Annual Meeting of Mathematics and Natural Sciences Forum of Indonesian Institutes of Teacher Training and Education Personnel (MatricesFor IITTEP)

In Conjuntion With:

International Conference on Mathematics, Natural Sciences, and Education (ICoMaNSEd 2015)

August 07-08, 2015, Aryaduta Hotel Manado, Indonesia

PROCEEDINGS

Theme:

"Enhancement and Acceleration on Research and Learning in Mathematics and Natural Sciences for the Utilization of Natural Resources"

Editors:

Prof. Dr. Cosmas Poluakan, M.Si.
Dr. Rymond J. Rumampuk, M.Si.
Dr. Anetha L. F. Tilaar, M.Si.
Dr. Heroike D. Rompas, M.Si.
Dr. Tinny D. Kaunang, M.Si.
Dr. Hetty H. Langkudi, M.Pd.
Dr. Alfonds A. Maramis, M.Si.

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Proceedings

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MESSAGE FROM RECTOR

The theme of the conference is " Enhancement and Acceleration on Research and Learning in Mathematics and Natural Sciences for the Utilization of Natural Resources". This event was aimed to providing dissemination and publication media for research results, theoretical studies, and best practices in the field of Mathematics, Natural Sciences, and Education; more over, strengthening the interaction and communication between researchers, promote mathematics and science research activities by the researchers in Indonesia and overseas, in hope to build networks and collaborations. By promoting collaboration across disciplines, we can further extend the opportunity to discover innovations, gain better understanding and enhance the advancement of science body.

The development of Mathematics and Natural Science can not be separated from the scientific charateristics that encourage high-curiosity in doing research. We hope, IITTEP always creating, maintaining, facilitating, and developing the world class academic atmosphere that encourage students and faculty to continue doing research, and community services.

Research is one of the *Tri Dharma* of the higher education. It is a systematic effort to solve the problems or answer the questions through data collecting, formulating the generalities based on the data, then finding and developing organized knowledge by scientific method. It is expected that from research activities valuable empirical facts can be obtained to improve and develop the theory and practice to bring a better quality of education. We do hope this conference will bear fruitful results and promote networking and future collaborations for all participants from diverse background of expertise, institutions, and countries to promote science, mathematics, and the education.

I would like to take this opportunity to express my gratitude to all delegates for their full support, cooperation and contribution to the Forum and Conference 2015. I also wish to express my gratitude especially to the Dean of Faculty of Mathematics and Science, Prof. Dr. Cosmas Poluakan, M.Si, and the Organizing Committee who dedicated their time and energy, and for their hard work to make this conference a big success. However, should you find any shortcomings and inconveniences, please accept my apologies.

Rector,

Prof. Dr. Ph. E A Tuerah, M.Si, DEA

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MESSAGE FROM DEAN

Praise and thanks to the presence of the Lord, because ICoMaNSEd 2015 event can be held with big success. We are proud because as a part of the academic community, we can take part in enriching the scientific communication forum between scholars through ICoMaNSEd. Through this Scientific Conference, we are present here, to share and to exchange experiences through various experts in the field of Mathematics and Natural Science Education from several countries and various parts of Indonesia. For the implementation of ICoMaNSEd 2015, we thanked to Rector of State University of Manado, Chairman of the Forum of Science IITTEP, deans of Mathematics and Natural Sciences Faculty of IITTEP along with vice deans and heads of departments and study programs, lecturers and students who support this event so it could be held. In particular, we express our gratituted to Keynotes Speakers and Invited Speakers who have agreed to attend and to present their articles.

Implementation of Scientific Conference or other scientific meetings forms such as symposium, seminar or FGD, etc by a university or research institute, is a form of scientists activities that always continue to strengthen scientific attitude and the scientists identity to be opened, objectived, and criticals to the science developments, especially for the further of science development. In ICoMaNSEd forum 2015, these things are reflected in the context of improvement and development in the learning of Natural Sciences and Mathematics. The experts involved not only from IITTEP-universities, but also involve the faculty of Mathematics and Natural Sciences of non- IITTEP ones. We strongly hope that the implementation of present Scientific Conference in State University of Manado, will be the pillars and a reference for the implementation of other scientific events in Indonesia, especially Manado, North Sulawesi.

Distinguished participants, last but not least, on this occasion, I would like to quoted from a Nobel laureate in Medicine Physiology back in 1960, Sir Peter Medawar, a British scientist, born in Rio de Janeiro Brazil. His advice for us academics and scientists started from the following question: "Do we need a sharp mind to be able to succeed as a scientist?". It is an anxiety that does not need to be considered, because one does not need to be too clever in order to be a successful scientist. Well-thoughts must be possessed. On the other hand, it would be very helpful to have some good qualities from ancient times that somehow now have been regarded as a trait that less ignored by the scientists. Those properties are: a practical view; perseverance; determination; ability to concentrate; tenacity to not despair when facing difficulties ".

Hopefully the advice from the Nobel laureate Sir Peter Medawar, could be an inspiration to all the academics towards successful stages in scientific careers. Keep this adage: "God does not call us to be a successful man, but to believe. Believe, in order to succes ".

Dean of the Faculty,

Prof. Dr. Cosmas Poluakan, M.Si.

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MESSAGE FROM CHAIRMAN OF THE EVENTS

This seminar entitled the International Conference on Mathematics, Natural Sciences, and its Education (ICoMaNSEd): ***Enhancement and Acceleration on Research and Learning in Mathematics and Natural Science for the Utilization of Natural Resources*** was organized by Faculty of Mathematics and Natural Sciences, Manado State University, supported and coordinated by 12 members of Association of the Faculty of Mathematics and Natural Sciences from Teacher Program.

On behalf of the committee of this conference, I would like to thanks and give the highest appreciation to keynote speakers including:

1. Prof. David F. Treagust, Ph.D., FSB., FAERA (Courtin University, Perth, Australia)
2. Rebecca Johnson, MA (Columbia University, USA)
3. Ed van den Berg, Ph.D (Free University, Amsterdam, The Netherlands)
4. Assoc. Prof. Dr. Vichit Rangpan (Yala Rajabhat University, Thailand)
5. Prof. Dr. Syamsu Qamar Badu, M.Pd (State University of Gorontalo, Indonesia)

I would like also to give thanks and gratitude to the invited speakers from 12 universities including:

1. Dr. Ir. Sri Nurdiati, M.Sc (Bogor Agricultural University, Indonesia)
2. Prof. Ferdy S. Rondonuwu, Ph.D (Satya Wacana Christian University, Salatiga, Indonesia)
3. Prof. Dr. Zulkardi, M.I.Komp, M.Sc (Sriwijaya University, Palembang, Indonesia)
4. Prof. Dr. Julius H. Lolombulan, MS (Manado State University, Indonesia)
5. Prof. Drs. Manihar Situmorang, M.Sc., Ph.D (Medan State University, Indonesia)
6. Prof. Dr. Liliasari, M.Pd (Indonesian Education University, Bandung, Indonesia)
7. Dr. Slamet Suyanto (Yogyakarta State University, Indonesia)
8. Dr. Suharto Linuwih, M.Si (Semarang State University, Indonesia)
9. Prof. Dr. Subandi, M.Si (Malang State University, Indonesia)
10. Dr. Hj. Yuni Sri Rahayu, M.Si (Surabaya State University, Indonesia)
11. Suwardi Anas, M.Sc., Ph.D (Makasar State University)

Now, I would like to special thanks to 156 speakers and all of participant required in this seminar.

As we all know that to be able to display text in the real international standard, required not only the international community of scientists involved in the research process, but is also involved in the process of publication. Therefore, I expect this event to be a dissemination of the lecturer researches.

Finally, I am delighted to thank to all the members of the committee who have been working very hard for the success of this conference.

Chairman of the Events,

Dr. Rymond J. Rumampuk, M.Si.

ISBN: 978-602-74204-0-3

META ANALYSIS ON THE APPLICATION OF STRUCTURAL EQUATION MODELS (DISSERTATION STUDIES ON PUBLIC ADMINISTRATION STUDY PROGRAM, POSTGRADUATE PROGRAM, STATE UNIVERSITY OF MAKASSAR)

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Abstract
This study examines the various things about writing a doctoral dissertation in Public Administration Study Program at the Postgraduate Program (PPs) State University of Makassar (UNM), which uses structural equation models or path analysis. The aim of this study is to get more qualified information, more precise and accurate, more useful in practice, and broaden the knowledge. Systematic steps taken, namely: identifying and selecting a dissertation that uses structural equation models, carefully read the problem statement and research questions of those selected dissertations, analyzing the accuracy of the analysis of the appropriate problem statement and research questions, making a compilation of all literature review from selected dissertation, incorporating relevant data for analysis (meta-analysis) in order to obtain a higher strength of the conclusions, making interpretations of the results of meta-analysis, and formulating recommendations for further research, as well as the revitalization of the learning and using statistics in research, as well as repairing the quality of supervising doctoral candidate students. The analysis showed that none of considered aspects is fully meet the expectations. Recommendations for subsequent meta-analysis of research need to be done in other dissertations of other study programs. Thus, the recommendation of the research is PPs UNM need to strengthen the teaching team of research methods and statistics and set a high quality as a target. This can be done by activating peer group of lecturers of statistics and research methods to conduct discussions and workshops on a regular basis to revitalize the way of thinking and researching among students and teachers.

Keywords: meta-analysis, structural equation models

1. Introduction

There is a lot of doctoral dissertation from public administration at the Postgraduate Program (PPs) State University of Makassar (UNM) which applies latent variable structural equation models. However, writing a dissertation that using path analysis still needs to be increased in terms of its quality. Based on the observations of researchers, in general, dissertations written by public administration students of PPs UNM using structural equation models still have many deficiencies, particularly with regard to supported theory that build the used path diagram, analytical techniques chosen for pathway analysis, presentation techniques of scientific information and technical interpretation of the results of path analysis.

Another problem faced by students in writing a dissertation is that commonly used analysis technique is limited to only using one single analysis, where in fact there is a variety of options. This happens due to lack of knowledge of students about the various options. Those other analyses are also still lacking or not yet supported with scientific rationale. Actually, with the ellipse method introduced by Tiro and Sukarna (2013) provide a variety of alternatives for students to perform quantitative analysis of the data in a way that is varied and mutually supportive for valid conclusions.

In the application of path analysis, there are several things that need to be attentive by students so that the findings meet a reasonable standard for a dissertation including; (1) the selection of exogenous variables, endogenous variables, and mediator variables is based on depth and rational analysis of theory/logic, (2) the used instruments are adequately developed or using standard instruments so that the data is valid, (3) the determination of path diagram is supported by a strong theory and logic, (4) the interpretation of the results is done in the right way, (5) the presentation of scientific information satisfies the good criteria.

To obtain more comprehensive information and generate suggestions or recommendations of varied analytical techniques, meta-analysis of relevant dissertations and qualified the inclusion criteria needs to be done. Meta-analysis led the researchers to draw conclusions from a few study reports so that the information has: (1) better quality, (2) more thorough and accurate, (3) more useful in practice, and (4) broaden the knowledge. This kind of thinking then motivated researchers to use meta-analysis to assess the various public administration doctoral dissertations which have been written by PPs UNM students who used the application of Structural Equation Models.

Application of meta-analysis in this study is expected to provide research results information that has: better quality, more precise and accurate, more useful in practice, as well as broaden the knowledge. In addition, the results of this study can map the quality of data analysis of dissertation written by public administration students of PPs UNM, especially those used path analysis (structural equation models). Having feedback to improve the quality of teaching of statistics and research methods in the Psotgraduate Program of State University of Makassar. Providing information or input to improve the quality of the process and outcome of supervision of public administration doctoral dissertation writing in PPs UNM.

2. Method

The type of research is literature studies (library research) that take a sample from doctoral dissertations of PPs UNM. The dissertation is a source of data analyzed with meta-analysis.

2.1. The Steps of Study

1. Identifying and selecting qualified dissertations that meet the research objectives, namely public administration doctoral dissertations that used structural equation models.
2. Carefully reading the formulation of problem and research questions of each selected dissertations. This step is done because the formulation of problem is the core of dissertation, while research question is the heart of the dissertation.
3. Analyzing the quality of variables, development of instrument, and the accuracy of the analysis in accordance with the formulation of problems and research questions.
4. Make a compilation of all literature review from selected dissertations.
5. Combining relevant data for analysis (meta-analysis) in order to make a conclusion and interpretation of the meta-analysis results.
6. Formulating recommendations on the PPs UNM for further research and the development of research methodology in order to revitalize of the learning and using of statistics in research.

2.2. Implementation of Study

The population of study is a doctoral dissertation on the public administration study program of PPs UNM from 2008 to 2013. To determine the sample, the inclusion criteria is performed

in the selection of a doctoral dissertation, that is public administration dissertation using Structural Equation Modeling, which represents the years from 2008 to 2013. The study of selected public administration doctoral dissertations was carried out by:

1. Analyzing the suitability of recorded data that includes: title; problem statement and research questions; hypothesis; variables (exogenous, endogenous, and mediators); basic theory that builds a model; Operational definitions of variables; analytical techniques; instruments (internal consistency, construct validity, and reliability).
2. Presentation of information: the quality of the presentation of information from the aspect; tables and graphs, display of numbers in the table, the adequacy of information, both in the table and in the graph.
3. Interpretation of the results of the analysis: the quality of the interpretation of results of analysis from the aspects of: a description of each variable, path coefficient, and the meaning of its significance.
4. In depth analysis about: the quality of the discussion assessed from the aspects (scientific analysis, new findings, reinforcing the existing theory, and sued the existing theory); conclusions and suggestions.

3. Results and Discussion

Results and discussion starts to represent the data sample, and proceed with the analysis of the results along with the discussions.

3.1. Dissertation Data Sample

Description of the data sample is given in the Figure 1. Based on this figure, it shows that in 2008 there is no dissertation chosen as a sample because there is no one using Structural Equation Models analysis. Most of samples (3 dissertations) were taken from 2010. This was done due to the highest completion of a doctoral dissertation that uses Structural Equation Modeling analysis is in 2010. Similarly, there are more samples taken from 2011 and 2013 than from 2009 and 2012. After having the description of samples, the following section will explain the results of the analysis and discussions.

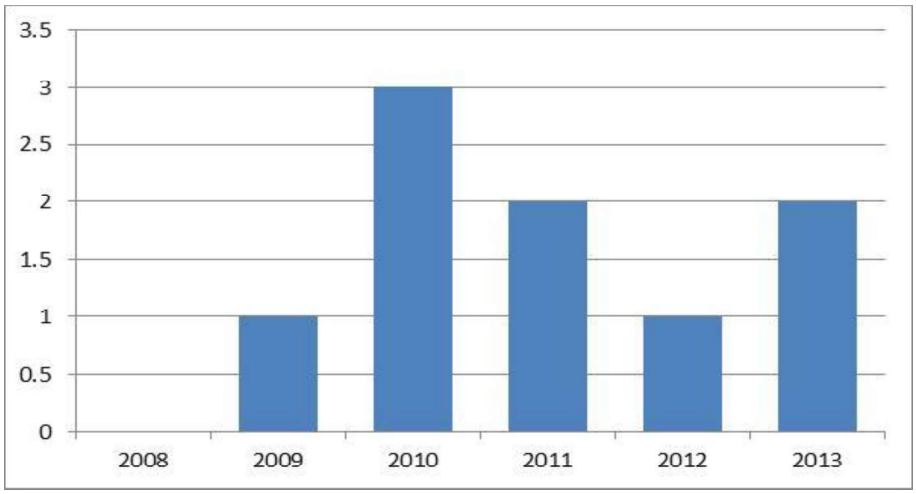

Figure 1. Bar diagram of data sample of public administration doctoral dissertation

3.2. Analysis and Discussion

Results of analysis are given in sequence with the discussion as follows.

3.2.1. Problem Statements, Research Questions and Hypotheses

The results of analysis about the problem statement, research questions, and hypotheses are given in Figure 2. From this figure, it can be seen that the quality of hypothesis is better than the formulation of problem and research questions. The lowest quality is on the quality of problem statement (at 32% of the ideal score). However, the quality of the hypothesis still needs to be improved because it is still slightly above the middle of the expected quality (at 56% of the ideal value).

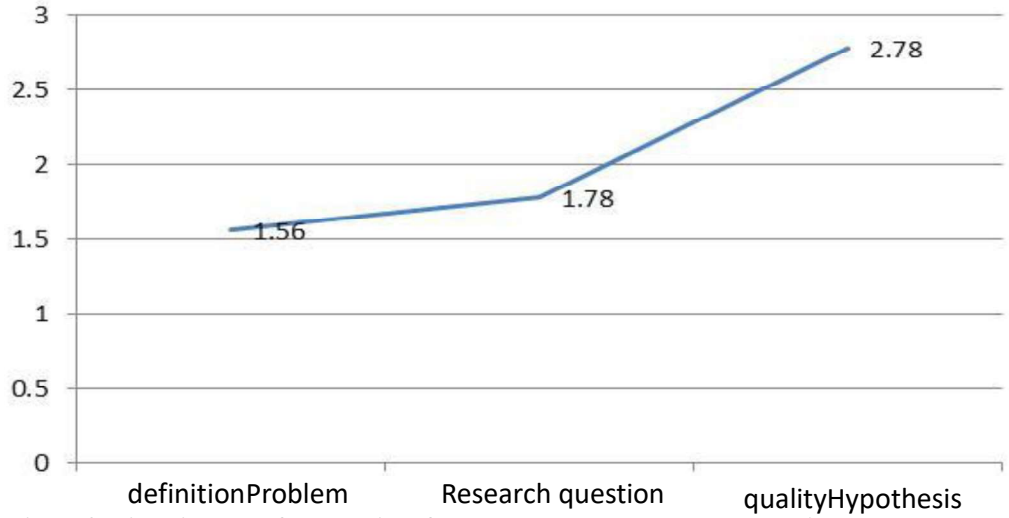

Figure 2. Line diagram of the quality of problem statement, research questions, and hypotheses

3.2.2. Operational Definition of Variables and Quality of Analysis

The results of analysis about the quality of the operational definition of variables and quality of analysis are illustrated in Figure 3. From this figure, it shows that the quality of the definition of operational variables is better than the quality of the analysis. However, the quality of operational definition only reached 64% of ideal quality, and the quality of analysis only reached 51% of ideal quality. Thus, the quality of the definition of operational variables and the quality of the analysis are still weak (far from ideal quality).

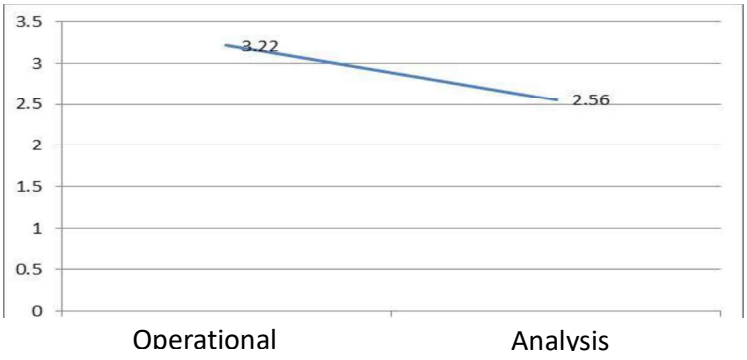

Figure 3. Visualization of variables operational definition and analysis qualities

3.3.3. Development of Instruments

The illustration of results and process of instrument development are given in Figure 4. From this figure, it shows that the quality of the process of instrument development still needs to be

improved. Thus, the accountability of the quality of instruments (internal consistency of each item, construct validity, and coefficient of reliability) also becomes weak, because many of dissertations do not report it.

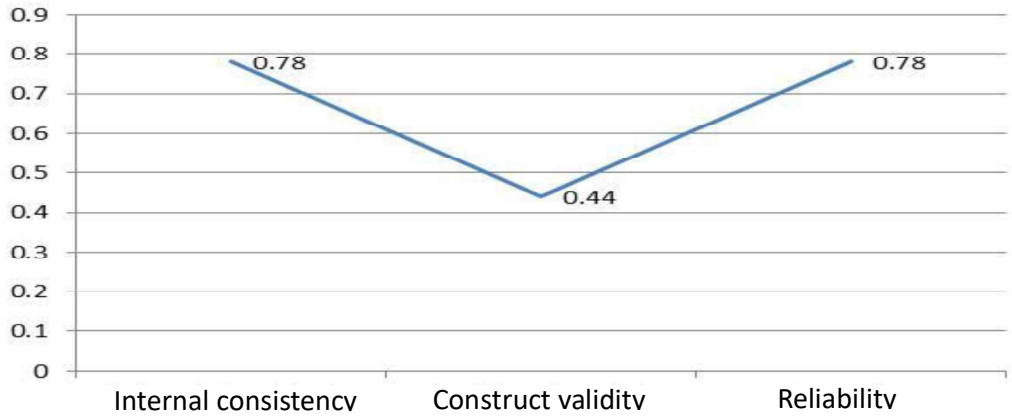

Figure 4. Line diagram of quality of instrument development

3.3.4. Table Presentation

Data from analysis results about the quality of the presentation and explanation of information are illustrated in the Figure 5. The line diagram of quality of presentation and explanation of information from the figure shows that the presentation quality and adequacy of information in the table is in a position slightly above moderate (54%), although the quality of explanations still the lowest (36%). Many explanations from the tables are only repeating information contained in the table, instead of adding explanation. That is, the explanation given is clearly legible with the figures in the table. Furthermore, the display of the numbers in the table still has a low level of legibility for some of them, which is a number with a high cognitive load. Principles for presenting numbers with low cognitive load will allow readers to capture the message easily.

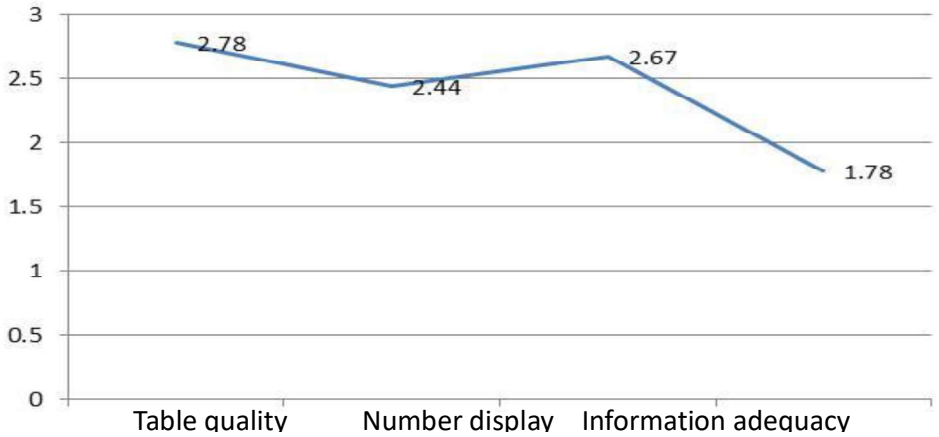

Figure 5. Line diagram of quality of presentation and explanation of information in the table

3.3.5. Graph Presentations

Data from analysis results about the quality of the presentation and explanation of a graphical illustration is given in Figure 6. From this figure, it shows that the quality of presentation and explanations is still far below expectations, especially the quality of the explanation (42%).

Quality of table that has the biggest score only reached 56% of ideal quality. Explanation of a graph should indicate a trend or comparison. It is yet to be seen in the dissertation that became the sample of study.

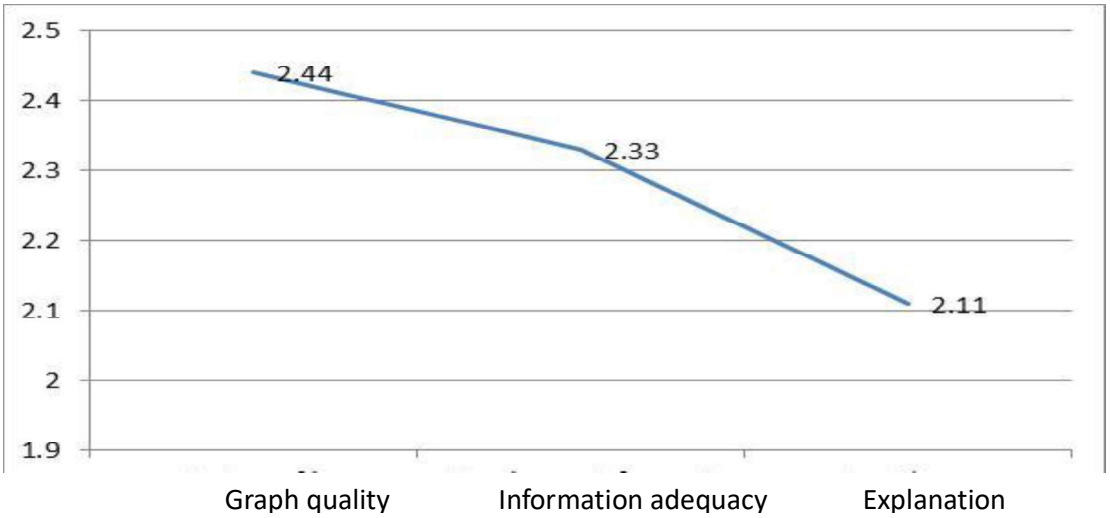

Figure 6. Line diagram of quality of presentation and explanation of graph

3.3.6. Discussion, Conclusions, and Recommendation

The illustration of the data from analysis results on the quality of discussion, conclusions, and recommendations of research is given in Figure 7. Line diagram of quality of discussion, conclusions, and recommendations of the study. From the figure, it can be seen that the quality of the research conclusions in a position to moderate (66%), although the quality of the discussion is still low (46%) and quality of advice (56%). The discussion needs to be supported by scientific arguments and strong logic. It is not yet clearly visible in almost all analyzed dissertations.

3.3.6.1. Specific Findings

Some specific findings that should not happen in a dissertation presented as follows:

1. The question is not feasible, such as: How big is the significance level of leadership influencing the effectiveness of the organization within the Government of Tangerang Regency?
2. The aim is not well defined, such as: Analyzing the significance level of leadership toward the effectiveness of the organization in the Government Tangerang Regency.
3. The use of the term statistics is wrong, for example:
   a. Using the terms of significance value that should be p value (probability value);
   b. Improper use of the term valid that should be the term of internal consistency, as the conclusions of the analysis of the correlation between the score of the terms and the total score of the result of the instrument development;
   c. Using the term of proving hypothesis where it should be testing hypothesis.
4. Containing information that is not important in the table.
5. Error in reading the results (output) of computer (choosing numbers incorrectly).
6. Writing the p value = 0,000 which should be written with $p < 0.001$

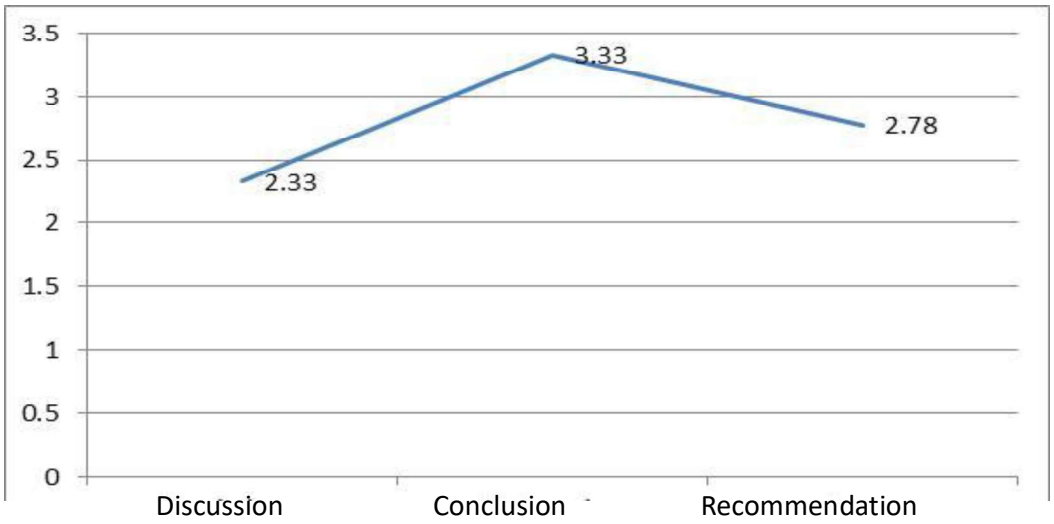

Figure 7. Line diagram of quality of discussion, conclusions, and recommendations

3.3.6.2.. Limitations Research

Like other types of research in general, this meta-analysis still has limitations that still need to be considered further.

1. The principle of auto meta-analysis that merges data from several studies cannot be done, so that it becomes a further research program.
2. The substance of the instrument has not received attention, the new ones pay attention only to the development procedures and validating test.
3. Substance of operational definitions associated with the construction of the underlying theory (conceptual definition) is not yet analyzed.

4. Conclusion & Recommendation

4.1. Conclusion

From the analysis and discussion, conclusions can be formulated as follows.

1. Selecting and positioning of exogenous, endogenous, and moderator variables have not shown a strong indication is done based on the analysis of in depth and rational theory.
2. The instruments used are not yet fully developed adequately or using an instrument that is standard so that the data collected is valid.
3. The determination of the structural model diagram is not well supported by a strong theory.
4. Interpretation of the results of the analysis has shown indications that it was done in the right way, but generally has not provided proper scientific analysis.
5. The way of presenting scientific information in the form of tables, graphs, and statistics value is not fully meet the requirements and criteria, so that it still needs to be improved.
6. The generated findings may already meet with a minimum standard of a dissertation, but not as expected in high quality.

4.2. Recommendations

Based on the conclusions and limitations of the study, some recommendations can be formulated as follows.

1. Lecturers in the research methods need to give emphasis to the need for the selection of exogenous, endogenous, and the moderator variables that are based on the rational analysis of theory.
2. The used instruments need to be developed adequately or using an instrument that is standard so that the data collected can be accounted for validity.
3. It should be given a special attention that the determination of path diagram must be supported by a strong theory, and not dictated by the suggestion of a computer program that is not based on reasonable theory or logic.
4. Interpretation of the results of the analysis carried out in the right way needs to have strengthening, philosophical studies, and that has not really need to be given an adequate explanation.
5. The way of presenting scientific information with a good requirement and criteria still need to be repaired and given attention.
6. The standard of producing findings in a dissertation must be formulated with a dynamic principle, to meet the expectations of high quality dissertation.

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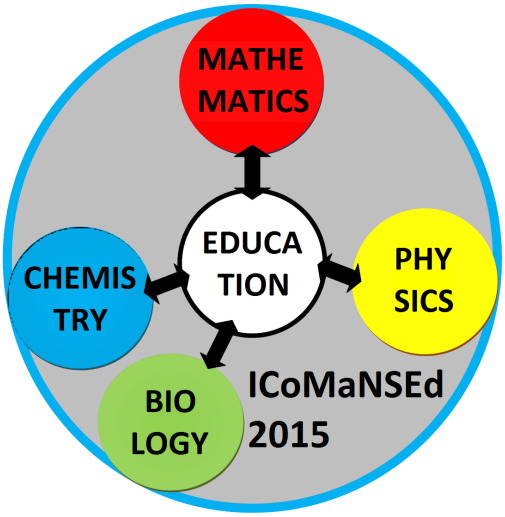
Phylosophy of ICoMaNSEd 2015 Logo

Basic form of a large circle symbolizes Mathematics, Science and Education as an integral unit of basic education and basic science, and states the symbol of mathematics geometry. Five small circle-shaped model of molymod express linkage development areas of Mathematics and Science which are centered on education activities. Red for Mathematics states: spirit, gives energy, symbol, action, passion, strength and joy. Yellow for Physics states: warmth and happiness, cheerful symbol and optimistic spirit, stimulate the mind and mental activity. Green for Biology states: calm and relax, the impression of balance the emotions, the symbol of openness and communication, color of hope and the future, justice and peace. Blue for Chemistry states: the calming effect and professional impression and trust. Stimulate communication skills, artistic expression, symbol of strength, able to calm the mind and improve concentration. Generally as a corporate base color, gray for Natural Science Education states: security, reliability, simplicity, and maturity. White for Education states: freedom and openness, represent the purity impression, chaste clean, symbol of peace.



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