

The Development of Competency in Measurement and Evaluation of Mathematics Learning Using Coaching for Pre-service Teachers, Suan Sunandha Rajabhat University

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Abstract

The objectives of this research were: 1) to develop the competency in measurement and evaluation of mathematics learning using coaching for student teachers at Suan Sunandha Rajabhat University; and 2) to study the effects of using the coaching technique to develop the competency in measurement and evaluation of mathematics learning for student teachers at Suan Sunandha Rajabhat University.

The sample, obtained through cluster random sampling, consisted of 30 Mathematics major students at Suan Sunandha Rajabhat University from a total enrollment of 250 students in the academic year 2567 (2024).

The experimental instruments included: 1) 10 lesson plans, with activities conducted over 15 weeks; 2) a 5-level competency assessment form for mathematics learning measurement and evaluation; and 3) a written mathematics learning measurement and evaluation achievement test, consisting of 7 items with a maximum score of 25 points. The statistics used for data analysis were the mean ($\bar{x}$), standard deviation (S.D.), percentage, and t-test (one-sample t-test).

The research findings indicated that: 1) The competency in mathematics learning measurement and evaluation among the sample students, following instruction using the coaching technique, was at a Good level (mean score percentage of 82.15%, standard deviation of 4.21). 2) The average achievement score on the mathematics learning measurement and evaluation test for the sample was 16.22 points, equivalent to 64.88%, with a standard deviation of 3.24 points. the sample group's learning achievement in mathematics learning measurement and evaluation, after instruction using the coaching technique, was significantly higher than the 70% criterion at the .05 level."

Keywords: Competency, Measurement and Evaluation, Coaching

1. Introduction

The delivery of mathematics instruction must be adapted to suit the current era. Mathematics teachers must continuously seek knowledge and develop themselves. Modern teachers need to integrate contemporary media and technology into their instruction.

Instructors who teach student teachers also need to find strategies to develop various expertise in mathematics student teachers, such as competency in mathematics instruction, competency in measurement and evaluation, and skills in organizing various mathematical activities. Using diverse techniques will help promote and develop these different competencies in mathematics student teachers.

For example, the research by Punyaphol Chanfoi et al (2024) studied the results of using the 5E Instructional Model combined with cooperative learning on the development of skills in organizing mathematics learning activities. The research found that the mathematics learning activity organization skills of third-year Mathematics major students, after instruction using the 5E model combined with cooperative learning, reached 83.56%, which is at a Good level. This is because the process steps in the 5E model lead students to carry out systematic work planning and engage in formal cooperative work. The instructor plans, organizes, sets rules, and provides methods to encourage students to converse, discuss, and exchange opinions to reach conclusions until the predetermined objectives are met.

Similarly, developing competency in measurement and evaluation is an extremely important and necessary aspect for student teachers, as it enables them to verify whether their instruction has achieved its objectives and to subsequently use the results of learner assessment to improve teaching and further develop the learners

Coaching is one method of professional development that serves as an effective alternative for developing educational personnel (Neufeld and Roper, 2003), which ultimately affects the quality of student learning and develops the competency of the teachers into leaders in instructional development. The coaching process applied in educational institutions often includes mutual teaching observation, collaborative feedback and learning, and the integration of a coaching and mentoring system. This system is adopted as a guideline for developing teachers' instructional competency through collaboration between coaches or mentors—experienced faculty members in instructional supervision from the university—and in-service teachers, who collectively learn and set shared goals to improve and develop the design of the teachers' instruction for efficiency and effectiveness.

From the study of relevant documents, theories, and research, academics have defined the term 'Competency' as a behavioral characteristic resulting from Knowledge, Skill, Ability, and Other Characteristics that leads an individual to successfully perform a job and achieve organizational goals. Alternatively, competency can be described as behavior that expresses an individual's ability to perform work well, resulting from Knowledge, Skill, Attitude, and Attribute, which serve as the foundation for excellent performance (McClelland, 1973)

In terms of developing the mathematics instructional competency of teachers and student teachers, this includes: competency in designing personalized mathematics learning, creating mathematics learning innovations, coaching for mathematics learning, and building a mathematics learning community. These are essential competencies that enable student teachers to systematically manage mathematics instruction, possess deep knowledge in their

own field (SEAMEO INNOTECH, 2016), design learning activities that promote and support mathematics learning through analytical thinking (Paithoon Sinlarat, 2024, Yuen Poovorawan, 2017), provide experiences for learners to exchange knowledge collaboratively (Suchatvee Suwansawat, 2019), train learners to have technology and information skills, and integrate digital-era technology into mathematics teaching (Wutthichai Phudee, 2020; UNESCO, 2018), as well as constantly monitor, supervise, and provide feedback to enable learners to develop their full potential (SEAMEO INNOTECH, 2018; UNESCO, 2018)

For these reasons, the researcher, in their capacity as an instructor for mathematics student teachers, is interested in developing the competency in measurement and evaluation of mathematics learning using coaching for mathematics major students in the Faculty of Education at Rajabhat University, in order to use the findings for the further development of the students.

Literature Review

1. Competency

McClelland defined competency as an underlying characteristic of an individual that is causally related to superior or criterion-referenced performance in a job or situation.

Furthermore, others have defined competency as the individual's characteristics in utilizing their knowledge, skills, and attributes to perform a certain job (Tisana Khammanee, 2019), enabling the individual to complete the work successfully and with a higher than usual standard (Tuen Thongkaew, 2018. Anuchit Hunsawadkul, 2018). The components within this definition therefore comprise only three parts: knowledge, skills, and attributes.

Consistent with McClelland's concept of competency, it is stated that competency is composed of knowledge, skills, attitude, and motivation to achieve excellent results in the work.

According to the concept proposed by McClelland, competency consists of four main components (McClelland, 1973)

1. Knowledge: Refers to the knowledge and understanding of principles, the essential substance, such as knowledge about construction, research, or astronomy, etc.
2. Skill: Refers to what is required to be performed effectively, such as computer skills, cooking skills, or speaking skills, etc. Acquired skills stem from a foundation of knowledge and can be performed fluently and quickly.
3. Attitude: Refers to the internal motivation or drive that causes an individual to exhibit goal-oriented or success-oriented behavior, etc.
4. Attribute: Refers to the individual's inherent personality traits (traits) that describe the person, such as being reliable and trustworthy, or possessing leadership qualities, etc.

2. Competency in Measurement and Evaluation of Mathematics Learning for Student Teachers

Chouang Utitasarn, (2022) defined the competency in creative mathematics instructional management for pre-service teacher at Suan Sunandha Rajabhat University as the behavioral expression of student teachers' ability to design and manage mathematics learning, create mathematics learning innovations that address learner differences, stimulate, support,

and motivate learners to succeed in their studies, and collaborate with others for the development of mathematics instruction.

Suppamas Chumkaew,(2021) stated that the measurement and evaluation competency for modern-era teachers uses the conceptual framework based on the competency standards of the international confederation (AFT, N. NEA. American Federation of Teachers, National Council on Measurement in Education & National Education Association (1990). These standards define teachers' competency in evaluating student learning from a concept that integrates assessment as part of teaching and learning, consisting of seven competencies:

1. Competency in selecting measurement and evaluation methods.
2. Competency in developing measurement and evaluation methods.
3. Competency in administering tests, scoring, and interpreting the results of both external assessments and teacher-developed methods.
4. Competency in using assessment results.
5. Competency in developing grading procedures used in student evaluation.
6. Competency in communicating assessment results.
7. Competency in the ethics of assessment.

This article aims to present measurement and evaluation competency in the 21st century, the concept of learning assessment, and the challenges and perspectives regarding the measurement and evaluation competency of modern teachers."

3. Coaching

Coaching is a method for developing learners to possess various competencies that are essential for their future careers (Marut Patpon,2019). It focuses on achieving the objectives of a particular task or assisting learners to translate their existing and/or acquired knowledge and understanding into practice.

Regarding coaching in the teaching profession defined coaching as a professional development activity that promotes learners by encouraging reflection, discussion, practical training, and the development of self-awareness concerning their instructional management and practice, making them increasingly efficient and effective, which in turn leads to their own professional advancement.

Coaching for competency enhancement is a process of developing learners' competencies, where the teacher acts as a guide, motivator, assistant, and supporter to help learners discover their potential, leading to enthusiasm and inspiration to develop their competencies to the fullest possible extent.

The role of the coach is to constantly ask questions to stimulate the learner's desire and motivation for self-development, guide them to set goals, and provide support to foster learning and development. The coach also provides encouragement and guidance to help learners practice self-assessment, gives feedback, and suggests directions for further development and evaluation.

The difference between being a coach and being a mentor is that a coach does not tell the learner what to do, but rather provides stimulating questions, creates alertness, and offers guidance to the learner."

Coaching Techniques

In organizing learning activities intended to achieve the desired learner competencies, the instructor should employ the following coaching techniques to enhance competency:

Trust and Rapport Building: The credibility and mutual trust between the instructor and the learner are crucial factors that ensure the guidance process is smooth and effective

Empowerment: This is a process that helps the instructor discover ways to enable learners to build self-confidence and develop themselves to their fullest potential (Marut Patpon, 2019)

Providing Information to Stimulate Learning: Learners should be consistently encouraged to link their knowledge, allowing them to expand their body of knowledge and translate it accurately into practice (Marut Patpon, 2562 [2019]).

Designing or Defining Scenarios that allow learners to apply their existing knowledge to perform specific tasks in line with their needs, interests, and aptitudes (Marut Patpon, 2019).

After Action Review and Reflection (AAR): Reflection on the work performed is a method that helps learners review their past actions and draw conclusions to form guidelines for future work (Marut Patpon, 2019)

The researcher applied these coaching techniques to stimulate learning, supervise, monitor, and follow up with the learners throughout the course curriculum to enhance the competency in mathematics learning measurement and evaluation for student teachers at Suan Sunandha Rajabhat University.

2. Objectives

- 1.To develop the competency in measurement and evaluation of mathematics learning using coaching for pre-service teacher at Suan Sunandha Rajabhat University.
2. To study the effects of using the coaching technique to develop the competency in measurement and evaluation of mathematics learning for student teachers at Suan Sunandha Rajabhat University.

3. Methodology

Population and Sample

Population used in this research included 250 Mathematics major students at Suan Sunandha Rajabhat University who registered in the academic year 2567 (2024).

Sample used in this research were 30 third-year Mathematics major students at Suan Sunandha Rajabhat University, studying in the first semester of the academic year 2567 (2024). The sample was obtained through cluster sampling.

Research Instruments

The instruments used for the research on the competency in measurement and evaluation of mathematics learning for Mathematics major students at Suan Sunandha Rajabhat University were as follows:

1. Lesson Plans: Ten lesson plans were developed, with activities spanning 15 weeks.
2. Competency Assessment Form: A 5-level quality assessment form for mathematics learning measurement and evaluation competency, with the following quality levels defined:

Percentage Range	Quality Level
86 – 100%	Excellent
76 – 85%	Good
66 – 75%	Moderate
51 – 65%	Fair
0 – 50%	Poor

3. Achievement Test: A learning achievement test on mathematics learning measurement and evaluation, which was a written response test consisting of 7 items with a maximum score of 25 points.

Data Collection

The researcher proceeded according to the following steps:

1. The researcher prepared the third-year students who constituted the sample group.
2. The sample group was informed about the research process, particularly that their characteristics and abilities in mathematics learning measurement and evaluation would be assessed.
3. The research was conducted by observing and collecting data on the mathematics learning measurement and evaluation characteristics of the third-year students in the sample group throughout the first semester of the academic year 2567 (2024).
4. The scores obtained from the sample students' assessments were analyzed using statistical methods, and the research results were summarized.

Data Analysis and Statistics Used

Data were analyzed in the following sequence:

1. Determining basic statistics, namely percentage, arithmetic mean, and standard deviation.
2. Determining the statistics used to check the quality of the research instruments, namely the Index of Congruence.

Statistics Used for Data Analysis:

The researcher used the following statistics for data analysis in this research:

1. Basic Statistics: 1.1 Percentage 1.2 Arithmetic Mean (Mean) 1.3 Standard Deviation (S.D.)
2. Statistics for Checking Instrument Quality: The appropriateness and congruence of the test items with the objectives were checked by calculating the Index of Item-Objective Congruence (IOC).

4. Results

The research, titled Competency in Measurement and Evaluation of Mathematics Learning for Mathematics Major Students at Suan Sunandha Rajabhat University, employed the following research instruments and quality assurance results:

Lesson Plans: Ten lesson plans were developed. After being reviewed for quality by three experts, they achieved a quality level of 4.25 out of a maximum of 5 points, indicating that the lesson plans were highly appropriate for use. They were then piloted with students outside the sample group, and the data obtained were used to revise the plans.

Assessment Instruments: The instruments included a 5-level assessment form for mathematics learning measurement and evaluation competency and an achievement test on the topic of mathematics learning measurement and evaluation. Both instruments were reviewed for quality by three experts and achieved an Index of Item-Objective Congruence (IOC) score of 1.00 for all items.

The results from the evaluation of the Mathematics Learning Measurement and Evaluation Competency of 32 Mathematics major students at Suan Sunandha Rajabhat University, following instruction utilizing the coaching technique, using an assessment form throughout the instructional period. The scores were summarized as percentages, and five quality levels were determined as follows:

Percentage Range	Quality Level
86 – 100%	Excellent
76 – 85%	Good
66 – 75%	Moderate
51 – 65%	Fair
0 – 50%	Poor

The individual assessment results are as follows: From table 1

Table 1

The results of the competency assessment in mathematics learning measurement and evaluation

No.	Score (%)	Quality Level	No.	Score (%)	Quality Level
1	84	Good	17	84	Good
2	74	Moderate	18	83	Good
3	85	Good	19	74	Moderate
4	77	Good	20	81	Good
5	80	Good	21	78	Good
6	81	Good	22	82	Good
7	83	Good	23	85	Good
8	79	Good	24	80	Good

9	77	Good	25	84	Good
10	86	Excellent	26	88	Excellent
11	89	Excellent	27	90	Excellent
12	87	Excellent	28	87	Excellent
13	76	Good	29	87	Excellent
14	79	Good	30	80	Good
15	83	Good	31	79	Good
16	83	Good	32	84	Good

From table1, The individual assessment results revealed that 6 students had an Excellent level of competency in mathematics learning measurement and evaluation, 24 students were at the Good level, and 2 students were at the Moderate level. These evaluation results can be presented in a graph format, as shown in Figure 1.

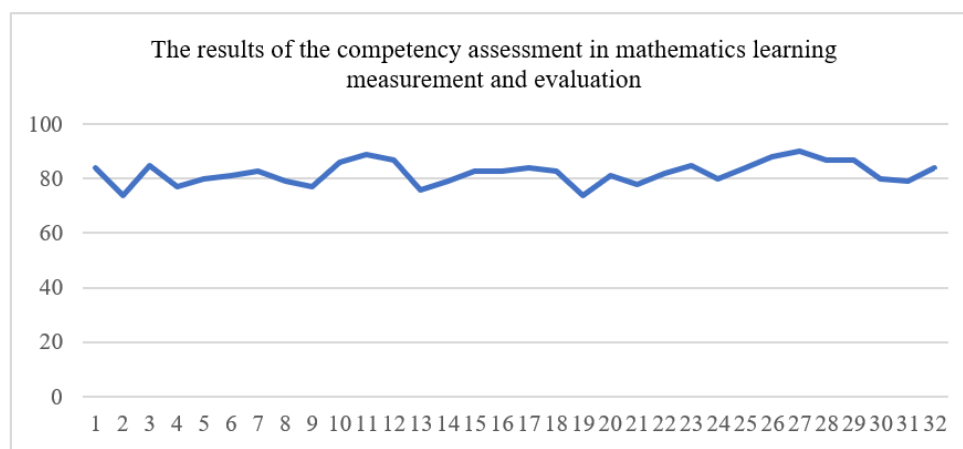


Figure 1

The overall results of the competency assessment in mathematics learning measurement and evaluation for 32 Mathematics major students at Suan Sunandha Rajabhat University are presented in Table 2

Table 2

The overall results of the competency assessment in mathematics learning measurement and evaluation

Sample Size (N)	Average Score (%)	Standard Deviation (S.D.)
32	82.15	4.21

The overall results of the competency assessment in mathematics measurement and evaluation showed that the 32 Mathematics major students had an average score of 82.15%, with a standard deviation of 4.21. This means that most of the students possess competency at a Good level.

The learning achievement test on mathematics learning measurement and evaluation, which was a written response test consisting of 7 items with a maximum score of 25 points From table 3,4

Table 3

The learning achievement test on mathematics learning measurement and evaluation

No.	Score (25)	Score (%)	No.	Score (25)	Score (%)
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1	18	72	17	17	68
2	10	40	18	17	68
3	18	72	19	10	40
4	13	52	20	14	56
5	15	60	21	14	56
6	14	56	22	17	68
7	18	72	23	17	68
8	12	48	24	16	64
9	13	52	25	16	64
10	18	72	26	21	84
11	21	84	27	22	88
12	19	76	28	19	76
13	12	48	29	22	88
14	15	60	30	15	60
15	18	72	31	13	52
16	15	60	32	20	80

Table 4

No.	Score (25)	Score (%)	Standard Deviation (S.D.)	t	sig
32	16.22	64.88	3.24	2.13	.041

From Tables 3 and 4, The average achievement score on the mathematics learning measurement and evaluation test for the sample was 16.22 points, equivalent to 64.88%, with a standard deviation of 3.24 points. the sample group's learning achievement in mathematics learning measurement and evaluation, after instruction using the coaching technique, was significantly higher than the 70% criterion at the .05 level.

5. Conclusion And Future Work

The research on the development of mathematics learning measurement and evaluation competency among Mathematics major students in the Faculty of Education, Suan Sunandha Rajabhat University, found that out of 32 students, 6 students achieved an Excellent level of competency, 24 students achieved a Good level, and 2 students achieved a Moderate level. The overall evaluation results showed that the average score was 82.15%, with a standard deviation of 4.21, indicating that the majority of the students possess competency in mathematics learning measurement and evaluation at a Good level. The average achievement score on the mathematics learning measurement and evaluation test for the sample was 16.22 points, equivalent to 64.88%, with a standard deviation of 3.24 points. the sample group's learning achievement in mathematics learning measurement and evaluation, after instruction using the coaching technique, was significantly higher than the 70% criterion at the .05 level."

In the instructional management of the Mathematics Measurement and Evaluation course using the coaching technique, students initially learned the principles and theories of measurement and evaluation. This was then followed by practical application: designing measurement instruments based on mathematics topics that the students in the group were interested in and proficient at. They constructed the assessment tools, had them verified by experts, administered them experimentally to 30 students, and performed statistical analysis to evaluate the tests they created. Subsequently, they revised the tests, presented the results in class, and compiled a final report. Throughout the instruction, the lecturer continuously monitored, supervised, provided suggestions, and followed up on the work, which led to the

individual development of the students' mathematics measurement and evaluation competency.

The students were able to correctly design measurement and evaluation instruments by applying principles and theories. This aligns with the coaching technique described by Marut Patpon (2562 [2019]), which states that coaching should involve providing information to stimulate learning, encouraging learners to regularly connect knowledge to accurately translate their body of knowledge into practice. This includes designing or defining situations that allow learners to apply their existing knowledge to specific tasks that align with their needs, interests, and aptitudes.

The coaching implemented by the instructor in this course successfully developed various competencies in the students that are components of measurement and evaluation competency. This is consistent with Suppamas Chumkaew, 2021), who stated that the measurement and evaluation competency of modern teachers uses the conceptual framework based on the competency standards of the international confederation: the American Federation of Teachers, National Council on Measurement in Education & National Education Association (1990). These standards define the teacher's competency in evaluating student learning from a concept that integrates assessment as part of teaching and learning, comprising seven competencies: 1) Competency in selecting measurement and evaluation methods, 2) Competency in developing measurement and evaluation methods, 3) Competency in administering tests, scoring, and interpreting the results of both external and teacher-developed assessments, 4) Competency in utilizing assessment results, 5) Competency in developing grading procedures used in student evaluation, 6) Competency in communicating assessment results, and 7) Competency in the ethics of assessment.

Suggestions (Recommendations)

Suggestions for Utilizing Research Findings or Policy Recommendations

The findings of this research can be used as a guideline for curriculum lecturers /instructors to adjust or develop teaching models to enhance students' academic achievement.

The results of the study on the development of mathematics learning measurement and evaluation competency using the coaching technique showed that the competency level of Mathematics major students was Good. Therefore, relevant agencies involved in the development of mathematics student teachers can use these findings as a guideline to enhance the students' mathematics learning measurement and evaluation competency.

Suggestions for Future Research

Further research should be conducted to study the various sub-components of competency that contribute to the overall mathematics learning measurement and evaluation competency.

Future studies should investigate various factors that influence the mathematics learning measurement and evaluation competency of Mathematics major students, in order to create diverse approaches for individual student development.

Acknowledgements

I would like to express my sincere thanks to Suan Sunandha Rajabhat University for invaluable help throughout this research.

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