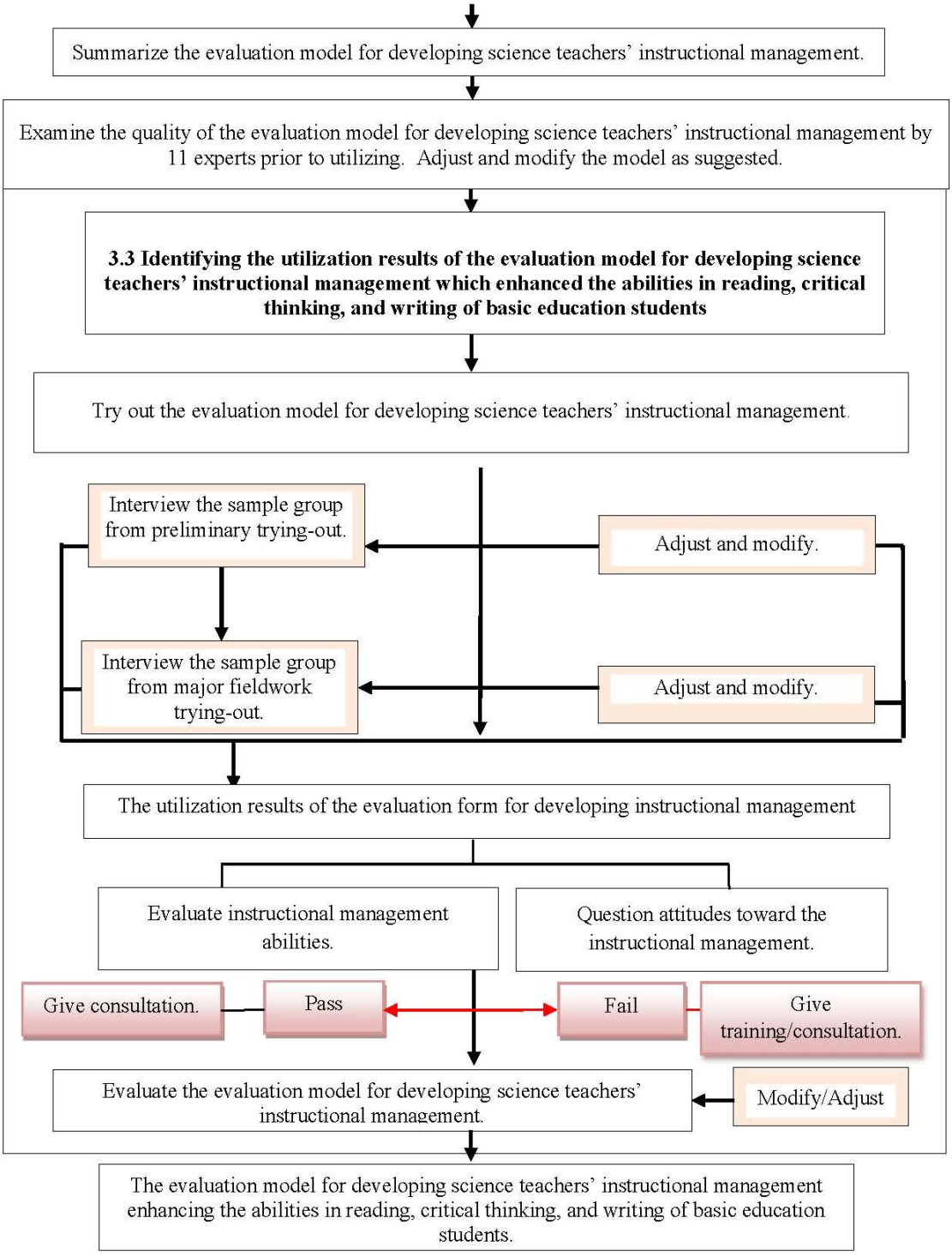

Figure 3.1 (continued)

The details of each major item were illustrated as follows:

3.1 Exploring the Instructional Management Conditions, Knowledge and Understanding in Instructional Management, and Needs and Necessity in Developing Science Teachers' Instructional Management which Enhanced the Abilities in Reading, Critical Thinking, and Writing of Basic Education Students. This item consisted of the followings.

3.1.1 Exploring the instructional management conditions

3.1.2 Exploring knowledge and understanding in instructional management concepts and principles

3.1.3 Exploring the needs and necessity in developing the instructional management

All of these three minor items were operated conclusively in terms of the population, research tools, data collection, and data analysis as detailed below.

Population and sample groups

The population group was 4,661 science teachers teaching in the educational institutions affiliated with the Primary Educational Service Area, Uttaradit, Areas 1 and 2 and the Primary Educational Service Area, Phitsanulok, Areas 1, 2, and 3 delivering in primary levels and junior high school levels (The Office of Policy and Planning, the Office of the Basic Education Commission: 2012).

The sample groups were obtained via multi-stage random sampling on a basis of cluster random sampling and stratified random sampling. They were classified into primary levels and junior high school levels delivering in five Primary Educational Service Area located in Phitsanulok and Uttaradit provinces. The random steps were as follows:

(1) Cluster random sampling: schools were divided into five groups based on their primary educational service areas as follows:

Group 1: Schools affiliated with Phitsanulok Primary Educational Service Area Office 1
Group 2: Schools affiliated with Phitsanulok Primary Educational Service Area Office 2
Group 3: Schools affiliated with Phitsanulok Primary Educational Service Area Office 3
Group 4: Schools affiliated with Uttaradit Primary Educational Service Area Office 1

Group 5: Schools affiliated with Uttaradit Primary Educational Service Area Office 2

After that, three school groups affiliated with the primary educational service areas were randomly selected as the sample groups. These three groups were Group 3: Schools affiliated with Phitsanulok Primary Educational Service Area Office 3, Group 4: Schools affiliated with Uttaradit Primary Educational Service Area Office 1, and Group 5: Schools affiliated with Uttaradit Primary Educational Service Area Office 2.

(2) Stratified random sampling: the schools in each group were stratified into two categories which were (1) schools delivering from Grade 1 to Grade 6 and (2) schools delivering from Grade 1 to Grade 9.

(3) Sample size calculation from the population of 3,506 science teachers in the three service areas and Hendel's Sample Size Table (1977) at a 99-percent confidence level, it was found that the sample groups of at least 557 teachers were employed for data strength. In this research, the researcher collected data from 800 teachers by calculating the number of sample groups based on the population size in each strata. The return ratio of the sample group of 741 people was detailed in Table 3.1

Table 3.1 Population and Sample Sizes Employed in the Research Classified by Education Levels

Affiliation	**Population (3,506)**		**Sample Groups (800)**		**Return Rate (741)**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Uttaradit PEASO 1	1,270	36.22	290	36.25	290	36.25
Primary	1,136	32.40	260	32.50	260	32.50
Secondary	134	3.82	30	3.75	30	3.75
Uttaradit PEASO 2	681	19.42	155	19.38	150	18.75
Primary	605	17.25	138	17.25	133	16.62
Secondary	76	2.17	17	2.13	17	2.13
Phitsanulok PEASO 3	1,555	44.35	355	44.37	301	37.63
Primary	1,331	37.96	303	37.87	249	31.13
Secondary	224	6.39	52	6.50	52	6.50
Total	**3,506**	**100.00**	**800**	**100.00**	**741**	**92.63**

Research Tools Employed

Set 1: Questionnaire on instructional management enhancing the abilities in reading, critical thinking, and writing of basic education students. It consisted of Part 1: General information about teachers and education institutes, Part 2: Conditions of instructional management, Part 3: Knowledge and understanding toward instructional management, and Part 4: Needs and necessity in developing instructional management. The details of each part were shown as follows:

The Steps of Constructing and Developing Tools

(1) Explore concepts and instructional management processes which enhanced the abilities in reading, critical thinking, and writing in basic education schools and were in accordance with the Basic Education Curriculum B.E. 2551 and relevant research. This could be performed simultaneously with a determined plan on composing the questions.

(2) Construct research tools as determined in the tool frame as follows:

Part 1: General information about teachers and education institutes. This consisted of 11 items in close-ended questions with multiple choices and open-ended questions with filling answers. This part was constructed in order to ask about age, educational background, grades they taught, training experience, and instructional management experience.

Part 2: Conditions of instructional management. This consisted of 40 items in five-point rating scale. This part was constructed in order to ask about practical conditions based on instructional management processes which were comprised of (1) teaching preparation, (2) instructional processes, and (3) summary records, reports, storage, and learning outcome utilization.

Consideration Criteria

5	referred to	extremely performed/extremely true
4	referred to	considerably performed/considerably true
3	referred to	moderately performed/moderately true

2 referred to inconsiderably performed/inconsiderably true

1 referred to least performed/least true

Part 3: Knowledge and understanding toward instructional management. This consisted of 24 items in true-false checklist. The sample groups had to answer about the concepts/principles in science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing in basic education students. This part covered (1) teaching preparation, (2) instructional processes, and (3) summary records, reports, storage, and learning outcome utilization.

Consideration Criteria

1 referred to possessed knowledge and understanding in instructional management

0 referred to possessed no knowledge and understanding in instructional management

Part 4: Needs and necessity in developing instructional management which enhanced the abilities in reading, critical thinking, and writing in basic education students. This part consisted of 30 items in five-point rating scale. The first 15 items concerned with the levels of authentic knowledge and abilities; the second 15 items concerned with likely knowledge and abilities. This would measure characteristics of data and allow self-report of the sample groups in the levels of their authentic and likely knowledge and abilities. This part also covered (1) teaching preparation, (2) instructional processes, and (3) summary records, reports, storage, and learning outcome utilization.

Consideration Criteria

5 referred to possessed the highest levels of authentic knowledge and abilities/likely knowledge and abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing

4 referred to possessed high levels of authentic knowledge and abilities/likely knowledge and abilities in instructional

management which enhanced the abilities in reading, critical thinking, and writing

3 referred to possessed moderate levels of authentic knowledge and abilities/likely knowledge and abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing

2 referred to possessed low levels of authentic knowledge and abilities/likely knowledge and abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing

1 referred to possessed the least levels of authentic knowledge and abilities/likely knowledge and abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing

(3) Examine item quality in terms of content validity. This was performed by five experts in educational measurement and evaluation. They would consider the congruence of items and variables. The consideration criteria were displayed as follows:

+1 if an expert considered that a question item was congruent with a variable

0 if an expert was not certain that a question was congruent with a variable

–1 if an expert considered that a question item was not congruent with a variable

According to the examination results of content validity, it was found as follows:

The IOC result of “Part 1: General information about teachers” was 0.8-1.00.

The IOC result of “Part 2: Conditions of instructional management” was 0.8-1.00.

The IOC result of “Part 3: Knowledge and understanding toward instructional management” was 0.8-1.00.

The IOC result of “Part 4: Needs and necessity in developing instructional management” was 0.8-1.00.

(4) Firstly, try out with three science teachers from Chumchonphailom School affiliated with Phrae Primary Educational Service Area Office 2 in order to adjust the language use of each item and clarify the instructions.

(5) Secondly, try out with 50 science teachers from Opportunity Expansion Schools affiliated with Phrae Primary Educational Service Area Office 2. As for Part 3 which tested on knowledge and understanding toward instructional management which enhanced the abilities in reading, critical thinking, and writing in basic education students, the difficulty value was identified by calculating the ratio of the respondents who answered that particular item correctly. The discrimination value was identified by calculating the different value of those who answered that particular item correctly and the different ratio of those who answered correctly in keen groups and weak groups. It was found that the difficulty value was 0.22-0.68 while the discrimination value was 0.24-0.92. There were 24 items that could be employed.

(6) Thirdly, try out with 50 science teachers from Opportunity Expansion Schools affiliated with Phrae Primary Educational Service Area Office 2 in order to identify overall quality. As for "Part 2: Conditions of instructional management" and "Part 4: Needs and necessity in developing instructional management" which were in a format of the rating scale, the validity value was identified via Cronbach's alpha coefficient principle. The validity value of "Part 3: Knowledge and understanding toward instructional management" was identified via KR-20 formula of Kuder and Richardson. It was found as follows:

The validity value of "Part 2: Conditions of instructional management" was 0.97.

The validity value of "Part 3: Knowledge and understanding toward instructional management" was 0.70.

The validity values of "Part 4: Needs and necessity in developing instructional management" in terms of likely and authentic knowledge and abilities were 0.97 and 0.98, respectively.

(7) Modify certain issues of the questionnaires and tests based on the experts' recommendations.

Data Collection

The researcher employed the questionnaire on conditions of instructional management which enhanced the abilities in reading, critical thinking, and writing in basic education students in order to collect data from May 17, 2013 to July 30, 2013. In order to yield enough number of the returned questionnaires to be matched with the number of determined sample groups, the researcher sent out 800 questionnaire copies and obtained 741 returned questionnaire copies. In other words, the return rate was 92.63 percent.

Data Analysis

Part 1: General information about teachers and education institutes. The data were analyzed by means of frequency and percentage.

Part 2: Conditions of instructional management. The data were analyzed on the basis of mean and standard deviation.

Interpretation Criteria

4.51-5.00	referred to	extremely performed/extremely true
3.51-4.50	referred to	considerably performed/considerably true
2.51-3.50	referred to	moderately performed/moderately true
1.51-2.50	referred to	inconsiderably performed/inconsiderably true
0.51-1.50	referred to	least performed/least true

Part 3: Knowledge and understanding toward instructional management. The data were analyzed by means of frequency and percentage.

Interpretation Criteria

A sum total of 18-24 points (75-100 percent) referred to “possessed a high level of knowledge, understanding, and instructional management concepts which enhanced the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551.”

A sum total of 12-17 points (50-74 percent) referred to “possessed a moderate level of knowledge, understanding, and instructional management concepts which

enhanced the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551."

A sum total of 0-11 points (less than 50 percent) referred to "possessed a low level of knowledge, understanding, and instructional management concepts which enhanced the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551."

Part 4: Needs and necessity in developing instructional management. The data were analyzed by identifying the mean and standard deviation of likely conditions and authentic conditions of instructional management. The needs and necessity were also identified via PNI modified formula (Suwimol Wongwanit: 2013).

$$\text{PNI modified} = (I - D) / D$$

I = Mean of likely conditions

D = Mean of authentic conditions

The interpretation was considered from the difference value of the mean.

3.2 Constructing and Identifying the Quality of the Evaluation Model for Developing Science Teachers' Instructional Management which Enhanced the Abilities in Reading, Critical Thinking, and Writing of Basic Education Students

As for constructing and identifying the quality of the evaluation model for developing the instructional management and as for identifying the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students, the operation was performed as detailed below.

3.2.1 Synthesis of indicators in instructional management which enhanced reading, critical thinking, and writing of basic education students

Sample Group

The sample group was 294 science teachers teaching in primary schools and junior high schools affiliated with Uttaradit Primary Educational Service Area Office 1.

Data Collection Tools

Set 2: Questionnaire on the appropriateness of the indicators toward science teachers' abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. It was in a format of five-point rating scale.

Steps of Constructing Tools and Identifying Tool Quality

(1) Explore the concepts in instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students in accordance with the Basic Education Curriculum B.E. 2551. Then, synthesize indicators on the abilities in instructional management.

(2) Construct a questionnaire on the appropriateness of the indicators toward science teachers' abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. The questionnaire contained 29 items and was in a format of five-point rating scale.

Consideration Criteria

5	referred to	extremely appropriate
4	referred to	considerably appropriate
3	referred to	moderately appropriate
2	referred to	inconsiderably appropriate
1	referred to	least appropriate

(3) Examine item quality in terms of content validity. This was performed by eight experts in educational measurement and evaluation. They would consider the congruence of items and variables. The consideration criteria were displayed as follows:

+1	if an expert thought that an item was congruent with a variable
0	if an expert was not certain that a question was congruent with a variable
–1	if an expert thought that an item was not congruent with a variable

According to the examination results of content validity, it was found that the IOC result of "Part 2: Conditions of instructional management" was 0.75-1.00. The researcher modified certain issues of the questionnaire based on the experts' recommendations.

(4) Try out with 50 science teachers from Opportunity Expansion Schools affiliated with Phrae Primary Educational Service Area Office 2 in order to identify validity value via Cronbach's alpha coefficient principle. It was found that the validity value was 0.95.

Data Collection

The researcher herself employed the questionnaire on the appropriateness of the indicators toward the instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students to collect data via educational supervisor cooperation in December, 2014. The data were collected from 294 science teachers teaching in primary schools and junior high schools affiliated with Uttaradit Primary Educational Service Area Office 1. Then, the questionnaire completeness was examined; it was found that there were 264 complete copies or 89.79 percent of the total questionnaire copies.

Data Analysis

This was conducted via the Exploratory Factor Analysis by extracting principal components with varimax rotation in order to identify the structural validity of the indicators focusing on science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This analysis was then employed as a part of the evaluation model. It was found that 29 indicators focusing on the instructional management when tested via Bartlett's test contained the chi-square value of 1004.4 and a significance level of .00. This expressed that the data sufficiently related to the factor analysis. Moreover, the Kaiser-Meyer-Olkin value was 0.918 showing that the data were extremely appropriate to be used for the factor analysis. After extracting the components, three components were obtained with the variance of 76.317. After that, the average of each component was analyzed.

The results of the factor analysis in order to determine the instructional management components were detailed as follows:

Table 3.2 Component Number, Eigen Value, Variance Percentage, Cumulative Variance Percentage

Component	Eigen Value	Variance Percentage	Cumulative Variance Percentage
1	13.680	47.172	47.172
2	5.352	18.283	65.455
3	3.150	10.862	76.317

According to Table 3.2, when considering three components containing the Eigen value higher than 1, it could explain the cumulative variance at 76.317 percent. In order to gain clearer interpretation, the researcher applied the orthogonal rotation via varimax method so that the variables related to the components in a clearer manner. Then, the factor loading value was considered to identify which components, each variable was supposed to be with. Three components were yielded with the factor loading values higher than 0.50. This expressed that the variables could be grouped into the components as shown in Table 3.3.

Table 3.3 Results of Grouping Variables into Components

Number	Item	Variable	Factor Loading
Component 1: Teaching Preparation			
1	Item 1	The indicators enhancing the abilities in reading, critical thinking, and writing which was in accordance with the Basic Education Curriculum B.E. 2551 were identified.	0.786
2	Item 2	The indicators of reading, critical thinking, and writing which were integrated with science learning areas were identified.	0.813
3	Item 3	The learning objectives and the indicators of reading, critical thinking, and writing required for students were identified.	0.824

Table 3.3 (continued)

Number	Item	Variable	Factor Loading
4	Item 4	Scientific contents which could be taught in order for students to achieve the indicators of reading, critical thinking, and writing based on their age ranges were identified in the curriculum.	0.861
5	Item 5	The indicators enhancing the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551 were identified.	0.837
6	Item 6	Media used in reading, critical thinking, and writing about science based on age ranges were identified.	0.830
7	Item 7	Various media used in reading, critical thinking, and writing were identified.	0.834
8	Item 8	Media used in reading, critical thinking, and writing which were in accordance with lessons or situations were identified.	0.847
9	Item 9	Activities leading to lessons linking former knowledge and new knowledge were identified.	0.804
10	Item 10	Activities in reading, critical thinking, and writing allowing students to practice authentically were identified.	0.831
11	Item 11	Tools evaluating the abilities in reading, critical thinking, and writing in science in authentic situations were constructed.	0.833
12	Item 12	Situations for reading, critical thinking, and writing in science which were appropriate to the age and stimulated thinking were constructed.	0.834
13	Item 13	Activities enhancing students to summarize lessons by themselves were identified.	0.765
14	Item 14	Technologies linking with lessons were identified.	0.734
15	Item 15	Media used to reading, critical thinking, and writing in science in accordance with lessons was provided and produced.	0.743
16	Item 16	Various methods evaluating the results of reading, critical thinking, and writing in science were employed.	0.734

Table 3.3 (continued)

Number	Item	Variable	Factor Loading
Component 2: Instructional Processes			
17	Item 17	Activities allowing students to repeatedly practice via reading, critical thinking, and writing in science were held.	0.687
18	Item 18	Activities enhancing authentic practice of reading, critical thinking, and writing in science were held.	0.749
19	Item 19	Techniques of questioning and stimulating students to think from reading in science were employed.	0.799
20	Item 20	Activities allowing students to think and assess thinking of their own after reading in science were held.	0.915
21	Item 21	Activities enhancing students to summarize lessons by themselves after reading, critical thinking, and writing in science were held.	0.898
22	Item 22	Instructional media that were in accordance with lessons were employed.	0.899
23	Item 23	Environment and media facilitating reading, critical thinking, and writing in science were provided.	0.907
24	Item 24	Learning outcomes which were in accordance with learning objectives were evaluated.	0.896
25	Item 25	Attitudes toward learning were evaluated.	0.912
Component 3: Summary record, report, storage, and outcome utilization			
26	Item 26	Learning outcome summaries of an individual and a class were recorded.	0.889
27	Item 27	Learning outcomes of an individual and a class were reported.	0.905
28	Item 28	Learning outcomes of an individual and a class were stored.	0.910
29	Item 29	Learning outcomes were used to planning on improving the students' quality continuously.	0.902

According to Table 3.3, it was found that all components contained the Eigen values higher than 1 and the factor loading values higher than 0.50. When considering each component, the results were shown as follows:

Component 1 consisted of the variables from Items 1-16, 16 variables in total. The factor loading values were between 0.734 and 0.861. The Eigen value was 13.680. This component was entitled teaching preparation.

Component 2 consisted of the variables from Items 17-25, 9 variables in total. The factor loading values were between 0.687 and 0.915. The Eigen value was 5.352. This component was entitled instructional processes.

Component 3 consisted of the variables from Items 26-29, 4 variables in total. The factor loading values were between 0.889 and 0.910. The Eigen value was 3.150. This component was entitled summary record, reports, storage, and learning outcome utilization.

The aforementioned components and indicators were employed as a part of the evaluation model.

3.2.2 Constructing the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students

The steps of constructing the evaluation model for developing instructional management that enhanced the abilities in reading, critical thinking, and writing were operated as follows:

(1) Study the research findings Item 3.1 of the conditions of contexts, needs, and necessity in developing the instructional management. It was found that the level of knowledge and understanding toward the instructional management was moderate resulting in the moderate level of instructional management performance. This did not meet expected results, so it was necessary that the instructional management be developed in order to possess the abilities in instructional management as determined in the components and indicators.

(2) Explore concepts and relevant theories consisting of (a) the concepts in instructional management that enhanced the abilities in reading, critical thinking, and writing as determined in the Basic Education Curriculum B.E. 2551 of the Bureau of

Academic Affairs and Educational Standards (2008), (b) the basic concepts regarding the evaluation as an evaluation process which consisted of objective determination, objects evaluated, evaluation methods, value judgement, evaluation results, and evaluation result utilization (Nevo: 1983, Sirichai Kanjanawasee: 2009, and Yaowadee Rangchaikul: 2003), and (c) the concept in the empowerment evaluation of Fetterman (2005). The major principles were (a) modification concepts as self-assessment in order to apply the evaluation results to improve as necessary until the desired goals were achieved, (b) competency development concepts via training and consultation to give knowledge during operation, (c) concepts of reference evidence identification as evidence of self-assessment in order to adjust and improve and evidence of advancement expression of operation with being empowered by evaluators. The researcher applied the empowerment evaluation to integrate with the concepts of educational evaluation in order to synthesize the draft of the evaluation model.

(3) Draft the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing which consisted of the followings:

3.1 Evaluation objectives

3.2 Objects evaluated

3.3 Evaluation operation: evaluators, evaluation tools and methods

3.4 Evaluation result judgement

3.5 Evaluation result report and utilization for developing instructional management

(4) Determine the details of evaluation objectives which were feedback information for science teachers so that they could develop the instructional management that enhanced the abilities in reading, critical thinking, and writing of basic education students.

(5) Determine the details of the objects evaluated which were components and indicators of instructional management that were partially gained from the operation in Item 3.2.1.

(6) Determine the details of the evaluation operation which were evaluators, evaluation tools, and evaluation methods.

(7) Construct the evaluation criteria at the level of indicator quality and instructional management ability. The criteria details were applied from those of Somsak Phuvipadawat (2001).

Evaluation Criteria

Scores	**Interpretation**
0	The quality level was "need improvement" which needed urgent improvement. Those evaluated could not express behavior as identified in the scoring criteria.
1	The quality level was fair which needed to be improved to the higher level. Those evaluated expressed key behavior at a lower level than that determined in the criteria.
2	The quality level was good but still needed to be developed partially. Those evaluated expressed key behavior as determined in the scoring criteria, but there still were minor drawbacks.
3	The quality level was very good which could be a model for others. Those evaluated expressed behavior as identified completely which was higher than the scoring criteria.

(8) Construct the judgement criteria for evaluation results in a rubric format which identified differences of science teachers' operational behavior and performance results of instructional management. This was applied from Somsak Phuvipadawat's (2011).

Judgement Criteria

Average Scores	**Quality Level**
0.00 – 0.49	did not meet the criteria and needed to be improved urgently
0.50 – 1.49	did not meet the criteria and needed to be improved on important issues so that they gained higher quality

1.50 – 2.49 met the evaluation criteria, but still needed to be improved partially in unimportant issues so that they gained higher quality enough to be a model

2.50 – 3.00 higher than the criteria and could be a model for others

(9) Provide the computer program in order to process the evaluation results.

(10) Provide the guidelines for developing science teachers' instructional management based on components and indicators for instructional management.

(11) Provide the instructional manual of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing.

3.2.3 Identifying the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students, conducted by the experts

Identifying the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students, conducted by the experts before implementing, was performed as follows:

Key Informants

The key informants in the step of constructing the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students were 11 experts. These experts had to hold doctoral degrees or possess an academic rank equivalent to associate professor in a discipline of educational measurement and evaluation or curriculum and teaching.

Data Collecting Tool

Set 3: The quality evaluation form of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical

thinking, and writing of basic education students. There were nine items in a five-point rating scale format.

Steps of Constructing the Tool

(1) Explore concepts and theories relevant to the quality evaluation of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

(2) Construct the quality evaluation form of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students to cover the aspects of (a) complete propriety of the evaluation results which were accepted among those relevant, (b) practical feasibility, (c) clarity of the evaluation results which were valid, and (d) easiness during practice. This form contained nine items in a five-point rating scale format.

Consideration Criteria

5 meant the evaluation model was extremely appropriate in terms of propriety, feasibility, clarity, and easiness when being utilized.

4 meant the evaluation model was considerably appropriate in terms of propriety, feasibility, clarity, and easiness when being utilized.

3 meant the evaluation model was moderately appropriate in terms of propriety, feasibility, clarity, and easiness when being utilized.

2 meant the evaluation model was inconsiderably appropriate in terms of propriety, feasibility, clarity, and easiness when being utilized.

1 meant the evaluation model was least appropriate in terms of propriety, feasibility, clarity, and easiness when being utilized.

(3) Examine item quality in terms of content validity. This was performed by five experts in educational measurement and evaluation. They would consider the mean of the evaluation results. The consideration criteria were displayed as follows:

+1 if an expert thought that a question was congruent with a variable

0 if an expert was not certain that a question was congruent with a variable

–1 if an expert thought that a question was not congruent with a variable

According to the examination results of content validity, it was found that the IOC result of the evaluation model was 1.00.

Data Collection

The researcher submitted the evaluation form of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students to the experts by herself and by post.

Data Analysis

The data analysis of the evaluation form toward the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students by identifying means and standard deviation.

Interpretation Criteria

4.51 – 5.00 meant the evaluation model possessed propriety, feasibility, clarity, and easiness when utilized at an extremely high level.

3.51 – 4.50 meant the evaluation model possessed propriety, feasibility, clarity, and easiness when utilized at a high level.

2.51 – 3.50 meant the evaluation model possessed propriety, feasibility, clarity, and easiness when utilized at a moderate level.

1.51 – 2.50 meant the evaluation model possessed propriety, feasibility, clarity, and easiness when utilized at a low level.

0.51 – 1.50 meant the evaluation model possessed propriety, feasibility, clarity, and easiness when utilized at the least level.

3.3 Identifying the Utilization Results of the Evaluation Model for Developing Science Teachers' Instructional Management which Enhanced the Abilities in Reading, Critical Thinking, and Writing of Basic Education Students

This phase consisted of the operational steps as follows:

3.3.1 Try out the evaluation model

3.3.2 Identify the utilization results of the evaluation model

3.3.3 Evaluate the evaluation model after being utilized

3.3.1 Try out the evaluation model

Research operation

There were two steps in trying out the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students as follows:

(1) Preliminary Trying-out

Sample Group

The sample group employed in the preliminary trying-out was three science teachers from Pangtonpueng School and Ratdumri School, Uttaradit Primary Educational Service Area Office 1.

Data Collecting Tool

The researcher interviewed the science teachers in a format of unstructured interview.

Data Collection

The researcher herself collected the data by interviewing the science teachers in order to examine the contents and language use obtained from the science teachers' self-evaluation as determined in an instruction manual of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

Data Analysis

The data were analyzed by content analysis. It was found that the contents and language use were appropriate. There were recommendations in three issues which the researcher had modified and adjusted prior to being used in a major fieldwork as shown in Table 3.4.

Table 3.4 Problems, Recommendations, and Solution Guidelines Gained from Preliminary Fieldwork Testing

Problems and Recommendations	Solution Guidelines
1. The explanation about the steps in the instruction manual was not clear.	1. The explanation about the steps in the instruction manual was modified so that it was clearer.
2. The explanation of certain indicators was not clear.	2. The explanation of certain indicators was modified so that it was clearer.
3. The evaluation criteria of certain indicators were not clear.	3. The evaluation criteria of certain indicators were modified so that they were clearer.

(2) Trying-out in major fieldwork

Sample Group

The sample group used in trying out in major fieldwork was ten science teachers teaching in primary and junior high school levels of Pakfang Community School, Phichaidabhak 1 School, Ban-ngew-ngarm School, and Danwittaya Community School affiliated with Uttaradit Primary Educational Service Area Office 1, the Office of the Basic Education Commission.

Data Collecting Tool

The researcher interviewed the science teachers in a format of unstructured interview.

Data Collection

The researcher herself collected the data by interviewing the science teachers on the utilization results of the evaluation model in order to evaluate the propriety of the contents and utilization methods of the evaluation model.

Data Analysis

The data were analyzed by content analysis. It was found that the contents were appropriate. In terms of the utilization methods of the evaluation model, however, there were problems and recommendations in three issues which the researcher had modified and adjusted prior to being used authentically as shown in Table 3.5.

Table 3.5 Problems and Recommendations from the Science Teachers who Tried out in the Major Fieldwork, and Solution Guidelines

Problems and Recommendations	Solution Guidelines
1. The explanation on the utilization of the evaluation form on science teachers' instructional management was not clear.	1. The explanation on the utilization of the evaluation form on science teachers' instructional management was modified so that it was clearer.
2. The details on scoring criteria of certain indicators were not clear.	2. The details on scoring criteria of certain problematic indicators were modified so that they were clearer.
3. The analysis and processing the evaluation results were complicated.	3. The computer program was provided in order to facilitate the processing scores prior to authentic utilization.

3.3.2 Identify the Utilization Results of the Evaluation Model

Sample Group

In this research step, the sample group was an authentic one used to identify the utilization results of the evaluation model. It contained 30 science teachers teaching in primary and junior high school levels from schools affiliated with Uttaradit Primary Educational Service Area Office 1. They were selected from the science teachers volunteering into the project. Since it was necessary that the researcher and the sample group of science teachers cooperate in making decisions in every step from self-

evaluation to training and consultation in order to give knowledge while teaching until the science teachers could manage instruction by themselves. Therefore, the researcher needed to select teachers in the sample group who were voluntary.

Operational Methods

(1) Hold a meeting in order to inform and make those relevant, such as empowering people, administrators, and a sample group of science teachers, understand toward the evaluation model utilization.

(2) Empowering people, administrators, and science teachers studied the evaluation manual containing the details of the evaluation model which were (1) evaluation objectives, (2) objects evaluated, (3) evaluation operation, (4) evaluation result judgement, and (5) evaluation result reports and evaluation result utilization in developing instructional management.

(3) Empowering people, administrators, and science teachers evaluated the abilities in instructional management of the science teachers by determining the passing criteria at higher than 1.49. There were seven people who failed the criteria in three overall aspects. Moreover, in terms of each aspect, there were (1) seven people who failed the criteria of teaching preparation, (2) nine people who failed the criteria of instructional processes, and (3) nine people who failed the criteria of summary records, reports, storage, and learning result application.

(4) Empowering people developed the instructional management for a sample group of science teachers. There were two development methods which were as follows:

4.1 The training aiming at giving knowledge was held for developing 22 science teachers who failed the evaluation criteria of instructional management abilities both in an overall picture and in each aspect. The empowering people and the science teachers failing the evaluation criteria determined the training curriculum together which contained the content in both theories and practicum. The theoretical part contained the concepts of reading, critical thinking, and writing and the instructional management in three aspects, namely (1) teaching preparation focusing on instructional

plan writing, (2) instructional processes focusing on teaching methods, and (3) summary records, reports, storage, and learning result application. In terms of the practicum, those attending practical training wrote teaching plans of reading, critical thinking, and writing, teaching methods that developed reading, critical thinking, and writing, and summary records, reports, storage, and learning result application in developing reading, critical thinking, and writing.

The training aiming at giving knowledge to the science teachers who failed the evaluation criteria lasted for two days. The training schedule was shown as follows:

Day 1

Time	Training Topics/Responsible Parties
08.00-08.30	Registration
08.30-10.30	A lecture given by the experts in curriculum and teaching in science on the concepts of reading, critical thinking, and writing in science
10.30-12.00	A lecture given by the experts in curriculum of teaching science on teaching preparation, instructional management, summary records, reports, storage, and writing in science for students
13.00-16.30	A practice given by the experts in curriculum and teaching science in writing teaching plans of reading, critical thinking, and writing

Day 2

Time	Training Topics/Responsible Parties
08.00-08.30	Registration
08.30-09.30	A lecture given by the experts in curriculum and teaching in science on the concepts of teaching methods to develop reading, critical thinking, and writing
09.30-12.00	A practice given by the experts in curriculum and teaching science in writing teaching methods in order to develop reading, critical thinking, and writing in science
13.00-13.30	A lecture given by the experts in measurement and evaluation on summary records, reports, storage, and learning outcome application in developing reading, critical thinking, and writing
13.30-16.00	A practice given by the experts in measurement and evaluation on summary records, reports, storage, and learning outcome application in developing reading, critical thinking, and writing
16.00-16.30	Discussion and questions given by the empowering people and their team

4.2 Coaching and facilitating aiming to give advices during the science teachers' teaching was held in two features which were coaching and mentoring. Coaching was a study of progress in instructional management of the science teachers who passed the evaluation. It developed and increased the quality until it could be a model for others. Mentoring was a consultation during the teaching operation of the science teachers who failed the evaluation after the training. The consultation was quite similar to coaching, but it was still different in that the empowering people had to assist and suggest closely. In terms of facilitating, it was cooperated with the consultation in order to offer service and activate the instructional management development activities of the science teachers until they achieved the goals during the instructional management operation all the time.

(5) Empowering people, administrators, and science teachers evaluated the abilities in instructional management of the science teachers after being developed based on the evaluation model. The evaluation results were then compared with those before being developed, and it revealed that everyone passed the evaluation criteria.

(6) The empowering people questioned on the attitudes of the sample group of the science teachers toward the instructional management.

Data Collection Tools

Set 4: The evaluation form on the abilities of science teachers' instructional management which enhanced abilities in reading, critical thinking, and writing of basic education students. It was in a format of scoring rubrics consisting of scoring scale and scoring criteria.

Set 5: The questionnaire toward attitudes in instructional management which enhanced the abilities in reading, critical thinking, and writing based on the Basic Education Curriculum B.E. 2551. It contained 14 items in a format of five-point rating scale. The sample groups had to express their attitudes after utilizing the model.

The details on constructing Set 4 and Set 5 tools were shown as follows:

Set 4: The evaluation form on the abilities in science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. This form was in a format of scoring rubrics consisting of scoring scale and scoring criteria. The steps of constructing tool and identifying tool quality for Set 4 were shown as follows:

(1) Explore concepts and research relevant to the evaluation of components and indicators of the abilities in instructional management obtained from Item 3.1 and the instructional management that was in accordance with the Basic Education Curriculum B.E. 2551 in order to synthesize the components and indicators of the abilities in instructional management that enhanced the abilities in reading, critical thinking, and writing of basic education students.

(2) Synthesize the components and indicators of science teachers' abilities in instructional management that enhanced the abilities in reading, critical thinking, and writing of basic education students. (The details were presented in Item 3.2: Constructing and Identifying the Quality of the Evaluation Model, Items 3.3.1 and 3.3.2.)

(3) Examine quality in terms of content validity which could be performed by seven experts in curriculum, teaching, and measurement and evaluation by means of analyzing the Item Objective Congruence Index (IOC). It was found that the tool possessed the IOC at 0.86-1.00.

(4) Examine the inter-rater reliability. The researcher took the tool to an educational supervisor, a school administrator, and a science teacher so that they could evaluate three science teachers affiliated with Uttaradit Primary Educational Service Area Office 1 as the trying-out. The steps were shown as follows:

4.1 Explain the evaluation methods to the evaluators and those evaluated so that they could understand indicator elements and details.

4.2 Allow the evaluators to observe behavior, interview, and question those evaluated for one week.

4.3 The evaluators judged the evaluation results as determined in the criteria and informed the results to those evaluated.

The result of identifying the inter-rater reliability value via Spearman's rho (ρ) formula expressed that the reliability value was 0.87. This showed that the evaluation results gained from those three evaluators were highly correlated. (Boonjai Srisathitnarakul: 2012)

Set 5: The questionnaire on attitudes toward the instructional management that enhanced the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551. This contained 14 items and was in a format of a five-point rating scale. The steps of tool construction and tool quality identification of Set 5 were shown as follows:

(1) Explore documents and research relevant to attitudes and instructional management that enhanced the abilities in reading, critical thinking, and writing of basic education students in order to construct the questionnaire and provide its draft.

(2) Construct the questionnaire on attitudes toward the instructional management that enhanced the abilities in reading, critical thinking, and writing of basic education students.

Consideration Criteria

5 meant extremely high
4 meant high
3 meant moderate
2 meant low
1 meant extremely low

(3) Examine the content validity of the questionnaire which was performed by eight experts in measurement and evaluation. It was found that the IOC was 1.

(4) Try out with the teachers in opportunity expansion schools affiliated with Phrae Primary Educational Service Area Office 2 who were not included in a sample

group in order to identify the reliability. It was found that the reliability value of the entire questionnaire was 0.98.

(5) Modify, adjust, type in order to be authentically employed.

Data Collection

(1) The researcher herself took "Set 4: The evaluation form on the abilities in science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students" to collect data from June to August, 2015 at the schools that contained the science teachers as the sample group. This was conducted two times. One was evaluated to gain information about the evaluation results so that they could be used to develop science teachers' instructional management. The other was evaluated after being developed based on the methods of the evaluation model. The abilities in instructional management both before and after being developed were then compared.

(2) The researcher herself took "Set 5: The questionnaire on attitudes toward the instructional management that enhanced the abilities in reading, critical thinking, and writing in accordance with the Basic Education Curriculum B.E. 2551" to collect data at the schools.

Data Analysis

(1) As for the evaluation form of science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students, the data were analyzed by identifying frequency, percentage, mean, and Wilcoxon Rank Test. (The details of the interpretation criteria were presented in Item 3.2.2, Numbers 7 and 8.)

(2) As for the questionnaire on attitudes toward the instructional management which enhanced the abilities in reading, critical thinking, and writing based on the Basic Education Curriculum, the data were analyzed by identifying mean and standard deviation. The interpretation criteria were determined as follows:

4.51 – 5.00 referred to extremely high level of attitude.
3.51 – 4.50 referred to high level of attitude.
2.51 – 3.50 referred to moderate level of attitude.
1.51 – 2.50 referred to low level of attitude.
0.51 – 1.50 referred to least level of attitude.

3.3.3 Evaluate the Quality of the Evaluation Model

Sample Group

In this research step, the sample group was an authentic one who would evaluate the evaluation model. There were 30 science teachers teaching in primary level and junior high school level from Uttaradit Primary Educational Service Area Office 1. They were selected from the science teachers volunteering into the project.

Data Collecting Tool

Set 6: The evaluation form used to evaluate the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. It contained 23 items and was in a five-point rating scale format.

Tool Construction and Quality Identification

(1) Explore documents and research relevant to the evaluation of model quality and construct question items for science teachers so that they could evaluate the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.

(2) Construct the evaluation form in order to be used to evaluate the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students. The form contained 23 items and was in a five-point rating scale format.

Consideration Criteria

5 meant the evaluation model contained supreme standards in utilization, feasibility, ethical propriety, and accuracy as set in that evaluation item.

4 meant the evaluation model contained high standards in utilization, feasibility, ethical propriety, and accuracy as set in that evaluation item.

3 meant the evaluation model contained moderate standards in utilization, feasibility, ethical propriety, and accuracy as set in that evaluation item.

2 meant the evaluation model contained low standards in utilization, feasibility, ethical propriety, and accuracy as set in that evaluation item.

1 meant the evaluation model contained slightest standards in utilization, feasibility, ethical propriety, and accuracy as set in that evaluation item.

(3) Examine the content validity performed by the eight experts in curriculum, teaching, and measurement and evaluation. This could be analyzed by identifying the Item Objective Congruence Index (IOC), and it was found that the IOC was 0.88-1.00.

(4) Modify as suggested by the experts prior to being utilized.

Data Collection

The researcher took the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students to collect data after being utilized completely in August, 2015 with the sample group of 30 science teachers. The evaluation model was used as an evaluation tool by those who employed the evaluation model.

Data Analysis

The data analysis of the evaluation form for the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, analyzing, and writing of basic education students was performed by identifying mean and standard deviation.

Interpretation Criteria

4.51 – 5.00	meant	the model contained supreme standards in utility, feasibility, ethical propriety, and accuracy as set in that evaluation item.
3.51 – 4.50	meant	the model contained high standards in utility, feasibility, ethical propriety, and accuracy as set in that evaluation item.
2.51 – 3.50	meant	the model contained moderate standards in utility, feasibility, ethical propriety, and accuracy as set in that evaluation item.
1.51 – 2.50	meant	the model contained low standards in utility, feasibility, ethical propriety, and accuracy as set in that evaluation item.
0.51 – 1.50	meant	the model contained slightest standards in utility, feasibility, ethical propriety, and accuracy as set in that evaluation item.

The aforementioned research operational steps could be summarized as shown in Table 3.6.

Table 3.6 Summary of Research Methodology

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
(1) To explore instructional management conditions, knowledge and understanding in instructional management, and needs and necessity in developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.	741 science teachers in the educational institutes in Phitsanulok and Uttaradit which were obtained by multi-stage random sampling.	(Set 1) Part 1: General information about teachers and education institutes Part 2: Conditions of instructional management	(1) Examine the content validity by 5 experts and the IOC result was 0.8-1.00. (2) The validity value was 0.97.	(1) Construct a questionnaire. (2) Send the questionnaire in person and by post. (3) Examine the questionnaire completion returned. (4) Analyze the conditions of the instructional management enhancing the abilities in reading, critical thinking, and writing.	(1) Analyze the content validity via IOC formula. (2) Analyze the validity via Cronbach Alpha formula. (3) Identify frequency and percentage of science teachers' general information. (4) Identify mean and standard deviation of operational conditions.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
Objective 1 (continued)	741 science teachers in the educational institutes in Phitsanulok and Uttaradit which were obtained by multi-stage random sampling.	(Set 1) Part 3: Knowledge and understanding toward instructional management	(1) Examine the content validity by 5 experts and the IOC result was 0.8-1.00. (2) Examine the quality of each item; the difficulty value was 0.20-0.68. The discrimination value was 0.24-0.92. (3) Examine the validity value via analyzing internal correlation and trying out with a sample group of 50 people. The validity value was 0.70.	(1) Construct a questionnaire. (2) Send the questionnaire in person and by post. (3) Examine the questionnaire completion returned. (4) Analyze and group knowledge and understanding of the concepts of the instructional management enhancing the abilities in reading, critical thinking, and writing.	(1) Analyze the content validity via IOC formula. (2) Analyze the difficulty value via a simple formula. (3) Analyze the validity via Kr-20 formula. (4) Identify frequency and percentage of knowledge and understanding toward the instructional management enhancing the abilities in reading, critical thinking, and writing. Rank the order of knowledge and understanding by comparing with the percentage and group in the levels of high, moderate, and low knowledge groups.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
Objective 1 (continued)	741 science teachers in the educational institutes in Phitsanulok and Uttaradit which were obtained by multi-stage random sampling.	(Set 1) Part 4: Needs and necessity in developing instructional management which enhanced the abilities in reading, critical thinking, and writing in basic education students	(1) Examine the content validity by 5 experts and the IOC result was 0.8-1.00. (2) Examine the validity value via analyzing internal correlation and trying out with a sample group of 50 people. The validity value of likely knowledge and abilities was 0.97; and that of authentic knowledge and abilities was 0.98.	(1) Construct a questionnaire. (2) Send the questionnaire in person and by post. (3) Examine the questionnaire completion returned. (4) Analyze and group the needs and necessity in developing the instructional management enhancing the abilities in reading, critical thinking, and writing.	(1) Analyze the content validity via IOC formula. (2) Analyze the validity via Cronbach Alpha formula. (3) Analyze and rank the needs and necessity in developing the instructional management enhancing the abilities in reading, critical thinking, and writing of science teachers via PNI formula.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
(2) To construct and identify the quality of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.	294 science teachers affiliated with Uttaradit Primary Educational Service Area Office 1	Set 2: Questionnaire on the appropriateness of the indicators toward science teachers' abilities in instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students	(1) Examine the content validity by 8 experts and the IOC result was 0.75-1.00. (2) Examine the validity value via analyzing internal correlation and trying out with a sample group of 50 people. The validity value was 0.95.	(1) Construct a questionnaire. (2) Send the questionnaire in person and via educational supervisors of the school group network. (3) Examine the questionnaire completion returned. (4) Analyze the components and indicators of instructional management.	(1) Analyze the content validity via IOC formula. (2) Analyze the validity via Cronbach Alpha formula. (3) Analyze the components and indicators via the exploratory factor analysis.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
Objective 2 (continued)	11 experts in measuring and evaluating and curriculum and instruction	(Set 3) The quality evaluation form of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students for the experts	Examine the content validity by five experts. The IOC value was 1.00.	(1) Study documents and relevant research. (2) Study the findings in Item 3.1. (3) Examine the model validity. (4) Analyze the model evaluation results.	Analyze the evaluation results in terms of propriety, feasibility, clarity, and easy-to-use property via identifying the mean and standard deviation.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
(3) To identify the utilization results of the evaluation model for developing science teachers' instructional management which enhanced the abilities in reading, critical thinking, and writing of basic education students.	(1) A sample group for the preliminary fieldwork, namely 3 science teachers	The researcher interviewed the sample group in terms of contents and languages.		(1) Try out the evaluation model for developing instructional management in the preliminary group. (2) Analyze opinions toward contents and language use in model utilization manual.	Content analysis
	(2) A sample group for the main fieldwork, namely 10 science teachers	The researcher interviewed the sample group regarding contents and usage.		(1) Try out the evaluation model for developing instructional management in the main fieldwork group. (2) Analyze opinions toward usage and evaluation criteria of model utilization manual.	

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
Objective 3 (continued)	A sample group of an authentic trying-out group, name 30 science teachers	(Set 4) The evaluation form on the abilities of science teachers' instructional management which enhanced abilities in reading, critical thinking, and writing of basic education students	(1) Examine the content validity by 7 experts and the IOC result was 0.86-1.00. (2) Examine the inter-rater reliability; the validity value was 0.87.	(1) Evaluate the sample group of science teachers on their abilities in instructional management via the evaluation model. (2) Process data, analyze, and report the evaluation results of the abilities in instructional management via a computer program in order to apply the results to develop the instructional management. (3) Evaluate science teachers' instructional management after being developed. (4) Compare science teachers' abilities of the sample groups before and after being developed.	(1) Analyze the content validity via the IOC formula of Set 4. (2) Analyze the inter-rater validity via Spearman's Rho. (3) Analyze the evaluation results of the instructional management by identifying the frequency and percentage. (4) Analyze the comparison results of science teachers' abilities via Wilcoxon Ranks Test.

Table 3.6 (continued)

Objectives	Sample Group	Research Tools	Quality Examination of Research Tools	Operational Methods	Data Analysis
Objective 3 (continued)	A sample group of an authentic trying-out group, name 30 science teachers	(Set 5) The questionnaire toward attitudes in instructional management of science teachers	(1) Examine the content validity by 8 experts and the IOC result was 1.00. (2) Examine the validity value via analyzing internal correlation and trying out with a sample group of 50 people. The validity value was 0.98.	Analyze attitudes toward the instructional management.	(1) Analyze the content validity of the questionnaire via IOC formula. (2) Analyze the validity via Cronbach Alpha formula. (3) Analyze the attitudes toward the instructional management by identifying mean and standard deviation.
		(Set 6) The evaluation form used to evaluate the quality of the evaluation model for developing the instructional management by the science teachers who used the model	Examine the content validity by 8 experts and the IOC result was 0.88-1.00.	Evaluate the model quality by the science teachers in the sample group.	Analyze the evaluation results on feasibility, ethical propriety, accuracy, possibility of the evaluation model by identifying mean and standard deviation.