The Development of Teaching and Learning Potential of Mathematics Teachers about Statistics for Data Analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province

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Abstract

This research aims:1) to explore the teaching potential of mathematics teachers, 2) to develop a guideline for the development of the teaching potential of mathematics teachers and 3) to study the satisfaction of mathematics teachers about statistics for data analysis. Target group is 15 mathematics teachers. The tools are potential survey form, brainstorming recorded form, and satisfaction questionnaire. The statistics are mean and standard deviation. The results were found as follows:

1) The potentials of teaching and learning management of mathematics teachers about statistics for data analysis in content was appropriate to the knowledge and students' ability but the basic or advanced statistical knowledge for teachers' research did not achieve curriculum objectives in real situations. Technical aspects of teaching and learning found that students were also involved in solving individual problems. Media resources found that most of the instructors used the media as books, textbooks, and lacking of media from real life situations and for measurement and evaluation indicated that the problem was only focus on knowledge. The test should be focused on critical thinking and mathematical skills as PISA.

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2) The guideline of mathematics teachers potential development in statistics for data analysis consisted of preparation of dummy tables for data analysis, statistics and mathematics relevant and appropriate for research, descriptive statistics and writing instructions, statistical inference or advanced statistics, analysis of qualitative data, including content analysis and interpreting and summarizing of data, data display and interpretation and case study of data analysis and interpretation.

3) Satisfaction of mathematics teachers about statistics for data analysis was at high level.

Keywords: Mathematics teachers, guidelines, learning management

Introduction

Due to the policy of higher education according to the policy statement of the current minister of education must accelerate the problem of educational reform at the basic level to have quality and equal standards throughout all areas in which the strength of the educational institutions or local schools is necessary to link the policy implications between the two organizations. In particular, the role that higher education institutions in each area have to act as mentors for schools to develop local education in the local area. Higher education networks in 9 regions will be a mechanism to drive and encourage higher education institutions to be mentors to strengthen local schools.

At present, it is found that the states of teaching and learning mathematics about statistics and data analysis in schools, especially local schools that lack the opportunity to use technology to be used for statistical analysis of data effectively are not successful. In addition, some schools still lack teachers who have expertise in using statistics for direct data analysis, lack of experience in knowledge, thought, skill, process that can be used to learn things and use it in everyday life creatively. As a result, students perceive value and have a good attitude towards mathematics are not good. In addition, students do not have the ability to work in a systematic manner, lack of prudence, responsibility, judgment and low confidence. Therefore, raising awareness in allowing learners to see the importance of statistical content is very significant. Mathematics teachers should not give examples only, but also should be practiced in research experiments, creating statistical patterns (Maria *et. al.*, 2001:1).

Therefore, it is necessary to find suitable innovations that will encourage teachers to develop their potential in teaching mathematics about statistics for more efficient data analysis, including the development of instructional activities

on statistics for data analysis, using appropriate technology and communication such as analysis and interpretation of using statistical packages for data analysis.

Concepts, theories concerning the potential of teaching and learning management of mathematics teachers about statistics for data analysis

1. Learning management in the 21st century

In the 21st century (January 1, 2001 to December 31, 2100) the world has changed in every aspects, whether it be economic, social, scientific and technologies. So to be ready to receive changes in the world, the instructor must be alert and prepared to learn to have knowledge of the main subjects (have learning skills and develop learners to have the skills necessary in the 21st century, information technology skills, thinking and problem solving skills, communication skills and life skills). The P21 (Partnership for the 21st century Skills) network has classified the skills needed in the 21st century into 3 categories:

1.1 Learning and innovation skills, it includes creativity and innovation, critical thinking and problem-solving, communication and collaboration.

1.2 Information, media and technology skills, it includes information literacy, media literacy, technology and communication literacy (information, communication, and technology literacy).

1.3 Life and career skills, it includes flexibility and adaptability, initiative and self-direction, social skills and understanding of differences during the social and cross-cultural skills, being a creator or producer and having responsibility (productivity and accountability) and leadership and responsibility.

2. Using technology to teach high school mathematics.

2.1 Use technology to learn, this is because of learning mathematics at the upper secondary level is a study of more profound mathematical contents and emphasizes application in real life situations. Therefore, the use of technology in teaching and learning will help reduce unnecessary steps and increase the times to focus on the learners to achieve their learning goals. For example, statistics are content that relates to calculations and uses a large amount of quantitative information. If instructors use technology to learn, such as a spreadsheet or GeoGebra will help reduce calculation time, reduce calculation steps. It will make students have time in analytical thinking considering the reasonableness of the answer and focus on applying statistics to interpret more information. Calculations

about functions and hand graphing are quite time consuming and not the focus of learning. If the instructor uses technology to help for writing graph, writing tables, and writing some pictures such as the Geometer's Sketchpad (GSP) or GeoGebra will be able to manage learning that focuses on doing understanding of mathematical concepts and principles, and allow students to explore, observe and predict.

2.2 Use technology as a learning source in the educational world, there are many useful resources for teaching and learning, not only in the classroom but also students can study and research various information related to content and applications on the internet or other learning resources such as website, online encyclopedia or electronic textbooks (E-Book) etc., which students can search for information quickly. Therefore, the instructors should use these technologies to use in teaching and learning by allowing students to study by themselves and use the information that has been utilized through thoughtful analysis processes.

2.3 Use communication technology, the use of communication technology will make mathematics teaching more effective and useful in improving the skills and mathematical processes of learners both in the classroom and outside the classroom. Using technology to help present information, submit work assignments, or as informal teaching methods outside the classroom (Ministry of Education. 2017: 10-54).

3. The statistical literacy and data

Basic mathematics course content consists of probability, statistics and data, introduction to data analysis, and opinion polls for opinion polling content or survey of public opinion (public opinion survey) is added to the course to keep students abreast of the current society,especially in the matters of various polls, since the current survey and presentation of information in many poll formats in Thailand.The content in this section will allow students to check the credibility of each poll at the beginning. Teaching statistics in high school in Thailand, teachers do not have sufficient statistical knowledge. That is, statistics teachers are also math teachers who do not have enough understanding of statistical reasoning methods to teach statistics like teaching mathematics by representing values. They enter the formula rather than understanding, reasoning, explaining critical theory and criticizing the correctness of using statistics in data analysis. When lacking statistical reasoning,teaching statistics are the same as teaching mathematics. Because it lacks critical thinking in analyzing, synthesizing information. So it has collaborated with the faculty of applied statistics at National Institute of Development Administration (NIDA) according to the higher education network strategy by organizing the project to develop academic

potential for teaching and learning for statistics teachers in high school mathematics courses (Sakworawit, 2017: 1-3).

Objectives

1. To explore the potential of teaching and learning of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

2. To develop guidelines for the development of teaching potential of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

3. To study the satisfaction of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province, after using the guidelines to develop teaching potential.

Methodology

1. Population

Population or target group is 15 mathematics teachers, and one school director, Nachuak Phittayasan School who attended the meeting to express opinions on the potential of teaching and learning management of mathematics teachers about statistics for data analysis.

2. Tools and quality of research tools

2.1 The questionnaire has methods or creating and finding quality as follows.

1) Study course documents Mathematics Learning Group (Revised Edition 2017) according to the Core Curriculum of Basic Education BE 2008, guidelines for development of teaching and learning of Mathematics, teachers in the 21st century, principles and principles of Mathematics teaching and learning management, and the importance of using statistics for data analysis and concepts and theories related to their development.

2) Create a potential questionnaire for teaching and learning management of mathematics teachers about statistics for data analysis.

3) To find the quality of teaching potentials for teaching and learning of mathematics teachers about statistics for data analysis by the content validity expert (IOC), It is found that all questions were between 0.80 to 1.00 (according to the criteria of the IOC value is greater than or equal to 0.50).

2.2 Brainstorming form for the development of teaching and learning potential of mathematics teachers about statistics for data analysis, there are ways to create and find quality as follows:

1) Study the documents on the principles and guidelines for the management of teaching mathematics and documents about mathematics teachers and the importance of using statistics for data analysis and various research related to the development of teaching and learning potential of mathematics teachers about statistics for data analysis in term of operational training model.

2) Define the scope of brainstorming notes' issue topic.

3) Create a brainstorming record about the potential development of teachers in teaching and learning management of mathematics teachers about statistics for data analysis.

4) Find the quality of the brainstorming record by asking the experts to check the suitability of each questions. It is found that the suitability of each brain record question is at the highest level ($\overline{X}$ = 4.50, S.D = 0.400).

2.3 Questionnaire for satisfaction of math teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

1) Study documents about satisfaction for applying knowledge in using statistics for data analysis after operating training.

2) Set the scope of topics as follows: (2.1) Applying knowledge in using statistics for data analysis to benefit teaching in the classroom (2.2) Applying knowledge from training using statistics for data analysis to develop potential (2.3) Applying knowledge in solving classroom teaching problems (2.4) Applying knowledge from training to be a consultant or to solve problems of other teachers and (2.5) to apply knowledge from the training to expand in performing duties as an instructor more effectively and overview.

3) Create a satisfaction questionnaire.

4) Find the quality of the satisfaction questionnaire of mathematics teachers about statistics for data analysis by the content validity (IOC), it was found that the IOC values of all questions were between 0.80-1.00 (according to the criteria of the IOC value is greater than or equal to 0.50).

3. Data collection and data analysis

3.1 Data collection and data analysis in Phase 1.

1) Explain the purpose procedures for attendees to acknowledge the reasons and importance of organizing meetings to find common ways to develop

the potential of teaching and learning management of mathematics teachers about statistics for data analysis.

2) The facilitator opens the questions prepared by asking the participants' opinions and giving the participants the opportunity to discuss and express their opinions to determine the potential development of the teachers.

3) Concluded together as a meeting resolution to develop the potential of teaching and learning management of mathematics teachers about statistics for data analysis.

4) Data analysis,the researcher used data obtained from analyzing the potential of teaching and learning management of mathematics teachers about statistics for data analysis to find guidelines or steps for developing mathematics teacher potential about statistics for data analysis using preliminary statistics including content analysis, frequency and percentage.

3.2 Data collection and data analysis in Phase 2.

1) Coordinate with the head of the Mathematics group and the school administrators at Nachuak Phitayasan School so that clarify the objectives of brainstorming sessions, thereafter conducted brainstorming sessions with participants including mathematics teachers, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province, and one school administrator.

Participants discussed together about the development of teaching and learning potential of mathematics teachers about advanced statistics for the analysis of possible and appropriate data in practical terms.

2) Data analysis,the researcher used the information obtained from brainstorming sessions to analyze the content (Content Analysis) to determine various issues in the development manual for teaching and learning management of mathematics teachers, Nachuak Pittayasan School about advanced statistics for data analysis.

3) Conducting workshops according to the manual that can be given 2 times, which is Wednesday 17 July 2018, from 13.00 - 16.30 hrs and Wednesday 7 August 2018, from 13.00 - 16.30 hrs.

3.3 Data Collection and Data Analysis in Phase 3.

1) The researcher conducted the self-collection of information about satisfaction with the application of statistical knowledge for data analysis to be used in the teaching of mathematics courses in the use of statistics for data analysis after finishing two workshops. The respondents were 15 mathematics teachers, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

2) Evaluate the satisfaction of mathematics teachers on the application of statistical knowledge for data analysis to be used in the teaching and learning of mathematics courses by using mean and standard deviation.

The results of potential development for teaching and learning of mathematics teachers about statistics for data analysis were as follows:

1. The findings of Phase 1: Survey of the potential of teaching and learning of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

By studying some corresponding documents about statistics for data analysis, it could be summarized as four main points in exploring the potential of teaching and learning of mathematics teachers about statistics for data analysis as follows:

1.1 Content, it consisted of (1) creating a puppet table to prepare data analysis (2) relevant statistics and mathematics that were suitable for research (3) descriptive statistics and written data analysis instructions by computer (4) statistics inference and written data analysis instructions by computer and (5) qualitative data analysis including content analysis and interpretation and summary of criticism (6) data display and interpretation and (7) case studies of data analysis and interpretation.

1.2 Techniques for teaching and learning activities.

1.3 The media of learning resources.

1.4 Measurement and evaluation.

Based on the above issues, the researcher therefore examined the potential of teaching and learning mathematics courses on statistics for data analysis, as shown in Table 1 as follows:

Table 1. The results of survey on the potential of teaching and learning mathematics courses on statistics for data analysis of mathematics teachers, Nachuak Pittayasan School, Mahasarakham province.

Potential of teaching and learning mathematics about statistics for data analysis	Survey results
1. Content	The content of the statistics for data analysis is appropriate for the students' knowledge and ability. However, the potential of applying statistical knowledge for data analysis in real situations is not as successful as it should be in basic or advanced knowledge and understanding about statistics for teachers' research that make students apply in making form of mathematics research projects are not fulfilled, according to the curriculum, students need to have the ability to apply statistical knowledge for data analysis and can use in daily life as the actual situation,
2. Teaching and learning management techniques	Students were also doing individual activities, solving individual problems on their own. Therefore, the potential for effective teaching and learning management was not as successful as the students were still studying alone, not cooperative learning.
3. Media and learning resources	The potential of using media, equipment and learning resources is not as successful as it should be. That is, most instructors use the media as books, textbooks, and use of media from real situations is not much such as presenting information from various agencies from communities or nearby agencies.
4. Measurement and evaluation	The potential for measurement and evaluation are not as successful as it should be. That means, using Mathematics problems with knowledge and memory emphasizing. The test should focus on analytical thinking and requires mathematical process skills such as the PISA exam.

From Table 1, it can be seen that the potential of mathematics teaching and learning management about statistics for analyzing the data in the overall are not as successful as they should be. In particular, the content of mathematics, teachers mainly includes basic or advanced statistical knowledge for teachers' research to be able to allow students to continue to apply knowledge, statistics and data analysis to apply in mathematics projects in the form of research, evaluating various projects for other potential,namely, the techniques of teaching and learning management on media, equipment, learning resources and measurement and evaluation as well as not being successful as well, but can be modified on occasion teaching and learning management techniques, cooperative learning. There are still some students doing individual activities, and each person solving problems on their own, without consulting or having different people doing media, learning resources. The use of media from the actual situation is not much such as presenting information from various agencies from the community or nearby agencies and measuring and evaluating It also uses the problems that emphasize the most necessary knowledge. Therefore, the test should focus on analytical thinking and require more mathematical process skills.

2. Research results in Phase 2: Guidelines for the development of teaching potential of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province From conducting brainstorming sessions at Nachuak Pittayasan School, Nachuak District, Mahasarakham Province, on July 3, 2018. participants were 15 mathematics teachers who attended the meeting. on the most important issues in the development of teaching potential of mathematics teachers about statistics for data analysis. The important issues to define guidelines for the development of teaching potential of mathematics teachers about statistics for data analysis found that the key issues for determining guidelines were as follows

2.1 Development guidelines with intensive workshops with important issues requiring intensive workshops on statistics for data analysis were 1) Preparation of a dummy table to prepare data analysis 2) Relevant statistics and mathematics that were suitable for research 3) Descriptive statistics and writing computer instructions for data analysis 4) Inferential statistics and computer instruction for data analysis 5) Qualitative data analysis, including content analysis and interpretation and summary of criticism and discussion and 6) Data display and interpretation. The Intensive workshop consisted of 1) lecture 2) group working 3) presentation and 4) question-answer. During the workshop and after the meeting, there must be a group discussion on mathematics teaching with teachers and lecturers to exchange statistics in order to closely analyze data.

2.2 Preparation of the operation manual to follow activities according to the guidelines in 2.1.

From the above guidelines, it was defined as a work manual to follow the activities which the manual had been used for the workshop on the potential development of teaching and learning of mathematics teachers, Nachuak Pittayasan School about advanced statistics for data analysis. This manual contains 3 parts, including Part 1: details of activities, Part 2: study, research and reporting and Part 3: learning unit, each units composes of contents to be compact and easy to read, that was, using examples to explain and not emphasize the proof or the source of the calculation formula, in order to facilitate the mathematics teachers who could apply the basic principles of using advanced statistics for analyzing research data and using for teaching mathematics courses in the section on using statistics for analysis information and decisions.

3. Research results in Phase 3: Satisfaction of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

The 15 mathematics teachers evaluated the satisfaction of mathematics teachers about statistics for data analysis and the results were demonstrated in Table 2 as follows:

Table 2. Mean ($\bar{X}$), Standard deviation (S.D) and Level of Satisfaction Regarding the Potential of Mathematics Teachers about Statistics for Data Analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

	Satisfaction about Potential	$\bar{X}$	S.D	Degree of Satisfaction
1.	Applying knowledge in using statistics for data analysis to benefit teaching in the classroom	4.2667	.70373	most
2.	Applying knowledge from training using statistics for data analysis to develop their teaching potential	4.3333	.72375	most
3.	Applying knowledge to solve classroom teaching problems	4.3333	.72375	most
4.	Applying knowledge from training to be a consultant Or can solve problems of other teachers	4.2667	.59362	most
5.	Applying knowledge from the training to expand further in performing duties as an instructor effectively	4.1333	.63994	more
6	Applying knowledge in using statistics for data analysis to be used in the overall issues	4.0667	.59362	more

Remark:

Range of Mean or average	Degree of Satisfaction
4.21 - 5.00	most
3.41 - 4.20	more
2.61 - 3.40	moderate
1.81 - 2.60	less
1.00 - 1.80	least

From Table 2, it was found that the satisfaction with the potential of using knowledge in using statistics for data analysis was used at a high level ($\bar{X}$ = 4.0667, S.D. = .59362).

If considering in each aspects, it was found that the potential of using knowledge from training, using statistics for data analysis to develop their teaching potential and applying knowledge to solve management problems taught in the classroom was at the highest level ($\bar{X}$ = 4.3333, S.D. = .72375), satisfaction with the potential of using knowledge in using statistics for data analysis to use in classroom teaching ($\bar{X}$ = 4.2667, S.D. =.70373) and applying knowledge from training to being a counselor or solving problems of other teachers at the highest level ($\bar{X}$ = 4.2667, S.D. =.59362) and applying knowledge from the training to

expand in performing duties as an instructor effectively at high level ($\bar{X}$ = 4.1333, S.D. = .63994), respectively.

Discussion

The results are discussed in accordance with the research objectives as follows:

1. Potential of teaching and learning management of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province

1.1 Content

From the finding, that is, the content of the statistics for data analysis is appropriate for the students' knowledge and ability. However, the potential of applying statistical knowledge for data analysis in real situations is not as successful as it should be. That is, the basic or advanced statistical knowledge and understanding of teacher research that will enable students to apply in making mathematics projects in the form of research are not achieving the objectives set by the curriculum that requires students to have the ability to apply statistical knowledge for data analysis in daily life according to the actual situation. It shown that understanding of mathematics teaching and learning management about statistics for data analysis in the real situation of teachers and students was not as successful as it should, so allowing students to apply in the project does not fully assured. Therefore, the teaching and learning of mathematics on statistics for data analysis and decision making is therefore essential for teachers to have profound use of statistics for research to develop teaching and learning. Student project preparation as well as application in real life situations in daily life in accordance with statistics and probabilities of standards that said students must understand the statistical process and use statistical knowledge to solve problems. In addition, it is consistent with the guidance of teaching and learning in the 21stcentury that teachers must change to the environment. The changing social and technological context is that teachers must design learning-oriented learners by allowing learners to learn from real-life situations and create their own knowledge. There are instructors who spark the interest of knowledge and convenience and create an atmosphere for mutual learning exchange. In addition, it is consistent with Carmen Batanero's research results (Batanero *et al.*, 2011: 407-418) who studied teacher preparation, mathematics and the challenges of teaching statistics in schools with mathematics teachers with the objective to study teaching statistics in schools and training teachers responsible for teaching,raising awareness in increasing statistics in school level content, they found that the development

of knowledge and competency in statistics for students around the world is linked to training and supporting mathematics teachers in all dimensions, teaching statistics based on school policy local resources and topics to be taught.

It was shown that the challenge of teaching statistics in schools with mathematics teachers was the most important issue leading to the teaching and learning of mathematics about statistics and effective data analysis leading to research to improve teachers' teaching and to conduct student research projects.

1.2 Teaching and learning techniques

From the finding that was students were also doing individual activities, each solving problems by themselves. Therefore, the potential for effective teaching and learning management techniques was not as successful as they should because single students did not have cooperative learning. This is because the teaching and learning activities has not yet adopted the principles of participation in mathematics, especially, the content on statistics and data analysis which is corresponding to Karnkirati (2011: 14-15), which stated that one of the important mathematical teaching principles was that the mathematics teachers must teach the learner to have a concept or gain mathematical knowledge from thinking and participating in activities with others by organizing activities for learners to learn from practical exercises so that learners could search for knowledge and analyze by themselves doubts were issues in discussions to get a variety of ideas and to lead to conclusions.

1.3 Media and learning resources

From the finding that the potential of using media, equipment and learning resources was not as successful as it should be. That is, most instructors use the media as books, textbooks, and use of media from real situations is not much such as presenting information from various agencies from the community or nearby agencies. Therefore, creation of networks from external agencies is not successful. However, in the current situation, the use of technology networks for teaching and learning management between departments must be more urgent and concrete. Because teaching of mathematics courses content on statistics and data analysis, teachers must have a statistical mastery, then teaching and learning using a variety of media, learning resources and technology. In accordance with the guidance of the Ministry of Education (2017: 10-54) that has been defined as one that the use of communication technology will make mathematics teaching more effective and useful in improving the skills and mathematical processes of learners both in the classroom and outside the classroom. Using technology can help students to present information, submit work assignments, or as informal teaching methods outside the classroom.

1.4 Measurement and evaluation

From the finding that the potential for measurement and evaluation had not been as successful as it should be said and also using mathematics problems that only emphasize in knowledge and memory. So the test should focus on analytical thinking and require mathematical process skills such as the PISA exam. This results reveals that teachers use measurement and evaluation that are not measurable and evaluate as real as they should. These results are corresponding to previous result by Worawit (2016) that provides guidance on whether relevant people should improve the high school mathematics curriculum in the whole country by studying the content analysis and studying the consistency between the high school mathematics curriculum, the PISA exam. His conclusions were the medium and long term solutions of the need to improve the upper secondary mathematics curriculum to include behavior indicators and objectives, by focusing on more mathematical and statistical reasoning, as well as improving exercises and measurements that corresponding to new courses. In addition, the curriculum for the production of undergraduate teachers must be improved to provide the content of mathematics and university level statistics that are in the proportion of high school mathematics in the corresponding proportion.

2. Guidelines for the development of teaching potential of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

From the results of the research, it was found that the appropriate approach to improve the teaching potential of mathematics teachers about statistics for data analysis must conduct intensive workshops and have a group discussion on mathematics teaching with teachers and lecturers to exchange statistical knowledge for continuous data analysis every semester. This is because the school administrators and the mathematics teachers of Nachuak Pittayasan School, Nachuak District, Mahasarakham Province have seen the importance of the intensive workshops and a group discussion on mathematics teaching with teachers and lecturers to exchange statistical knowledge every semester. Therefore, the organizing of such intensive workshops is corresponding to Intharaksa (2007) which discusses the development of human resources as a personal activity so that the person has the potential to respond to the needs of the organization, with activities to be performed, namely ; (1) training is a defined activity to improve the work of operator or better staff while holding positions (2) Education is an activity related to the development of human resources established in order to improve the ability of all workers or staff in any direction, but more meaningful than the work they perform and (3) Development is to prepare workers or staff that can grow together. With the development, change and growth of the organization or it can be said that training means the process

of changing attitudes knowledge and expertise to enhance the efficiency and effectiveness of the staff's work at present may include preparing workers who are ready to advance to higher positions in similar jobs.

3. Satisfaction of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province.

The results of the research showed that the satisfaction with the potential of using knowledge in the use of statistics for data analysis to be used in the overall picture is at a high level that is like this because the organizing workshops in this research takes a limited time. It is not possible to exchange knowledge between speakers or between colleagues. In addition, the content of the statistics used in this training, are quite difficult to understand. It will take a lot of time, even though many of you have passed the statistical studies for research at the graduate level and the researcher has created a manual to use statistics for research and analysis of data for every mathematics teacher and corresponding to Koparan (2015, 94-97), which discusses the difficulty of statistical subjects to be taught in secondary schools. Therefore, the results of the satisfaction assessment of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province in the overall issues is therefore at a high level. However, when considering each aspects, it was found that (1) satisfaction with the potential of using knowledge from training, using statistics for data analysis, to develop their teaching potential and applying knowledge to solve problems at the highest level of teaching and learning in the classroom, (2) satisfaction with the potential of applying knowledge in using statistics for data analysis to be useful for classroom teaching and applying knowledge from training to be a consultant or problem solving teacher, and (3) satisfaction about the potential to apply knowledge from the training to expand in performing duties as an instructor effectively, respectively. It is shown that the mathematics teachers at Nachak Pittayasan School is also confident that it will be able to effectively apply the knowledge to solve the problem of teaching and learning in the classroom because it is confident that the approach with the speaker by research from the department of educational research and development , faculty of education, Mahasarakham University, will be able to provide advice on the use of statistics for research and making student project work closely and continuously every year. Therefore, the results of the satisfaction assessment regarding the potential of using knowledge in using statistics for analyzing the side data is at the highest level, in accordance with Navi (2000) divided human needs into 5 levels and one of those three levels is social needs, This level of demand is stimulated after the physical and safety needs have been met. Social needs will mean the need to be involved having friends and being accepted by other people to meet social needs. Therefore, the confidence of mathematics teachers and administrators

of Nachak Pittayasan School, Na Chuak District, Mahasarakham Province is at the highest level. Because there is a need for social networking and participation with Mahasarakham University personnel as research mentors in accordance with European Network of Education Council ; eunec. (2010: 94-97) indicated that building a network of academic relations with stakeholders and use of statistics for research and eventually will be accepted by all parties.

Suggestion

1. Suggestions for applying research results to be useful

Based on the results of this research, the guidelines for the development of teaching potential of mathematics teachers about statistics for data analysis, Nachuak Pittayasan School, Nachuak District, Mahasarakham Province, and the teachers and administrators are confident to use the knowledge from training to use statistics for data analysis to develop their teaching potential and applying knowledge to solve problems in teaching and learning in the classroom with satisfaction at the highest level. Therefore, in the next academic year, mathematics teachers should be adopt the PDCA principle to encourage themselves for studying statistics and data analysis according to the manual which is the most important tool for studying and learning about the use of statistics for design, data analysis, research for development of teaching and learning. Furthermore, if possible it should be considered an important policy that develops teaching and learning management of Nachuak Pittayasan School, Nachuak District, Mahasarakham Province and making of formal cooperation with the faculty of education Mahasarakham University by continuously.

2. Suggestions for further research

Teachers should use statistics literacy to conduct research on the development of teaching and learning innovation in accordance with the 21st century learning management according to their research potential.

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References

Batanero, C., Burrill, G. and Reading, C. (2016, January17). *Overview: challenges for teaching statistics in school mathematics and preparing mathematics teachers*. Retrieved July 3, 2018, from http://www.ms.src.ku.ac.th.

Burakarn, A. (2017). The result of cooperative learning management by individual assistance groups in mathematics for Mathayom Suksa 1 students, schools under the Provincial Administration Organization,Nakhon Ratchasima. *Sikkha Journal of Education. 4*(2): 49-50.

European Network of Education Council ; eunec. (2010). Participation and stakeholder involvement in education policy making. *Proceeding of the Conference of the European Network of Education Councils*, Brussel, 1-3 December 2010.

Intraraksa, P. (2007). *Operations in the training section*. Thesis, MBA (business administration), Chon Buri, Burapha University.

Karnkirati, W. (2011). *Learning mathematics management*. Faculty of Science and Technology, Phetchaburi, Phetchaburi Rajabhat University.

Koparan, T. (2015). Difficulties in learning and teaching statistics : teacher views. *International Journal of Science and Technology. 46*(1): 94-104.

Milito, A.M., Pannone, M.A. and Luchini, S.R. (2014, January 23). *New strategies for teaching statistics at school*. Retrieved March 29, 2018, from http://www.iase-web.org.

Ministry of Education. (2017). *Course manual of group learning mathematics according to the core curriculum of basic education (Revised edition)*.

Navi, S. (2000). *Administration and organizational behavior*. Bangkok. Bangkok Printing House.

Sakworawit, A. (2017). *Developing statistical intelligence and data for math teachers*. secondary level. Retrieved February 29, 2018, from http:// www.Mgronline.com.