

Full Length Research Paper

A study of factors and causal relationships on the results of national test: Mixed method research

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The general objective of this research was to study factors and causal relationships on the results of national test. Also, the research was conducted under three specific objectives: 1) to study causal relationships on the results of national test, 2) to create and investigate causal relationships on the results of national test, and 3) to develop excellence model in promoting the results of national test. Quantitative data were collected from 580 fourth-grade students in schools under the Office of the Basic Education Commission, Chaiyaphum Province. They were drawn using multistage sampling. Qualitative data were collected from 3 school administrators, 6 fourth-grade to sixth-grade teachers, and 6 fourth-grade students in schools under the Chaiyaphum Primary Education Service Area Office 2, using Stratified random sampling. The criterion of schools holding the results of national test higher than national level on the average in all learning strands for 6 consecutive years was employed in this research. Research instruments consisted of 30-item test, 14-item questionnaire, and 3 interview forms. Mplus Version 7.2 was applied to structural equation model and confirmatory factor analyses. The analyses revealed 3 main findings. 1) Positive relationships between observed variables were found, and all pairs of the variables showed statistical significance level of .01. This finding indicated that the relationships between the observed variables were adequate for the analyses. 2) Creation and investigation of the causal relationships demonstrated the model fits empirical data. Factors of direct and indirect effects consisted of creativity, reading literacy, and analytical thinking, showing their effects of 0.306, 0.194, and 0.095 respectively. Factors possessing only direct effects consisted of mathematical literacy and scientific literacy, showing their effects of 0.297 and 0.108, respectively. In addition, the coefficient of determination was 0.946. 3) Development of excellence model showed that the sample prescribed the principles for improving learning achievement as well as educational quality. Those principles included 3% increase in prescribed criteria of test results, performance guidelines according to the plan of learning achievement improvement, analyzing learners individually, providing several activities based on problems and needs of authentic development in accordance with the focal point of school and community environment.

Key words: Causal relationships, national test, mixed method research, structural equation model, excellence model.

INTRODUCTION

The Basic Education Core Curriculum B.E. 2551 (A.D. 2008) has divided educational measurement and

evaluation into 4 levels: classroom, school, education service area, and national levels. The national level comprises 2 types of measurement and evaluation. First, Ordinary National Educational Test (O-NET), which is the national standard-based quality assessment for students, provided for the sixth-, ninth-, and twelfth-grade students. Second, National Test (NT) provided for the third-grade students to examine the tendency of educational development and is used as a national indicator of educational quality (National Institute of Educational Testing Service, 2016). The students are tested covering 3 skills, that is literacy, numeracy, and reasoning abilities.

Office of the Education Council (2016) has set the National Education Plan Framework Bill B.E. 2560-2574 (A.D. 2017-2031) for the purpose of being a tool for developing human resources in terms of citizenship, discipline, and life quality including happiness of life at social, national, and global levels. In addition, curriculum and instructional management have been prescribed to be flexible, diverse, and able to respond to students' needs. This is in order to promote desirable behaviors, the 21st century learning skills, and life skills including developing knowledge, ability, and competency. To promote and develop human capital potential, Thai people of all ages should be good and talented, disciplined, and gain high quality of life by focusing on developing human potential as the foundation for increasing national competitiveness by improving educational quality for the 21st century learning (Office of the National Economic and Social Development Board, 2016).

The Institute for the Promotion of Teaching Science and Technology (IPST) collaborating with the Organization for Economic Co-operation and Development (OECD) has run the Programme for International Student Assessment (PISA) to assess the quality of educational system of member states and to assess students' knowledge and skills in terms of reading, mathematics, and science. The assessment results has shown that Thai students' scores in 2015 are lower than 2012 (Institute for the Promotion of Teaching Science and Technology, 2015). In case of the Ordinary National Educational Test or O-NET, the results have demonstrated that the sixth-grade students' scores in 2016 academic year are lower than 2015 academic year (Chaiyaphum Primary Education Service Area Office 2, 2017). In consequence, the results are not in line with the policy of the Office of the Basic Education Commission; in other words, instructional method should be improved to get positive learning achievement (Chaiyaphum Primary Education Service Area Office 2, 2015). As

mentioned earlier, these problems should be solved by educational organizations under the goal of the 20-Year National Education Plan B.E. 2560-2579 (A.D. 2017-2036). The goal of this plan is that all Thai people receive high-quality education and life-long learning and live happily based on the Sufficiency Economy Philosophy and the changes in the 21st century (Office of the Education Council, 2017). According to the national assessment of educational quality of the third-grade students in 2013 academic year and the sixth-grade students in 2016 academic year in schools under the Chaiyaphum Primary Education Service Area Office 2, the results of relationship analysis reveal the relationships between students' scores showing statistical significance level of .01. In 2016, the sixth-grade students' average O-NET scores are mostly below national level standard. From a review of literature and related studies, there are some scholars studying and seeking proper ways in improving the results of national test. For example, Suwathanpornkul (2015) conducted the research on analysis and synthesis of strategies to develop students' quality, using Ordinary National Educational Testing (O-Net) results: a multi-case study of O-Net high score schools. This research consisted of 10 schools with a good level of O-NET performance. The qualitative data were collected using the document analysis form, interview form, and observation form. In addition, Wongchai (2015) studied the multi-level factors affecting the result of Ordinary National Educational Test (O-NET) in mathematics of sixth-grade students in educational opportunity expansion schools under Chiangrai Primary Education Service Area Office 3. However, there has not been any research investigating factors affecting the results of national test by applying the scores that show their relationships from 2 tests to instructional development purpose. Apart from that, schools have to provide learning activities to promote students' important skills for the purpose of preparing them for the complex life and the 21st century working environment (Office of the Education Council, 2017).

National test is used in educational quality assessment in terms of instruction focusing on testing, literacy, numeracy, and reasoning abilities. The assessment results are implemented during planning to improve as well as develop the national education. Factors and models affecting the results of national test are highlighted in this research; thus, learning theories as well as mentioned factors and models were synthesized using mixed method. In the first step, quantitative research method was used to gain data to assure the factors and models. In the second step, qualitative in

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Table 1. The number of sample in quantitative research.

| Affiliation | Sex | | | | Total | |
|--|--------|-------|--------|-------|--------|-----|
| | Male | | Female | | Number | % |
| | Number | % | Number | % | | |
| Chaiyaphum Primary Education Service Area Office 1 | 148 | 25.52 | 142 | 24.48 | 290 | 50 |
| Chaiyaphum Primary Education Service Area Office 2 | 144 | 24.83 | 146 | 25.17 | 290 | 50 |
| Total | 292 | 50.34 | 288 | 49.66 | 580 | 100 |

research method was employed to study two groups of schools. First, schools that were successful educational management were investigated to obtain the finding of best practice for being used as a model and guideline by general schools, with similar factors and contexts for better practice. Second, schools with different factors and contexts were studied to gain a guideline that can be applied to practice such academic administration and improvement of instructional management to promote student quality and learning achievement to meet the national standard.

Objectives

1. To study causal relationships on the results of national test
2. To create and investigate causal relationships on the results of national test
3. To develop excellence model in promoting the results of national test

Scope of the study

The population was 10,883 fourth-grade students of 2017 academic year in schools under the Office of the Basic Education Commission, Chaiyaphum Province. The sample was divided for 2 methods of research: (1) Quantitative research comprised 580 fourth-grade students of 2017 academic year in schools under the Office of the Basic Education Commission, Chaiyaphum Province drawn using stratified random sampling to gain data for validity check of structural equation model; (2) Qualitative research comprised 15 people divided into 3 groups (3 school administrators, 6 fourth-grade to sixth-grade teachers, and 6 fourth-grade students in schools under the Chaiyaphum Primary Education Service Area Office 2 using purposive sampling to gain data about effective instructional model).

Variables comprised 5 causal factors on the results of national test, that is analytical thinking, creativity, reading literacy, mathematical literacy, and scientific literacy.

RESEARCH METHODOLOGY

This research was to study factors and causal relationships on the

results of national test, using mixed method research with 2 phases of data collection: quantitative research for the first phase and qualitative research for the second phase. The research was performed according to the following steps:

1. Review of literature, theories, and studies related to factors and causal relationships on the results of national test covering 5 aspect: analytical thinking, creativity, reading literacy, mathematical literacy, and scientific literacy was conducted to obtain important data for developing conceptual framework.
2. The conceptual framework was developed based on the reviewed literature, theories, and studies.
3. The conceptual framework was checked and edited by advisors and experts.
4. Research instruments, 30-item test, 14-item questionnaire, and 3 interview forms for interviewing school administrators, teachers, and students, were developed and validated before collecting data.
5. Data collection plan was created.
6. Quantitative data were collected from a sample of 580 people.
7. The obtained quantitative data were analyzed using descriptive statistics and inferential statistics as well as using Mplus program for structural equation analysis. Then the findings obtained from quantitative research were summarized.
8. Qualitative data were collected from a sample of 15 people; school administrators, teachers, and fourth-grade students in school under the Chaiyaphum Primary Education Service Area Office 2.
9. The obtained qualitative data from interviewing school administrators, teachers, and students were analyzed using content analysis followed by conducting analytic induction.
10. The findings were summarized and policy recommendations were proposed. Finally, the research report was written.

RESULTS

Results of studying relationships on the results of national test

Analysis results of basic information of the sample in quantitative research for investigating general characteristics of the sample are shown in Table 1.

Table 1 indicates that the number of the sample for quantitative research is equal in both affiliations. Classified based on sex, there are 292 males (50.34%) and 288 females (49.66%), the proportion between male and female is almost equal. Based on service area, there are more males than females in the service area office 1 but more females than males in the service area office 2.

Analysis results of elementary statistics on factors

Table 2. Elementary statistics of factors affecting national test.

| Variable | n | Min | Max | \bar{X} | S | C.V. | Sk | Kur |
|---------------------------------------|-----|-----|-----|-----------|-------|--------|--------|--------|
| 1. Analytical thinking | | | | | | | | |
| 1.1 Factor Analysis | 580 | 2 | 5 | 3.047 | 0.801 | 26.288 | 0.057 | -1.115 |
| 1.2 Relationship Analysis | 580 | 1 | 5 | 3.117 | 0.808 | 25.922 | 0.197 | -0.549 |
| 1.3 Principle Analysis | 580 | 2 | 5 | 3.040 | 0.814 | 26.776 | 0.408 | -0.394 |
| 2. Creativity | | | | | | | | |
| 2.1 Originality | 580 | 1 | 5 | 2.967 | 0.858 | 28.918 | 0.474 | -0.535 |
| 2.2 Fluency | 580 | 1 | 5 | 3.038 | 0.849 | 27.946 | 0.302 | -0.709 |
| 2.3 Flexibility | 580 | 1 | 5 | 2.953 | 0.967 | 32.746 | 0.461 | -0.710 |
| 3. Results of national test | | | | | | | | |
| 3.1 Literacy | 580 | 8 | 35 | 17.960 | 4.934 | 27.472 | 0.418 | -0.196 |
| 3.2 Numeracy | 580 | 6 | 27 | 16.926 | 4.182 | 24.708 | 0.171 | -0.825 |
| 3.3 Reasoning Abilities | 580 | 9 | 34 | 19.719 | 5.544 | 28.115 | 0.307 | -0.602 |
| 4. Reading literacy | | | | | | | | |
| 4.1 Reading Comprehension | 580 | 1 | 4 | 3.284 | 0.721 | 21.955 | -0.591 | -0.845 |
| 4.2 Reading for Main Idea | 580 | 1.5 | 4 | 3.158 | 0.615 | 19.474 | -0.451 | -0.271 |
| 4.3 Interpretation | 580 | 1.5 | 4 | 3.257 | 0.698 | 21.431 | -0.528 | -0.919 |
| 5. Mathematical literacy | | | | | | | | |
| 5.1 Chart and Three Dimensional Shape | 580 | 1 | 4 | 3.357 | 0.694 | 20.673 | -0.826 | -0.300 |
| 5.2 Thinking and Reasoning | 580 | 1 | 4 | 3.348 | 0.575 | 17.174 | -0.862 | 0.544 |
| 5.3 Problem Posing and Solving | 580 | 1.5 | 4 | 3.277 | 0.683 | 20.842 | -0.574 | -0.729 |
| 6. Scientific Literacy | | | | | | | | |
| 6.1 Scientific Phenomena | 580 | 1 | 4 | 3.358 | 0.698 | 20.786 | -0.906 | 0.036 |
| 6.2 Inquiry Process | 580 | 1 | 4 | 3.319 | 0.597 | 17.987 | -0.823 | 0.674 |
| 6.3 Interpretation of Data | 580 | 1 | 4 | 3.244 | 0.839 | 25.863 | -0.849 | -0.452 |

affecting national test are presented as Table 2.

According to Table 2, observed variable is used for measuring the factor of analytical thinking showing mean (\bar{X}) of 3.040 – 3.117. Considering its sub-variables, relationship analysis displays highest mean ($\bar{X} = 3.117$) including showing its standard deviation (S) = 0.808, right-skewed distribution (Sk) = 0.197, kurtosis (Kur) = -0.549. Factor analysis displays second highest mean ($\bar{X} = 3.047$) including showing its standard deviation (S) = 0.801, right-skewed distribution (Sk) = 0.057, and kurtosis (Kur) = -1.115. Principle analysis displays the lowest mean in this variable ($\bar{X} = 3.040$) including showing its standard deviation (S) = 0.814, right-skewed distribution (Sk) = 0.408, and kurtosis (Kur) = -0.394.

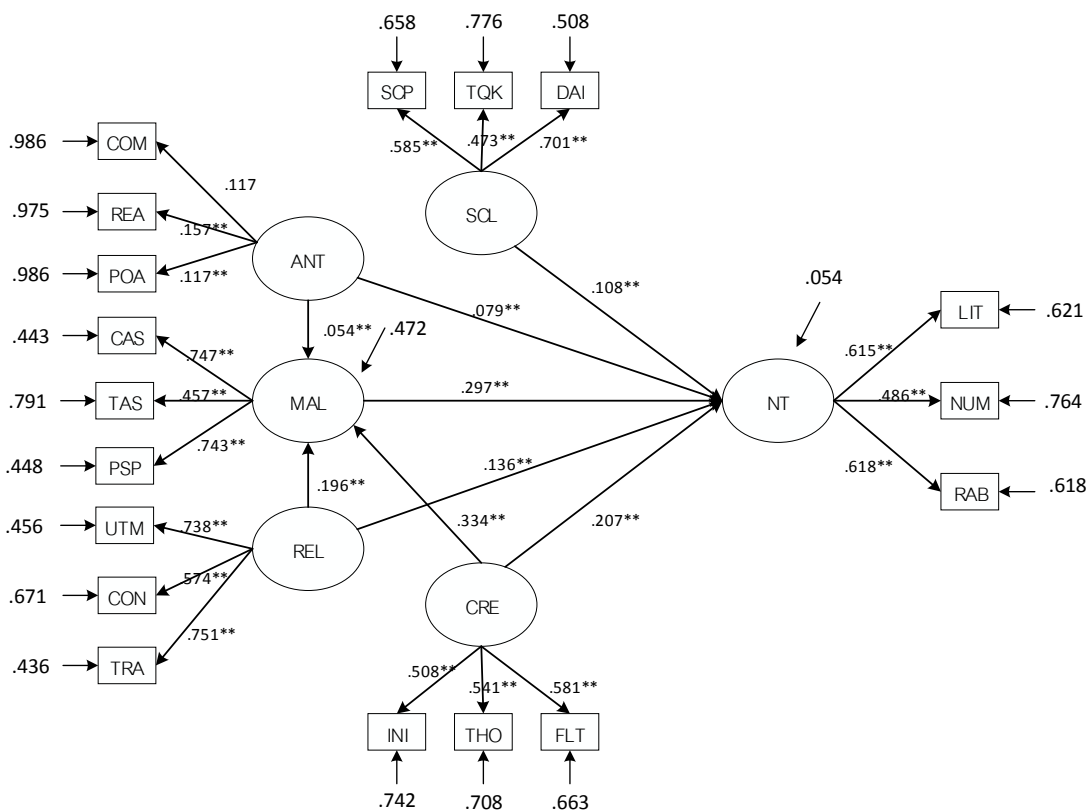
Analysis results of coefficient between observed variables reveal that the relationships between 18

observed variables demonstrate positive relationships of 153 pairs of the variables, and all pairs of them show statistical significance level of 0.01. This means that the relationships are adequate for analyses with Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.911, Bartlett's Test of Sphericity Approx. Chi-Square = 3.874, df = 153, and p = 0.000.

Results of creating and investigating causal relationships on the results of national test

After investigating the causal relationships on the results of national test by linear structural relationship analysis using Mplus program, the results are shown in Figure 1 and Tables 3 and 4.

Figure 1 exhibits the investigation results of causal relationships on national test considering from statistics using for testing goodness of fit between developed



$\chi^2 = 32.848$ $df = 40$ $\chi^2/df = 0.821$ $P\text{-Value} = 0.7815$ $RMSEA = 0.000$ $CFI = 1.000$ $TLI = 1.007$ $SRMR = 0.014$

Figure 1. Causal relationships on the results of national test.

model and empirical data. After adjusting the model, the results are as follows: Chi-square = 3.874 at Degree of Freedom of 40 showing no statistical significance ($P = .7815$), Comparative Fit Index (CFI) = 1.000, Tucker-Lewis Index (TLI) = 1.007, Root Mean Square Error of Approximation (RMSEA) = 0.000, and Standardized Root Mean Square Residual (SRMSR) = 0.014. From the results, it can be indicated that the developed model theoretically fit empirical data.

Total effect (TE), indirect effect (IE), and direct effect (DE) are shown in Tables 3 and 4. From Tables 3 and 4, the results of national test obtained the most positive total effect, both directly and indirectly, from creativity factor with the effect of 0.306 followed by reading literacy factor with the effect of 0.194 and analytical thinking factor with the effect of 0.095.

The mathematical literacy factor had the most direct effect on the results of national test, with the effect of 0.297; followed by creativity factor, with the effect of 0.207; reading literacy factor, with the effect of 0.136; scientific literacy factor, with the effect of 0.108; and analytical thinking factor, with the effect of 0.079.

The mathematical literacy factor is positively affected

directly by reading literacy factor, with the effect of 0.334 followed by creativity factor with the effect of 0.196, and analytical thinking factor with the effect of 0.054.

Considering the coefficient of factors determination, its value is 0.946, which indicates that the factors in the form of causal relationships on the results of national test can be generally used for describing variance of factors affecting the results of national test (94.60%).

Results of developing excellence model in promoting the results of national test

Analysis results of the basic information of a sample of 15 people from 3 different schools in quantitative research reveal that each school consists of a sample of 5 people; 1 school administrator, 2 teachers, and 2 students.

In quantitative research, the sample was interviewed about causal factors on the results of national test. The results are divided into following 5 points.

- (1) In analytical thinking factor, school administrators set up policies and provide guidelines for managing learning

Table 3. Direct effect (DE), indirect effect (IE), total effect (TE) of latent variables, and standard error of causal relationships on the results of national test.

| Criterion variable | Factor variable | Direct effect (DE) | Indirect effect (IE) | Total effect (TE) |
|-------------------------------|-----------------------------|--------------------|----------------------|-------------------|
| Results of National Test (NT) | Analytical Thinking (ANT) | 0.079** (0.018) | 0.016 (0.007) | 0.095** (0.016) |
| | Creativity (CRE) | 0.207** (0.078) | 0.099** (0.030) | 0.306** (0.069) |
| | Reading Literacy (REL) | 0.136** (0.048) | 0.58 (0.028) | 0.194** (0.056) |
| | Mathematical Literacy (MAL) | 0.297** (0.094) | - | 0.297** (0.094) |
| | Scientific Literacy (SCL) | 0.108** (0.037) | - | 0.108** (0.037) |
| Mathematical Literacy (MAL) | Analytical Thinking (ANT) | 0.054** (0.015) | - | 0.054** (0.015) |
| | Creativity (CRE) | 0.196** (0.056) | - | 0.196** (0.056) |
| | Reading Literacy (REL) | 0.334** (0.069) | - | 0.334** (0.069) |

**Showing statistical significance level of 0.01. Values in parentheses represent standard error.

Table 4. Correlation matrix between latent variables.

| Latent variable | ANT | CRE | NT | REL | MAL | SCL |
|-----------------|---------|---------|---------|---------|---------|-------|
| ANT | 1.000 | | | | | |
| CRE | 0.525** | 1.000 | | | | |
| NT | 0.592** | 0.437** | 1.000 | | | |
| REL | 0.558** | 0.456** | 0.554** | 1.000 | | |
| MAL | 0.564** | 0.483** | 0.549** | 0.727** | 1.000 | |
| SCL | 0.595** | 0.458** | 0.502** | 0.692** | 0.696** | 1.000 |

**Showing statistical significance level of 0.01.

activities by giving teachers freedom to provide practice-based learning including preparing instructional media under the extent specified in curriculum. Teachers provide and insert activities promoting analytical thinking into other subject areas, while students can practice their analytical thinking during learning such as mathematics, arts, and Thai.

(2) In creativity factor, school administrators provide practices as well as evaluation for teachers by giving them freedom in terms of instructional management including promoting the use of media, especially multimedia, and promoting student to learn by doing, such as making a tiny book. In case of teachers, they can have the guidelines for carrying on activities and doing evaluation by allowing students to get involved in designing learning activities as well as implementing group process and project-based learning. For students, their favorite activities are science experiment, invention, and making tiny books.

(3) In reading literacy factor, school administrators have the guidelines for instructional management in terms of using innovation to solve illiteracy problem among students including putting projects in an operational plan, promoting creation of media, and giving priority to buying books for a library. In terms of teachers, model on

promoting students' reading literacy is integrated in all subject areas. For students, they are promoted their reading literacy by reading as well as making a reading summary, and project-based learning activities.

(4) In mathematical literacy factor, school administrators set a policy in organizing instructional activities and mathematics competitions for students without expectation of prize except experiences students will get, and examining the outcomes of teaching. Moreover, using games in the classroom is promoted. At the same time, teachers have techniques and methods in teaching mathematics that do not make students get bored by using games, using attractive teaching style, and trying to get them remember complex theories. In case of students, geometry is their favorite topic in mathematics, because they can create many things in different shapes. In addition, they enjoy number crunching, learning fractions, and telling time.

(5) In scientific literacy factor, school administrators provide operational guidelines and promote participation in academic competitions arranged by other organizations, including emphasizing scientific process such as experiment or learning by doing. As for teachers, they provide interesting instructional style and evaluation of science for students such as learning by doing,

learning outside the classroom, learning through multimedia, and getting involved in the Little Scientists' House Project. Students, therefore, can have opportunities to learn in science classroom, and they prefer scientific experiment and using or touching real objects.

The results of developing excellence model in promoting the results of national test according to authentic investigation and data about sample schools reveal that schools have analyzed students individually and created the guidelines for developing students individually. The results of O-NET have been used as the standard for improving lesson plan allowing students to experience virtual test based on the concept of the National Institute of Educational Testing Service. In addition, strategic plan has been created to raise students' learning achievement, and there have been various activities for improving the quality of students based on the focal point of school. All activities have been planned, designed and carried on with cooperation from many sectors. Trace and care system has also been created to develop and solve problems encountered by the students individually. Classroom research as well as development of the schools to become a learning society of the community has been conducted. Similarly, teachers have advanced in terms of instructional activity management for the 21st century. Apart from this, community or locality involvement has been highlighted regarding Local Wisdom Project, support of local resources, and project monitoring and evaluation. Regarding students, a project concerning educational opportunity promotion for students has been developed using an educational administration system called "SMILE Model" together with focusing on students' quality development, life planning skills, and appropriate behaviors. Finally, the project "Parents as Teacher, Promotion of Wisdom" has been performed.

DISCUSSION

The results of studying causal relationships on the results of national test showed that according to the relationships between 18 observed variables, there were 153 pairs of variables demonstrating positive relationships and statistical significance level of .01. This means that the relationships are adequate for the analyses. According to investigation of data distribution in each variable, normal distribution was found when Maximum-likelihood Estimation of Confirmatory Factor Analysis used the Skewness between -3 and +3 and positive Kurtosis (or greater 0) (Vanichbuncha, 2013). These results, Skewness (-0.906 – 0.474, |Mean|= -0.201) and Kurtosis (-0.919 – 0.544, |Mean|=-0.439), met the criteria. In testing the suitability of data, Kaiser-Meyer-Olkin (KMO)

was used to examine the relationships between variables (Poonpong, 2014), and the analysis found that KMO = 0.911. The results of hypothesis testing of the relationships between variables employing Bartlett's Test of Sphericity with Chi-square approximation distribution at significance level of < 0.05 revealed that $\chi^2 = 3.874$ and P-value < 0.001, so the data can be used in continued factors analysis.

The results of creating and investigating causal relationships on the results of national test confirmed that the model fits the empirical data. The results generally showed that the factors having direct and indirect effect on the results of national test were creativity, reading literacy, and analytical thinking (Effect = 0.306, 0.194, and 0.095, respectively). The factors having direct effect on the results of national test were mathematical literacy and scientific literacy (Effect = 0.297 and 0.108, respectively).

Creativity factor having an effect on the results of national test was composed of 3 observed variables that is originality, fluency, and flexibility. According to the results, creativity factor had both direct and indirect effect on the results of national test (Effect = 0.306). It can be said that creativity is the mental ability to think complicatedly and diversely, "Divergent Thinking", comprising originality, fluency, and flexibility. Naturally, all human beings have creativity and positive thinking that can lead to new things that will benefit to individuals and public; however, usability depends on obtained development and promotion (Tweesak, 2016). Boonnita (2015) studied on the development of creative thinking using the creative skills practice on computer project subject. The results revealed that efficiency index was 0.5106 or 51.06%. Students' scores increased after skill training. Their average score after skill training was 47.52 or 79.20%, which increased from the score before skill training, which was 34.50 or 57.50%; and their average development score was 50.69%.

Reading literacy factor had both direct and indirect effect on the results of national test (Effect = 0.194). Reading literacy is the ability of readers to read correctly within prescribed time and to understand what they read (Bureau of Academic Affairs and Educational Standards, 2014). Moreover, reading literacy is defined as knowledge and skill of reading comprehension including interpreting what the readers perceives from reading, and evaluating as well as analyzing based on purposes in writing (Institute for the Promotion of Teaching Science and Technology, 2015). Furthermore, reading is regarded as a tool for knowledge acquisition, especially school age people, as well as a tool for a successful career; in other words, knowledge gained from reading is beneficial to personal and career development (Ratchaneekool, 2015).

Analytical thinking factor had both direct and indirect effect on the results of national test (Effect = 0.095). From the result, it can be explained that analytical thinking is

intellectual ability composed of analytical thinking of content and analytical thinking of relationship. Analytical thinking of content is the decomposition of factor while analytical thinking of relationship is analysis of relationship between factors to examine the relationship of data reasonably and to check and find out more data for decision-making (Worakamin et al., 2016). Analytical thinking influences the results of national test, which is consistent with the study of Potisutha (2014) on the development of learning achievement and thinking analysis skills of concerning environmental problems in North and South America through the cooperative learning model with the six thinking hats technique of grade 3 students. The result revealed that the students' learning outcome after participating in learning was better than one before participating in learning showing statistical significant level of .05.

Mathematical literacy factor had direct effect on the results of national test (Effect = 0.297). This is because the Institute for the Promotion of Teaching Science and Technology or IPST (2015) has determined the elements based on the evaluation framework of OECD/PISA, focusing on students' mathematical understanding and skills to face the real world as much as possible. In other words, mathematical literacy is regarded as situation or context mostly close to the students, so it can influence the results of national test. Supported by the study of Pejchang (2015) on the development of mathematics achievement on probability for grade 11 Students by the Polya process, the students' mathematics learning achievement after learning was higher than before, with .05 level of statistical significance. In addition, the study of Leeyana (2015) on the mathematical learning achievement on probability for IPST students in grade 9 using the 7E learning cycle and STAD methods showed that the students' average achievement score was 20.17 which was higher than the 50% of deducted scores from pre-test exam (16.13).

Scientific literacy factor had direct effect on the results of national test (Effect = 0.108). This is because scientific literacy originates from 4 associated factors: 1) intellectual development, 2) understanding of environment, 3) use of reasoning and thinking for inquiry process, and 4) mind habits. Comparing these factors in the form of a four-sided pyramid, scientific is at the top of the pyramid, so instructional management has to emphasize students' scientific literacy. The Department of Academic and Educational Standards (2014) defined scientific literacy as the ability for a person to connect real life situations with relevant scientific issues by creating a discourse with the reason related to science and technology. Capacity and scientific knowledge in the context of disease and health, natural resources, environmental quality, harm, and advanced science and technology in accordance with the PISA framework is required.

This conforms to the study of Khanthasiri (2014) on an organization of learning activities on the topic "Life and the Environment" using the Inquiry and the socio-scientific issue-based approaches to promote learning achievement in science literacy and decision making for sixth-grade students. The results found that students' average scores of learning achievement, scientific literacy, and decision-making were 58.33, 56.67, and 67.58% respectively; besides learning achievement in science literacy is also higher.

The results of developing excellence model in promoting the results of national test obtained from in-depth interview with school administrators, teachers, and students as well as analyzing data about sample schools. The findings consisted of analyzing students individually, implementation of O-NET analysis results in improving lesson plan, organizing virtual test, creation of strategic plan to raise learning achievement, planning as well as design and running the activities with the cooperation, developing school into learning center, test construction based on learning standards, support of resources from community, community involvement, project regarding educational opportunity promotion for students using an educational administration system "SMILE Model", administration of students' quality development, emphasis on life planning skills as well as appropriate behaviors, and conducting project like "Parents as Teacher, Promotion of Wisdom".

Conclusion

The results of studying causal relationships on the results of national test show that according to the relationships between 18 observed variables, there are 153 pairs of the variables demonstrating positive relationships and statistical significance level of .01. This indicates that the relationships are adequate for analyses.

The results of creating and investigating causal relationships on the results of national test reveal that the model fits the empirical data ($\chi^2 = 32.848$, $df = 40$, $\chi^2/df = 0.821$, $p\text{-value} = 0.7815$, $CFI = 1.000$, $TLI = 1.007$, $RMSEA = 0.000$, and $SRMR = 0.014$).

The results of national test receive the most positive total effect, both directly and indirectly, from creativity factor (Effect = 0.306) followed by reading literacy and analytical thinking (Effect = 0.306 and 0.095 respectively). The factor having the most direct effect on the result of national test is mathematical literacy factor (Effect = 0.095) followed by creativity, reading literacy, scientific literacy, and analytical thinking factors (Effect = 0.207, 0.136, 0.108, and 0.079 respectively). The obtained coefficient of determination is 0.946, indicating that the factors in the form of causal relationships on the results of national test can be used for expressing variance of factors affecting the results of national test

(94.60%).

The results of developing excellence model in promoting the results of national test are concluded as following.

(1) The sample schools specify the principles to improve learning achievement and educational quality by increasing the criteria of test results by 3% in all subjects as well as setting the guidelines according to the plan of learning achievement improvement that is creation of guidelines for developing students individually and implementation of O-NET analysis results in improving lesson plan.

(2) Schools provide various activities for improving the quality of students based on authentic problems and needs corresponding to the focal point of the school and local or community characteristics. In terms of administrative process, school administrators plan, design, and run the activities with the cooperation. Historical results of evaluation and operation are applied to the development, in accordance with the development goal. For teachers, they organize student-centered instruction.

(3) Factors leading to meeting the criteria for being a best-practice small-sized school comprise participative management, creation of plans and projects on cooperation with related parties, networking for seeking cooperation, involvement of community in supporting local wisdom, and monitoring, evaluation, as well as reporting for future development.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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