



An Analysis of the Efficiency of the Educational Management of the Academic Cooperation Project between the Department of Local Administration and Suan Dusit University: Data Envelopment Analysis

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Article info

Article history:

Received: 1 October 2019

Revised: 3 December 2019

Accepted: 25 December 2019

Keywords:

DEA, Effectiveness of education, Academic cooperative project between The Department of Local Administration and Suan Dusit University

Abstract

The research objectives consist of the following: 1) to evaluate the efficiency in educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University 2) to analyze the approaches to improve the inefficiency of educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University, and 3) to study the factors that affects the efficiency of educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University. The data was collected by questionnaires and recording forms from the students and instructors in academic cooperative project between the Department of Local Administration and Suan Dusit University. The research results found that there are 4 effective educational centers having efficiency scores of educational management at 100.00. The approaches to improve the inefficiency of educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University is that each educational center should increase 8.98 – 77.89% of variables. Most of all the inefficiency must be improved by rising the variable of the students' quality regarding discernment and thinking. Regarding the factors influencing the efficiency of educational management found that the independent variable was academic leadership of the administrators. This significantly affects the efficiency of educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University at .01 level. Thus, the development of academic management of administrators could improve the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University.

Introduction

For developing social and nation to reach the prosperity and have a progress equivalent to international countries, Thailand was required to develop the national

educational management process to achieve academic standards at the international level. Moreover, Thailand should set an educational management policy for developing Thai society to be a knowledge society, and

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providing Thai citizen to have equal education opportunities. Teachers and educational personnel development, both in public and private sectors, as well as community leaders and local administrative organization leader development are the key foundation for driving an educational reform effectively. The department of local administration plays a role and has a duty to provide education for the community, especially to develop education in child care centers to be ready for physical, mental, emotional, social and intellectual. In operating with standards and qualities, the department of local administration should administrate the related personnel to child care centers to be responsible for efficient and systematic work. Nationwide, there are large number of personnel at child care centers who want to develop themselves to be knowledgeable and capable and have qualifications that can obtain a professional license which is self-improvement and develop their locality to be better (Department of Local Administration, 2017) in order to make the child care centers under the department of local administration to have a potential in managing the education, nurturing and promoting development for young children correctly in relation to academic principles with appropriate quality. Therefore, they have to be developed for achieving the operational competency in line with the curriculum standards and have security in the profession.

Suan Dusit University realizes the importance of personnel development under the department of local administration which is a significant issue affecting the national education reform. In addition to the important mission as a higher education institution for local development in accordance with article 7 of the Rajabhat University act B.E. 2547 (2004. A.D.) that allows the university to be a higher education institution for local development that strengthens the intellectual power of the land and restore the power of learning, the university aims to promote the advanced academic and high profession, teach, research, provide an academic service to society, improve technology transfer, preserve arts and culture, train a person to be a teacher, and promote teacher academic standing. Moreover, one of the important duties of the university is to coordinate and cooperate between universities, communities, local administration organizations and other organizations both in the domestic and international for local development, promoting teaching profession, training and developing teacher and educational personnel to have quality and

standards suitable for being a high profession. For those reasons and necessities, the university has created an academic cooperative project between the Department of Local Administration and Suan Dusit University for supporting educational personnel development under the local administrative organizations to continue proficiently.

The researcher believes that the efficiency evaluation of the educational management of academic cooperative project between the Department of Local Administration and Suan Dusit University in which there is a need to search for the guideline for improving inefficiency and to study the factors that affect the educational efficiency of academic cooperative project between the Department of Local Administration and Suan Dusit University. Thus, the Data Envelopment Analysis (DEA) is a proper method for analyzing the educational management efficiency of the academic cooperative project between the Department of Local Administration and Suan Dusit University, which have the characteristics inputs, processes, and productivity at different units and measures. To calculate specific efficiency parameters for each decision-making unit (DMU), while the nature of the decision-making unit (DMU) is determined by the number or type of inputs, processes, and productivity that is different or there are variances in measurement units, the outcomes from the Data Envelopment Analysis (DEA) are valuable in terms of operational improvements. The decision-making unit (DMU) in each unit was proper to analyze the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University.

Objective

1. To evaluate the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University
2. To analyze guidelines for improving an inefficient educational management of the academic cooperative project between the the Department of Local Administration and Suan Dusit University.
3. To study the factors affecting the educational efficiency of academic cooperative project between the Department of Local Administration and Suan Dusit University.

Literature Review

Concept, theory and related studies, the concept of efficiency (Karnchanawasri Sirichai, 2009) stated that the efficiency means the ability to utilize resources economically or utilize wisely for maximum benefit, and the production efficiency means the ability to reduce costs per unit of production. Akkaradej Ketchum (2010) summarized that to study the educational efficiency, it needed to study the relationship between the practice of educational inputs and educational products. In addition, when comparing those products, we will understand the efficiency in educational management, which proves the ability to use resources effectively, including able to compare that efficiency among organizations or compare within the organization between periods in order to examine the ability of educational management and the movement of the educational efficiency.

Efficiency evaluation by using Data Envelopment Analysis (DEA) which is a popular method for measuring the efficiency and was first developed by an economist named M.J. Farrell (1957) by using the principle of frontier analysis. Later, there were scholars who were interested in this method and developed the models. Charnes, Cooper and Rhodes (1978) developed a mathematical method to find the relationship between Multiple Inputs and Multiple Outputs by using Non-parametric Method to analyze the Input and the Output of the production unit which is called Decision Making Unit or DMU. The aim is to analyze the efficient DMU which has the characteristics of an Envelopment Frontier and to specify the inefficient DMU which lines under the Envelopment Frontier. Moreover, the inefficient size can also be identified by projection to the decision-making unit that is on the nearest efficiency curve. It also can specify the size of the inefficiency and the ways to improve for increasing the efficiency to equivalent to an effective decision-making unit by using the principles to analyze the efficiency through the Data Envelopment Analysis (DEA) which has the ability to increase the output of the slack output, which means the product that should be produced but cannot, while require to reduce the Express Input to a minimum.

The efficiency analysis by using DEA consists of 4 models: the Additive Model, the Multiplicative Model, BCC (The BCC Model) and CCR (The CCR Model). This study selected the BCC (The BCC Model) for analyzing the educational management efficiency of the academic cooperative project between the Department of Local Administration and Suan Dusit University. The

good point of using Data Envelopment Analysis (DEA) is that it can calculate specific efficiency score values for a variety of production units or with differences in measurement units and the results found from the analysis will be beneficial in terms of improving the operations of the production unit. This is due to the DEA method not being based on parameters, therefore, it has no limit to the type of production function appropriate for the data. Also, it can compare the operations of each production unit with the best efficiency boundary. The results will reveal the source of the inefficiency of the production units that does not operate at the efficiency boundary.

Conceptual Framework

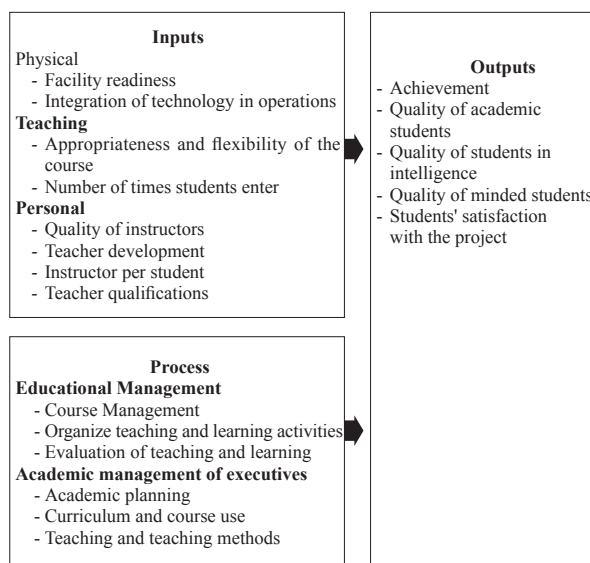


Figure 1 Conceptual Framework

Research Methodology

1. Population

The population used in this research consist of 2 groups: student group and professors group within the academic cooperative project between the Department of Local Administration and Suan Dusit University, which were 2,663 students and 129 professors (Source: Suan Dusit University, 2014)

2. Research Instrument

The instruments used for data collection are divided into 2 types which are document record form and questionnaire. 1) Document record form is a form for filling words or statements in the blank used for data

collection. The variables used in DEA are the variables in readiness, facilities, teaching and learning, personnel and budget. 2) The questionnaires used to collect the data consisted of 2 versions: the first version is for students which consist of 2 parts: Part 1 is for student data including gender, class attending and GPA. Part 2 is the questionnaire for studying the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University and this questionnaire is divided into 85 items. The second version was for professors. This version consists of 2 parts: Part 1 obtains the professor information such as gender, the highest educational background and field of graduation. Part 2 of the questionnaire is to study the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University and the professor questionnaire is divided into 127 items.

3. Collection of Data

This research used an online data collection by: 1. Providing an online questionnaire. 2. Submitting the online questionnaire file to the project coordinator for collecting data online. 3. Submitting the document to the educational center coordinator for recording the data in the document recording form.

4. Data Analysis

The following are the data analysis and the statistics used. Part 1, the researcher used statistical software package to do analyzes and basic statistics of respondents. Part 2, the researcher used the Frontier Analysis to analyze the efficiency of educational management by analyzing the DEA. Part 3, the researcher analyzed factors affecting the efficiency of education by Regression Analysis.

Results

1. The results of the analysis of the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University in line with the evaluation group which consists of the student group and professor group, found that there was no difference in evaluation results. Overall, the evaluation of the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University reveals that there are 4 educational centers that show the efficiency in educational management with an efficiency score of 100.00 points. They are Chiang Rai Rajabhat University

Educational Center, Kamphaeng Phet Rajabhat University Educational Center, Ubon Ratchathani Vocational College Education Center and Nakhon Ratchasima Rajabhat University Educational Center.

2. The guidelines of improving the inefficient

Table 1 Educational performance scores of academic cooperative project between the Department of Local Administration and Suan Dusit University

| Education center | Performance score | | |
|--|-------------------|------------|-----------------|
| | Student | instructor | Average overall |
| Chiang Rai Rajabhat University Education Center | 100.00 | 100.00 | 100.00 |
| Kamphaeng Phet Rajabhat University Education Center | 100.00 | 100.00 | 100.00 |
| Nakhon Ratchasima Rajabhat University Education Center | 100.00 | 100.00 | 100.00 |
| Ubon Ratchathani Vocational College Education Center | 100.00 | 100.00 | 100.00 |
| Uttaradit Rajabhat University Education Center | 97.34 | 90.34 | 93.86 |
| Rajabhat University Education Center Yala | 80.26 | 80.61 | 80.44 |
| Suan Dusit University Education Center (Bangkok) | 73.56 | 81.74 | 77.65 |
| Suan Dusit University Education Center (Nakhon Nayok Center) | 76.34 | 74.74 | 75.54 |
| Suan Dusit University Education Center (Suphan Buri Center) | 74.82 | 75.37 | 75.10 |
| Nakhon Si Thammarat Rajabhat University Education Center | 75.98 | 72.87 | 74.43 |
| Maha Sarakham Rajabhat University Education Center | 66.27 | 68.43 | 67.35 |
| Songkhla Rajabhat University Education Center | 55.21 | 54.89 | 55.05 |
| Institute of Physical Education Sisaket Campus Education Center | 56.89 | 49.84 | 53.37 |
| Suan Dusit University Education Center (Lampang) | 51.92 | 54.63 | 53.28 |
| Suan Dusit University Education Center (Trang Center) | 46.93 | 47.92 | 47.43 |
| Number of educational centers with a performance score of 100.00 points | 4 | 4 | 4 |

educational management guidelines of the academic cooperative project between the Department of Local Administration and Suan Dusit University from the evaluation of students and professors reveals overall, each educational center had to adjust to increase the variable at 8.98 – 77.89 %. The variable that the educational center should improve the most is the students' intellectual thinking by increasing the variables of their qualities (23.12 – 77.89 %). The following are variables of curriculum management (30.78 - 72.45%), curriculum variables and curriculum usage (19.09 - 71.16%), teaching management and teaching method variables (10.43 - 70.23%), the variables of technology integration operating (12.47 - 67.33 %), the variables of quality of the students' psychological (34.11 - 63.23 %), the project satisfaction variables in overall (24.38 - 61.28 %), the variables of the quality of the teachers (32.12 - 60.34 %) the variables of the facility availability (13.45 - 56.76 %) and the variables of the student academic qualities (22.17 - 56.71 %).

Table 2 The Percentage of Variables that Need to be Adjusted to Improve the Inefficiency of Education Management of Academic Cooperative project between the Department of Local Administration and Suan Dusit University

| Education center | Variables | | | | | | | | | | | | | | | |
|--------------------|-----------|-------|---------|---------|---------|---------|-------|-------|-------|---------|-------|-------|-------|-------|-------|---------|
| | FAC | TECH | FEX_CUR | QUA_LEC | DEV_LEC | MAN_CUR | ACT | EVA | PLAN | USE_CUR | TEA | ACA | COG | MEN | STA | LEC/STU |
| CRRU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| KPRU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| URU | - | 12.47 | - | - | 8.98 | - | - | - | - | 10.43 | - | - | - | - | - | - |
| SDU (Lampang) | - | 67.33 | - | 40.45 | - | - | 56.11 | 45.21 | - | - | 42.16 | 56.45 | 40.32 | 57.87 | - | - |
| RMU | 45.34 | 52.89 | - | - | - | - | - | - | - | - | 46.31 | 45.22 | 39.53 | - | 15.68 | |
| UVC | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| IPE SSK | 56.76 | 39.54 | 44.32 | - | 45.23 | 30.78 | - | - | 70.43 | 56.32 | 50.12 | 30.56 | 42.39 | 62.45 | 61.28 | - |
| NRRU | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| SDU (Bangkok) | 13.45 | 14.56 | - | - | - | - | 18.45 | - | - | - | - | - | 23.12 | - | - | - |
| SDU (Suphan Buri) | 23.34 | - | - | - | 24.89 | - | - | - | 29.56 | 32.11 | 38.45 | - | 32.12 | - | 24.38 | - |
| SDU (Nakhon Nayok) | 18.94 | - | - | 45.56 | 48.31 | - | - | - | - | - | - | - | 33.23 | 41.29 | 40.87 | - |
| NSTRU | 45.72 | - | 45.22 | 32.12 | 29.04 | 32.11 | 25.66 | - | 34.11 | 19.09 | 32.45 | 22.17 | 27.64 | 34.11 | - | - |
| YRU | 19.67 | - | - | - | - | - | - | - | - | - | - | - | 24.67 | - | 28.11 | - |
| SKRU | - | - | - | 56.57 | 36.79 | 49.87 | - | - | - | 67.87 | 70.23 | 56.71 | - | - | - | - |
| SDU (Trang) | 45.56 | 56.32 | 65.23 | 60.34 | - | 72.45 | - | - | - | 71.16 | - | - | 77.89 | 63.23 | - | - |

FAC = Facility readiness TECH = Integration of technology in operations FEX_CUR= Appropriateness and flexibility of the course QUA_LEC = Quality of instructorsDEV_LEC = Teacher development MAN_CUR = Course Management ACT = Organize teaching and learning activities EVA = Evaluation of teaching and learning PLAN = Academic planning USE_CUR = Curriculum and course use TEA = Teaching and teaching methods ACA = Quality of academic students COG = Quality of students in intelligence MEN = Quality of minded students STA = Students' satisfaction with the project LEC/STU = instructor per student

FAC = Facility readiness TECH = Integration of technology in operations FEX_CUR= Appropriateness and flexibility of the course QUA_LEC = Quality of instructorsDEV_LEC = Teacher development MAN_CUR = Course Management ACT = Organize teaching and learning activities EVA = Evaluation of teaching and learning PLAN = Academic planning USE_CUR = Curriculum and course use TEA = Teaching and teaching methods ACA = Quality of academic students COG = Quality of students in intelligence MEN = Quality of minded students STA = Students' satisfaction with the project LEC/STU = instructor per student3. The regression analysis results of factors affecting the efficiency of the educational management of the academic cooperative between the Department of Local Administration and Suan Dusit University shows that the positive relationship between the variables of administrators in academic leadership and the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University. From the correlation coefficient of 0.277, it could forecast the equation at 7.70% which affects the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University significantly at .01 with a predictive coefficient of 8.773. Consequently, it could be written as a simple regression for forecasting as follows;

Forecasting equations in raw scores, $Y = 40.070 + 8.773X$

Table 3 The Correlation Coefficient Analysis of Factors Affecting the Educational Efficiency of the Academic Cooperative Project

| Forecasting variables | B | Std. Error | Beta | t | Sig. |
|-----------------------------------|--------|------------|-------|-------|------|
| Constant | 40.070 | 11.136 | | 3.598 | .000 |
| Academic management of executives | 8.773 | 2.696 | 0.277 | 3.255 | .001 |

R = 0.277 adjusted R² = 0.077

Discussion

1. The results of the efficiency analysis of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University by comparing the ability in educational management of 15 educational centers in this project according to the evaluation group of students and professors, the results show that overall, there was no difference in evaluation results and the efficiency was between 64.48 - 100.00. From 15 educational centers, there are 4 efficiency educational centers or 26.67%, and 11 inefficiency educational center or 73.33%. In the efficiency analysis, by using the Data Envelopment Analysis: DEA, it can identify the educational centers that have problems with the efficiency of the educational management that need to solve immediately. In addition, to increase the efficiency of educational management by using techniques of the Data Envelopment Analysis: DEA, it was able to deliver

useful information for increasing the efficiency of the education center according to the DEA such as having the opportunity to reduce inputs or increase productivity. In line with the direction and size indicated by the analysis results by improving the efficiency of each educational center. The efficiency could be increased in two directions; reducing some of the inputs with the same productivity or using existing inputs but increasing the quantity or quality of the produce. This is consistent with findings of prior efficiency theory research. There are prior research that has used the DEA model to operate the above data such as Rawiwan Krittaya (2012), Saengsri Natcha (2013), Wilun Nipon (2011), Sirichot Panya (2011), Tangchitcharoenkul Rungnapa (2014), Suphanimitcharoenporn Asama (2009),

2. For the guidelines to improve the inefficiency of educational management in the academic cooperative project between the Department of Local Administration and Suan Dusit University, it found that each educational center should increase the variable by 8.98 - 77.89% by adjusting the inefficiency by increasing the quality variables of the students' intellectual thinking the most (23.12 - 77.89%). The following are variables of curriculum management (30.78 - 72.45%), curriculum variables and curriculum usage (19.09 - 71.16%), teaching management and teaching method variables (10.43 - 70.23%), the variables of technology integration operating (12.47 - 67.33 %), the variables of quality of the students' psychological (34.11 - 63.23 %), the project satisfaction variables in overall (24.38 - 61.28 %), the variables of the quality of the teachers (32.12 - 60.34 %) the variables of the facility availability (13.45 - 56.76 %) and the variables of the student academic qualities (22.17 - 56.71 %), respectively. Furthermore, when considering the basic statistical values of variables in the student group and the professor group, it exposes that the variables that have to be improved in order to increase the efficiency of the educational management are the opinions about readiness in terms of facilities, the student group showed their opinion of 3.85% and the professor group showed their opinion of 4.02%. For the technology integration operating, the student group revealed their opinions of 3.95% and the professors' opinions were 4.02%. This conforms to the prior studies of Krittaya Rawiwan (2012), Natcha Saengsri (2013), Nipon Wilun (2011), Ketchum Akaradej (2010) Rassouli Currier (2007), Sarrico and Rosa (2008), which studied about the guidelines to improve the inefficiency of institutes to achieve the best efficiency of educational management.

3. The regression analysis results of factors affecting the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University conducted by using the factors with independent variables which were academic management variables of administrators. The results shows the positive relationship between the variables of administrators in academic leadership and the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University. From the correlation coefficient of 0.277, it could forecast the equation at 7.70% which affects the efficiency of the educational management of the academic cooperative project significantly at .01 with a predictive coefficient of 8.773. Consequently, it could be written as a simple regression for forecasting as follows;

In addition, the correlation coefficient was 0.277 and it can forecast the equation of the analysis that is 7.70%. This result reveals that it affects the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University Significantly at the .01 level with a prediction coefficient of 8.773. From the initial data, it found that the academic management of administrators was at the average of 4.10 and from the regression analysis found that the academic management of administrators has a positive relationship with the educational management efficiency of the academic cooperative project between the Department of Local Administration and Suan Dusit University. In cases that administrators show a great academic leadership potential, this will lead to the efficiency of educational management. Ruchiraphan Kongchuai (2012) noted that administrators' leadership was a very important factor in administration. Administrators had a duty to be leaders and being the focal persons and representatives of everyone in the organization. For these reasons, the administrators who had leadership was able to decide, make a final decision, set policies, plans and motivate staffs to work together. Therefore, administrators are very important and play a key role for leading the institution or organization to success which is consistent with the research results of Wittaya Suankularb (2015,102) which found that there was a high-level practice in the academic leaders of the administrators. The study results also exposes that all factors related to academic leadership of administrators, atmosphere and environment, and the

learning process management could forecast the efficiency of the educational management of the schools under the office of Kamphaeng Phet Primary Education Area 1 of 56.50%, the remaining 43.50% derived from other factors. Additionally, the factors related to academic leadership of administrators revealed the best predictive power.

Suggestion

1. From the efficiency analysis of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University by comparing the capability in educational management between 15 educational centers implementing Data Envelopment Analysis (DEA), the results identify educational centers that had problems with the efficiency of educational management and the necessity to solve immediately. Furthermore, improving the efficiency of educational management by using DEA techniques could deliver useful information for increasing the efficiency of the inefficient educational centers. Consequently, the development was able to affect the efficiency of the educational management.

2. From the efficiency guideline analysis of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University found that overall, the inefficiency should be improved by increasing the productivity factors which are the following qualities; intellectual thinking, mind set and academic matter. For the overall satisfaction of the project relating to inputs, it found that the inefficiency should be improved by increasing course management, teaching management and teaching method, curriculum and curriculum implementation. The quality of the instructors, integration of technology in operations, facility readiness for increasing the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University.

3. From the analysis of factors affecting the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University, it found that the administration of academic management could forecast the efficiency of educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University with statistical significance at the level of .01. Thus, the

development of academic management of administrators could improve the efficiency of the educational management of the academic cooperative project between the Department of Local Administration and Suan Dusit University to be better.

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Some students had trouble in paying attention on learning because they thought that they had studied statistics before.

3) Students' assignment:

The students' worksheet shows their confusion between qualitative and quantitative data. They thought that citizen ID number, ages, and salaries were quantitative data. In representation of data, students showed confusion on using histogram or bar chart. In addition, using different scales in drawing graphs or histograms of a data set resulted in different shapes of graph which led to different understanding.

4) Improvement plan:

For the students who did not pay attention in class because they had studied statistics before, the researcher assigned advanced problems for them. Moreover, the researcher planned to enhance statistical reasoning about types of data by giving more examples together with discussion and made a judgment whether a data set were qualitative or quantitative. For students' confusion between histograms and bar charts, the key points discussed using bar charts for qualitative data and using histograms for continuous quantitative data.

Reflection from Cycle 2

1) Students' knowledge:

After the researcher used examples to explain and to discuss with students about types of data, some students could identify the difference between qualitative and quantitative data.

For statistical formulas in measures of central tendency and measures of positions, most students could remember the formulas and plug in the data without understanding the meaning of the variables in the formulas. Therefore, they easily forget those formulas and had difficult to interpret the results.

Some students could not justify the use of mean, median, or mode to tell the center of a data set, and some students became confused between positions of data and numerical values of that position.

2) Students' behavior:

Some students did not pay attention to the lessons and they missed some important key points. So, the researcher had to explain again.

3) Students' assignment:

From some students' homework, students could not 1) choose the appropriate central tendency, 2) differentiate between positions of data and numerical values of the positions, and 3) explain the differences between the formulas of grouped and

ungrouped data.

From observation, misconceptions found during the class includes: 1) computing the combined means, 2) median positions, 3) mode conceptions, 4) confusion in using central tendency, 5) using symbols having the same pronunciation (σ and Σ), and 6) errors in using summation properties.

4) Improvement plan:

In the next classes, the researcher gave students data sets with outliers and asked them to compute mean, median, and mode. After the computation a discussion was held to see which obtained values showed the better central value. Then, teacher and students summarized together to obtain the reasoning about central value with the outliers in data sets. For the students who paid less attention, the researcher gave more problems to solve.

Reflection from Cycle 3

1) Students' knowledge:

After students discussion regarding the comparison of each central tendency, students had better ideas in choosing appropriate central values. In addition, the researcher emphasized meaning to prevent mistakes between data values and their position values.

In teaching measures of dispersions, it was found that some students were confused in 1) interpreting meaning of some dispersions especially the meaning of standard deviation, 2) identifying formulas for grouped or ungrouped data, and 3) identifying formulas for sample standard deviation or population standard deviation.

2) Students' behavior:

When the researcher asked students to do assignment about dispersions, some students complained that the computation was very complicated. So, some students did not pay attention to do the problems during the class. Therefore, the researcher allowed students to use a calculator.

3) Students' assignment:

From students' worksheet, the researcher found that students avoided or misunderstood to interpret the meaning of standard deviations.

From the researcher's observation, misconceptions found during the class activities were about the properties of standard deviation.

4) Improvement plan:

The researcher decided to add exercises about meaning and interpretation of each measure of dispersion. For the next lesson, the researcher emphasized