The application of structure equation modeling analysis for assessment and educational research

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Abstract
The purpose of this study is discovering and confirmingthe essentialfunction of Structure Equation Modeling (SEM) Analysis for assessment and educational research. The literatures in regards to SEM analysis as method of assessment and educational research will be descriptive analyzed and explored in the light of meta-analysis. The result of the study shown that by using SEM analysis ones get empirical data and clear picture of student's need and do right assessment and research in education. The empirical data enable scholars and government to set new or revise current education program for the future. Therefore this result should be considered as important data for government, especially Education department to establish curriculum and planning strategy of teaching and learning which is conjunction with reality in the field. It means the education program that been established and will develop really match with real life and needs of student, society and the nation. So SEM analysis is important method for each researchers and scholars to run assessment and educational research now and beyond.

Keywords: Structure equation modeling, assessment, education, research.

Introduction

Structural equation modeling (SEM) is a general method of data analysis that brings together path analysis and factor analysis. The path analysis specifies and tests a models of causal relationships among variables and to estimate direct and indirect effects. SEM uses traditional path analysis by estimating of full model simultaneously and providing overall measures of model fit (Hair et al, 2014). The factor analysis is to identify unobserved, latent variables that related between observed variables. SEM is a statistical technique that use to test hypothesis and to analysis a structural theory (Raykov and Marcoulides, 2006; Fadlelmula, 2011). SEM been used to construct validation and theory development (Pedhazur & Pedhazur, 1991; Fadlelmula, 2011). SEMemphasis on confirmatory factor analysis that been proposed a factor model and test to see whether the data is fits. Finally, SEM allows to combine path analysis and confirmatory factor analysis by testing models of causal relationships among hypothesized factors.

Mirroring on the title of articles there are three elements that need to be explore in this article such as SEM, educational assessment and educational research. Speaking about SEM analysis ones thinking are directly pointed to the highest and complicated method. The method that been used to analysis the data of social, economic, psychology and education since Wright (1918) in (Khine, 2013). For analysis the data of

genetic theory in biology has been created a path analysis (Teo & Khine, 2009). Since then SEM has been develop more rapidly in social science such as using AMOS (Analysis of Moment Structures) been developed (Arbuckle, 2006). Nowadays SEM takes essential place in multivariate statistical analysis.

Nowadays, SEM has become increasingly popular among researchers from many different disciplines. Interestingly that SEM has been growing numbers of software programs to apply SEM such as (AMOS, EQS, LISREL, and Mplus) (Ruiz etal, 2010; Brandmaier et al, 2013; Hair et al, 2014). Numerous graduate and postgraduate level courses were continuing education workshops to explain SEM. Many empirical works been published the researchers describe SEM results (Kline, 2011). This fact is proving that most of the data analytical techniques, such as confirmatory factor analysis,multiple regression, path analysis, and several analysis of variance as well as multivariate variance analysis, are special cases of structural equation modeling (Hayes, 2013).

In regards to the running program of SEM there are 6 basic steps that been formulated by Kline (2011) these steps are actually iterative because problems at alater step may require a return to an earlier step: (1) Specify the model. (2) Evaluate model identification (if not identified, go back to step 1). (3) Select the measures (operationalize the constructs) and collect, prepare, andscreen the data. (4) Estimate the model: (a) evaluate model fit (if poor, skip to step 5), (b) interpret parameter estimates, (c) consider equivalent or near-equivalent models (skip to step 6). (5) Re-specify the model (return to step 4). (6) Report the results.Without abandoned the other social science which use SEM as method of analyzing the data; this article more focus on the data of assessment and educational research.

The terms of evaluation or assessment are both in common using in education environment. In Timor Leste, both terms are using to describe two simultaneously attitude, assessment refer to judgment of students work, mean-while evaluation to refer to judgecourse/s delivery andthe process of judgments. That is how those both termswill be used in this article. Assessment isreferring to a judgment which can be justified according to specific weighted set goals, yielding either comparative or numerical ratings. It is necessary to justify (a) the data-gathering instruments, (b) the weightings and (c) the selection of goals (Scriven, 1967). It means assessment is essential part of running the education system.

Assessment is a process to obtain information relative to some goals. Assessment be understood also as ongoing process of: (a) establishing clear, explicit and measurable objectives of student learning, (b) ensuring and verifying the program is designed to foster students learning and opportunities to gain those objectives, (c) systematically gathering, analyzing, and interpreting data that indicate student ability to determine student ability in learning conjunction to education institute's expectations, (d) using the resulting information to understand, to foster and to elevate student learning. Assessment be formulated that expectation outcomes of student learning at all levels of education system and of all programs that address to foster student learning and development. The result of assessment providesfact that students are achieving key institutional and program learning outcomes (López &Garcia, 2014). It will be used to improve student teaching and learning.

There are two types of assessment test and non-test. Assessment non-test be conducted without using instrument such as observation and interview. Assessment test be done by instruments of test to get result of an education system that been implemented.Standard instruments refer to instruments such as rulers, scales, thermometers, pressure gauges, etc. Assessment is a broad term that includes testing. A test is a special form of assessment. Tests are assessments made under especially circumstances which be administered. Tests are assessments however not all assessments are tests. Testing be done at the end of a program (Kizlik, 2012). Assessment is a progress at the end of a school year by testing. Assessment is most usefully in related to some goal for which the assessment is designed.

Validity of instrument needs to be tested divergent and convergent validity. These both elements are important to be examined. However there is a lack of studies which examine and establish the convergent validity among creativity tests (Plucker & Maker, 2010; Yoon, 2017).Critical thinking are examples of studies attempting the validation of critical thinking as a subject-specific skill (Tiruneh et al, 2017), the primary purpose of assessment is to improve of student learning. The assessment process will highlight and promote those practices that are most effective, determine action for improvement where needed and

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provide evidence of program quality and student learning. Assessment is essential element of education (Taras, 2005).

However, there is no evidence about the convergent validity between measurement tools of critical thinking. Even when convergent validity of critical thinking measurement tools is examined, it is not established on comparison of performances in critical thinking assessments (Ventista, 2018). The researchers tried to establish the criterion validity with comparing the performance of students with their grades of students in arts, in spite of another critical thinking assessment (Gelerstein et al, 2016).

Assessment yields information relative to goal. It means that assess to determine whether or not goal has been obtained. Assessment of skill attainment is rather straight achieved. Either the skill exists at some acceptable level or it does not. Assessment of understanding is much more difficult and complex (Kizlik, 2012). The Assessment could be done on a person's knowledge in a variety of ways. In the section on behavioral verbs is to assess means the conditions by which the behavior specified in goal may be exacted.

Based on the result of assessment government or those in charge of education responsibility should be provide a good system of teaching and learning to create and to elevate student's skill. It will facilitate student to able to adapt with gadget era. Student must be critical and creative thinking in face this development (Berliner, 2011).Those activities exist during the learning process be named assessment (Dylan Wiliam, 2011).

Furthermore, economies, societies and psychologies aspects nowadays are changing rapidly, therefore schooling must be prepared learners to deal with specific problems (Chiu, 2016). In spite of timing learners will finish their study, there areraisednew problems to be solved. It means they should be able to critically approach these issues and generate solutions creatively (Ventista, 2018). Nowadays, particularly in the English-speaking research has been an increasing tendency to understand activities that are provided to guide the learning towards the goals. The one spesific goal of education is outcomes of the student learning.

Learning outcomes becomesfundamental key to a meaningful education. The focusing on learning outcomes is essential elementsto inform diagnosis and improve processes of teaching and student learning. Meanwhile there is a long tradition of discovering learning outcomes which named assessment. Assessment that been running within institutions courses and programs, emphasis on learning outcomes has become more important in current years (Marshall, 2009). The steps assessment: (1) determine goals and objectives, (2) checking alignment between the curriculum and objectives, (3) develop a meaningful, manageable, and sustainable assessment plan, (4) collect assessment data, (5) close the loop–collective reflection and action, (6) Routinely examine the assessment process.Interesting on developing comparative measures of learning outcomes has increased also in response to a range of higher education trends, challenges and paradigm shifts (Tremblay, 2012).

Australian Learning and Teaching Council, (2010) presented seven key points to guide assessment in light of increasing focus on standards, and to address criticisms of current practice. It sets directions for change designed to enhance learning achievements for all students. Students be able to improve the quality of their experience (Faulkner, 2017). The seven key points states that assessment has most effect when assessment is used to: (1) engage students in learning that is proactive, (2) actively improve student learning, (3) facilitate student and teachers become responsible partners in learning and assessment, (4) help students to induct into the assessment practices and cultures of higher education, (5) assessment for learning is placed at the centerof subject and program design, (6) assessment for learning is a focus for staff and institutional development, (7) assessment provides inclusive and trustworthy representation of student achievement.

Based on the description of the assessment by some researchers, would be formulated that assessment is ongoing process of education system such as teaching and learning circle. Assessment be needed to courage teacher/lectures and student to be partner in learning process. It will be able student to proactive in learning to improve the skill, knowledge, critical thinking ability to achieve best outcomes of learning.

Education becomes essential part of the human race, without gaining good education ones will not be fully function in socially life (Scott & Usher, 2011). To provide best education systemand curriculum for

the learners, government and education institution need to do educational research. Education research is the scientific study to exam the education and learning processes. The learning process expresses in human attributes, interactions, organizations, and institutions which provide and shape educational outcomes (Smeyers & Depaepe, 2010). Scholars endeavor to describe, understand, and explain how learning should takes place throughout the life. How ones be educated in formal and informal education contexts that affect all forms of learning.

Education research involve the full spectrum of fabulous methods appropriate to the questions that being asked and also engage the development of new tools and methods (Greeno, 2006).Developing new tools and method are one advance step in research, however should be started from many basic ideas and concepts that involved in educational research(Chiu, 2016). Those concepts that been included in educationalresearch as follows: quantitative, qualitative, R&D, hypotheses, population, sampling, variables, indicator, item, measurement, exploratory factor analysis, confirmatory factor analysis, validity, reliability, correlation, simple regression, multi regression, Path Analysis, SEM and so on (OECD, 2009).

Process of educational research also need certain skills that will enhance researchers'ability to understand and master the research process (Reason & Bradbury, 2006).These include such things as how to select a research problem, formulate a hypothesis, conduct a literature search, choose population and sample, define words and phrases clearly, develop a valid instrument, and many other steps that needs to take place (SAS, 2003). Regardless of the methodology a researcher uses, all of these skills are important to master a research. Mentioning also the ethical aspects and implications involved in conducting of research itself(Maxwell, 2004). The ethical and aspect that involved in research such as citation and quotation, should according to the rule of it.

Based on the description about educational resercah can be conclude that educational research is essential and central part of education system, program and process. Education research are integral and central part of education system because of conducting educational research new and affective instruments an methods of education can be discover. Scholars and government has responsibility to promote and to embraces each one who are conducting educational research.

Method

This study is literature study that uses meta-analysis to explore and to discover the function of SEM analysis in assessment and educational research. Study been done by analyzing the literature of SEM analysis, assessment and educational research that provided in books and international journal. First of all Study been done about literature that describe all the aspect of SEM including important steps and points. This same processstudy also been done toward assessment and educational research.

Result and Discussion

The literature study towards SEM analysis, Assessment and educational research discovered four essential points: (1)SEM analysis is best method to discover and confirm detail and specific the empirical data of research. (2) Assessment is one way of research to discover and to get empirical data and clear information of education program that has been done by education institutions. (3) Educational research is the study that been taken place in education circumstances to get and to develop effective tools and methods of education. (4)SEM analysis becomes a best method in conducting assessment and educational research.

Based on the literature study towards application of SEM analysis for assessment and educational research there are three points (SEM, Assessment and research) need to be discussed.

First of all, SEM is clear and detail and exact method of analyzing data in regards to any social science topic, economic, psychology, politic even biology and health. SEM embraces all aspect that form and include in quantitative research. SEM presents empirical data more detail and explicit, from the correlation between items, indicators, variables, item to indicators and variables. That is why SEM be name best method of the statistical data analysis at present moment probably unto beyond. However SEM

has limitation in providing and in conveying the information. The limitation is focus only on statistical data (numerical, nominal and scale), out of the numerical data such observation and interview as even documentation (pictures) could not be able to analysis.

Secondly, assessment be understood that an ongoing process of getting and collecting information that becomes empirical data do establish or revise any existing programs, especially in education circumstances. By assessment conductors of assessment be able to distribute questions in frame on test, and observe and interview to collect the correlation data in terms of non-test. Using assessment education people be able to identify the needs of learners and to discover the strength or advantage of learners. These data will help educators to create education programs and system that match with the needs of learners in all education levels. Means the program that being established based on assessment there are small possibilities to fail. Because the program is creating and establishing based on empirical data from the field no according to the will of educators. It will be able learners to enjoy with teaching and learning process because program is matching with learners ability and capacity. This point is conjunction with teaching of the Vygotsky (in Hitepeuw, 2009)that program been established no too far from the initial ability of learners, learners will enjoy the program and will succeed in teaching and learning process. Mirroring of this fact all educators must integrate assessment effectively in education program and system to establish program based on characteristic learners and program.

Finally, education research means an effort that been done, is doing and will be running in all education system. Educational research is essential element of the education system and program, because by research education institute and government be able to revise, to increase and to provide valid and reliable tools and methods of education. At this point educators and government be enriched experiences of education and enable to establish effective education program to educate learners and all citizens and furtherresearch in various fields.

Conclusion

Based on the all process of study including result, could be concluded that application of SEM analysis of assessment and educational research are most important. SEM analysis contribute an empirical data by analyzing the collected data. Assessment is collecting empirical data by test and non-test methods to establish effective program by considering characters of learners and characters of program. It will facilitate learners to enjoy the program, means learners and educators will success in the process of teaching and learning. Educational research is essential and fundamental element of education system and program, because it provide effective tools and methods of education now unto beyond.

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