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BUILDING YOUNG RESEARCHERS' COMPETENCE THROUGH MODERN DATA PROCESSING APPLICATION TO ENHANCE EDUCATION QUALITY

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Abstract

Data analysis techniques are one of the critical stages that young researchers must carry out when conducting research. Apart from that, young researchers also need to understand knowledge related to statistical methods to make carrying out their research easier. This community service activity aims to increase the knowledge of young researchers (especially students) related to Structural Equation Modeling using the PLS and the Simultaneous Equation Model. Apart from that, this activity also aims to increase the experience of young researchers by directly instilling the use of the SmartPLS program. This Community Service Activity was conducted as a seminar on June 13, 2024, from 08.00 to 12.00 WIB (09.00 to 13.00 MST) online via Zoom Cloud's Meeting. Universiti Malaysia Sabah is a partner in this activity. Seventy-six participants, including lecturers, students, and researchers from state and private universities in Indonesia and Malaysia, participated in this activity. The activity evaluation results show that participants' understanding and skills regarding Structural Equation Modeling-Partial Least Square (SEM-PLS), SmartPLS, and Simultaneous Equation Model have increased.

Keywords: Structural Equation Modeling, Partial Least Square, SmartPLS, Simultaneous Equation Model

INTRODUCTION

Quality education is essential for a country to prepare its young generation to face global challenges, especially current technological developments. In the current digital era, all aspects of education require very sophisticated technology, including in the field of research.

Students are young researchers who will be the successors of the country's development, especially in developing science to encourage society's progress. Students have a big responsibility to support the implementation of the Tri Dharma of Higher Education, which includes aspects of education, research and development, and community service.

Research is the application for students of the knowledge they have learned in society, namely by studying problems that exist in society and solving them. Student contributions in research, such as product innovation and regional potential, are highly expected. Research is a means to improve students' cognitive aspects. Research is one way to make students become insightful thinkers. Research is expected to train students to think objectively and systematically, understand problems more deeply, and think forward. Through research, students are trained to think critically about the issues they face in their field.

According to Sarwono (2021), several things must be prepared to conduct research, namely (1) Language, (2) Statistics, (3) Logic, and (d) Library. Statistics is a crucial research tool, and statistics is

the only tool that can be used to analyze data or information collected while conducting research. Statistics are also used to quantify data into numbers that readers can understand.

The first stage in conducting research is that the researcher must find the problem to be studied. After the problem is found, the next step is to determine the approach that will be taken, which consists of a quantitative and qualitative approach. A quantitative approach means that researchers will use numbers as a measure of the results of their research. Conversely, if the researcher uses qualitative data, do not use numbers to measure the study's results. After determining the type of research, the researcher will then carry out data processing and analyze the data processing results.

Current technological developments have significantly changed data analysis techniques used in research. Advances in computing, software, and access to big data have helped researchers improve their ability to collect, analyze, and interpret data more efficiently and accurately.

The impact of technology on research data analysis techniques includes (a) Faster and more powerful computing, where modern computers have greater data processing capacity, allowing researchers to analyze large and complex data sets. In addition, today's computing can process in parallel with the use of graphics processing units (GPUs) and cloud computing so that it can increase the speed of data analysis; (b) More sophisticated analysis software, such as SAS, SPSS (Statistical Package for The Social Science), Stata (Statistics and Data), SmartPLS which provides various data analysis techniques ranging from descriptive analysis to complex models such as panel data regression and SEM (Structural Equation Modeling); (c) Access to Big Data which helps researchers access various data sources, such as transaction data, social media, and IoT (Internet of Things) sensors; (d) Machine Learning and Artificial Intelligence can help researchers automate the process of data analysis, identify patterns, and make predictions with an even higher level of accuracy. In addition, Artificial Intelligence (AI) can help researchers build models that not only predict results but also provide recommendations for action; and (e) Real-Time Data Analysis, where technology allows data analysis to be carried out in real-time from various sources and even allows for rapid response to changing conditions (Provost et al., 2013; James et al., 2013, and Hastie et al., 2009).

Young researchers have great potential in applying this technology when processing and analyzing their research data. However, young researchers need more knowledge and skills in using this technology. Most student research results (thesis) only use multiple linear, logistic, and panel data regression. The data processing program used only uses SPSS or Eviews. Young researchers still need to gain more knowledge regarding Structural Equation Modeling, especially using the PLS method. The SmartPLS program still needs to be used when processing data. These young researchers also need to learn more about the Simultaneous Equation Model.

Based on the situation analysis explained above, the problems faced by Partners are: (1) Partners still need to gain more knowledge of research data analysis techniques; (2) Partners must gain knowledge and skills regarding Structural Equation Modeling using the PLS method and

Simultaneous Equation Model; and (3) Partners need to gain skills in using the SmartPLS data processing program.

METHOD AND PROCEDURES

Seminar activities in this community service program will be carried out online via the Zoom Meeting application. Online implementation is carried out because the partners' locations are far away, so activities will be more effective and efficient if they are online. Seminar activities will be preceded by a lecture (presentation of material), practice, and discussion (question and answer). With practice, it is hoped that participants will be able to understand the material presented well.

The target participants for this seminar are active students from Universitas Negeri Jakarta, Universiti Malaysia Sabah, and other universities who want to participate in this activity. Students who can participate in this activity are taking a thesis or a research methodology course. Lecturers and researchers can also take part in this activity.

This series of activities consists of (1) Participant Identification, (2) Identify Participant Needs, (3) Determination of activity schedule, (4) Implementation of Activities, and (5) Evaluation of Activity Results.

The details of the information of this training activity are as follows:

1. Time and Place of Implementation

   Day and Date Implementation: Monday, July 10, 2023

   Implementation Time: 08.00-10.30 WIB (UTC +7) // 09.00-11.30 MST (UTC +8)

   Place of Implementation: Virtual Conference (Zoom Application)

   Participants: Students and lecturers from Universitas Negeri Jakarta, Universiti Malaysia Sabah, and other universities who wish to participate in this activity. Researchers from Indonesia and Malaysia can also join in this activity.

2. Implementation (Event Arrangement)

   The composition of the implementation event is as follows:

   08.00-08.30: Registration

   08.30-08.32: Opening by MC

   08.32-08.35: Opening Speech by Deputy Dean for Student and Alumni Affairs, Faculty of Economics, Universitas Negeri Jakarta-Dr. Indra Pahala, M.Si.

   08.35-08.50: Keynote Speech by Dr. Saizal Pinjaman (Senior Lecturer of Fakulti Perniagaan, Ekonomi, dan Perakaunan, Universiti Malaysia Sabah Universiti Malaysia Sabah

   08.50-10.20: First Presentation and Discussion "Structural Equation Modeling-Partial Least Square (SEM PLS)" by Dr. Ayatulloh Michael, S.E., Ak., M.Ak. (Lecturer of Faculty of Economics, Universitas Negeri Jakarta)

10.20-11.50: Second Presentation and Discussion "Simultaneous Equation Model" by Pr. Dr. Haryo Kuncoro Wirologo, S.E., M.Si. (Professor of Faculty of Economics, Universitas Negeri Jakarta)

11.50-12.00: Documentation and Closing

3. Training Materials
   a. Structural Equation Modeling-Partial Least Square (SEM PLS) consisting of the SEM-PLS Concept, PLS Model, SmartPLS, PLS Algorithm, and Bootstrapping.
   b. Simultaneous Equation Model (SEM) consisting of SEM Concepts (What is SEM, Why SEM, and How is SEM?) and SEM Applications

RESULTS

This Community Service Activity is carried out as an offer of solutions to overcome the problems partners face. The PKM team provided a solution through a seminar activity that presented material regarding Structural Equation Modeling using the PLS and Simultaneous Equation Model methods. This activity was carried out through several stages, namely delivery of material, practice in using data processing programs, and questions and answers. This stage is based on the needs analysis carried out previously, where partners need to understand the concept first and then practice activities and questions and answers.

The results of the evaluation of this PKM activity are (score scale 1-5): (a) Delivery of material by the first resource person received an average score of 4.67; (b) The presentation of material by the first resource person received an average score of 4.72; (c) The suitability of the material presented by the resource person with the activity topic received an average score of 4.67; (d) The services provided by the committee received an average score of 4.64; (d) Compliance with the implementation of the activity with the participants' expectations in participating in this activity received an average score of 4.55; and (e) Assessment of all implementation activities received an average score of 4.62. The participants also provided testimonials that their knowledge and skills had increased related to the material obtained in this activity.

Documentation of the online implementation of this activity is presented in Figure 1 and Figure 2 below.

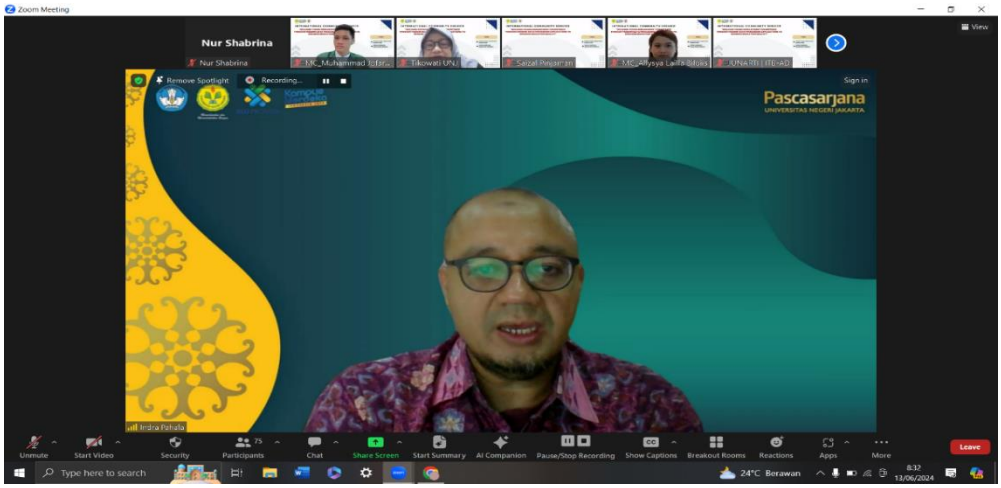

Figure 1. Opening Speech by Deputy Dean for Student and Alumni Affairs, Faculty of Economics, Universitas Negeri Jakarta

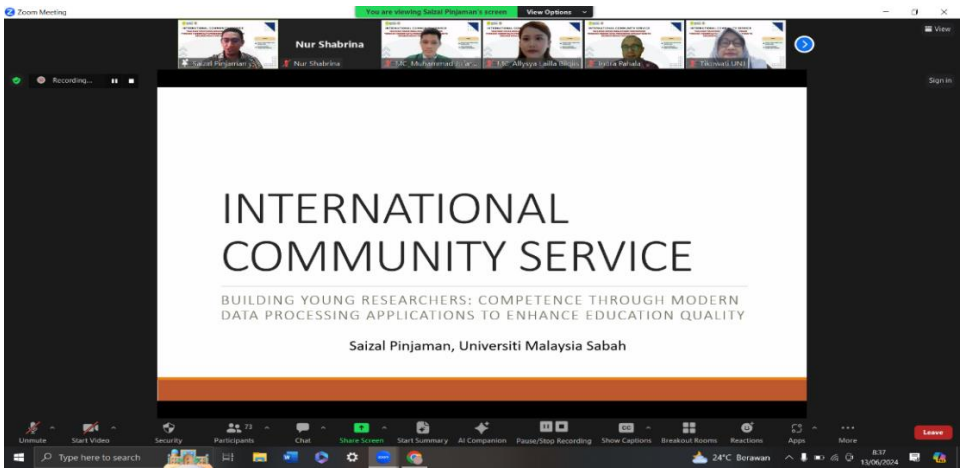

Figure 2. Keynote Speech by Dr. Saizal bin Pinjaman

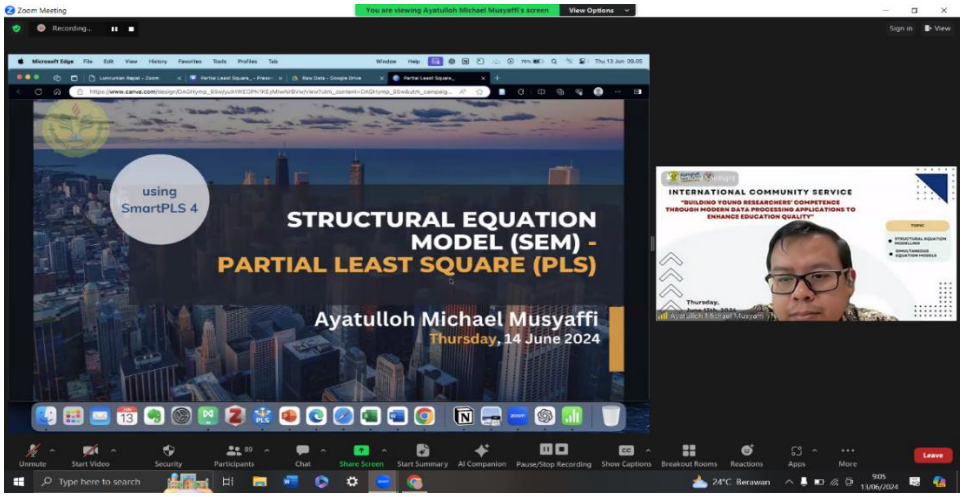

Figure 3. First Presentation by Dr. Ayatulloh Michael, S.E., Ak., M.Ak.

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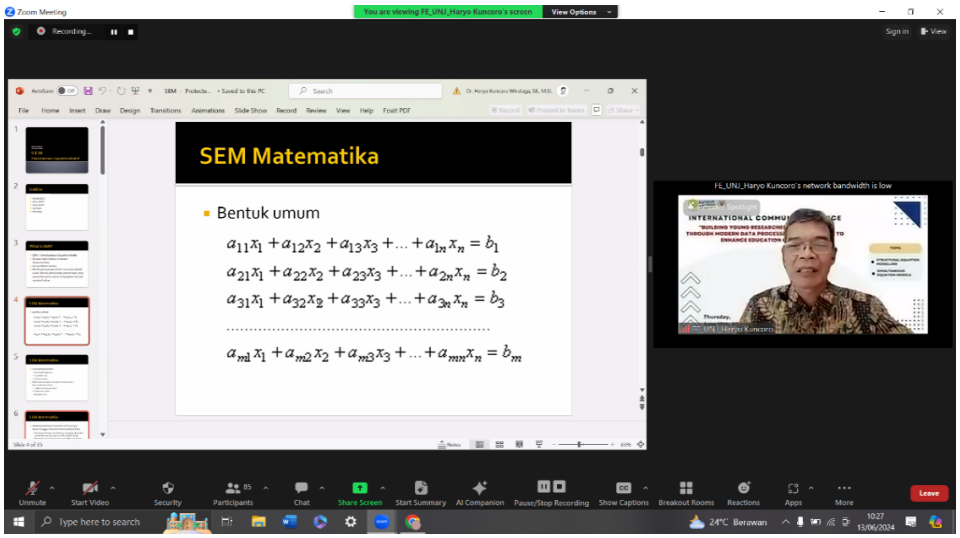
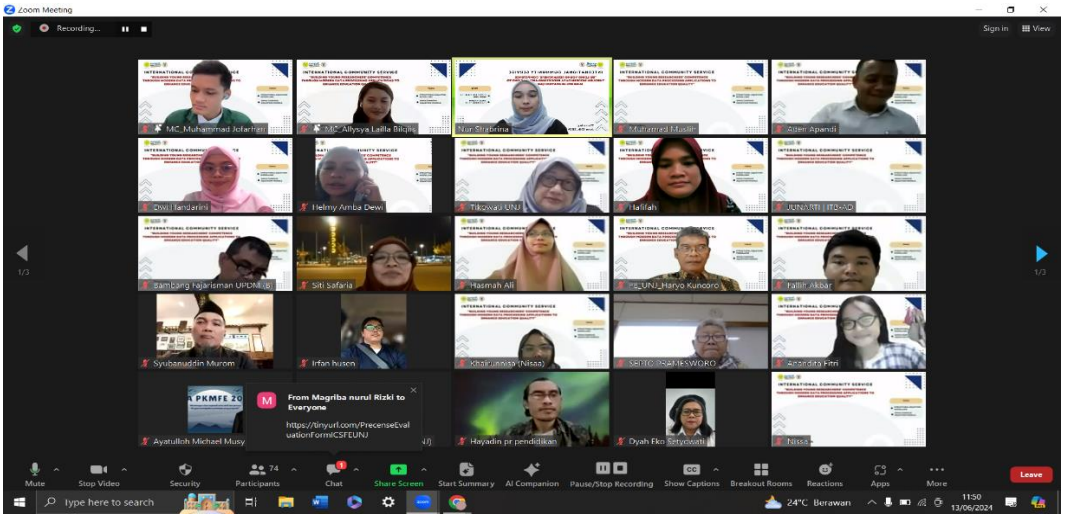
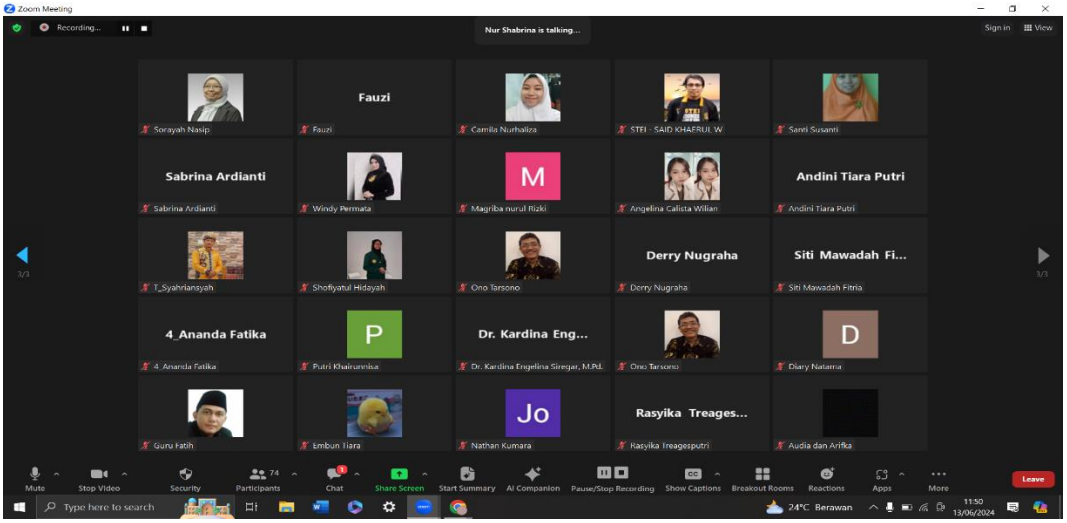


Figure 4. Second Presentation by Prof. Dr. Haryo Kuncoro Wirologo, M.Si.





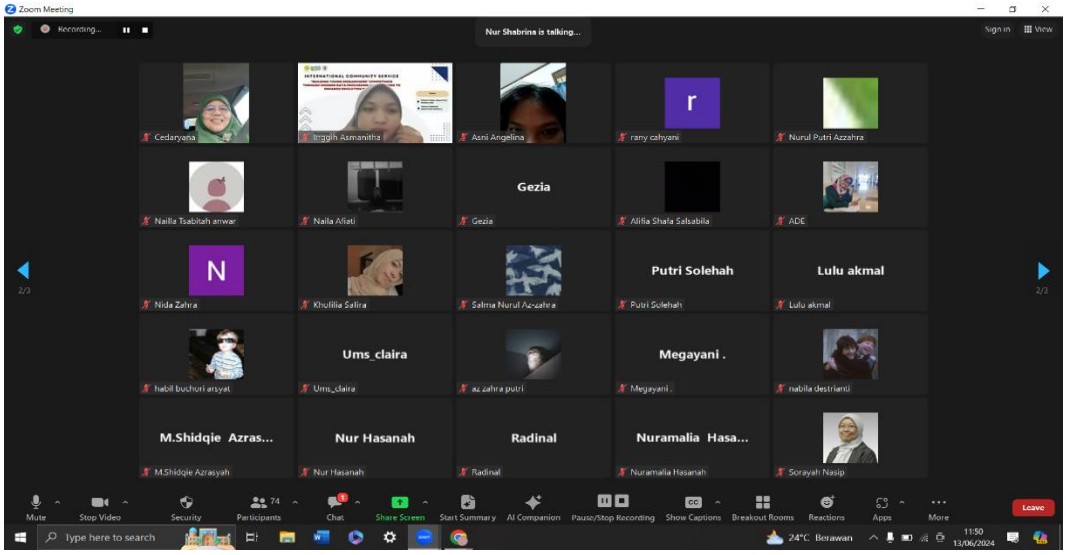


Figure 5. Participants

Figure 6. Committee

CONCLUSION

This activity was carried out smoothly through a four-hour online seminar, which was adjusted in advance to the agreement with the partners. Seventy-six participants in this activity were students, lecturers, and researchers from Indonesia and Malaysia. Implementing this Community Service is a seminar that presents material regarding Structural Equation Modeling - Partial Least Square (SEM-PLS) and Simultaneous Equation Model (SEM). Activity participants also had direct practice regarding data processing and analysis using the SmartPLS program.

This activity benefits partners and several participants from other universities because it has improved the partners' basic abilities in understanding SEM-PLS data analysis techniques and SEM statistical methods. Apart from that, participants' skills have also increased when operating the

SmartPLS program. The activity evaluation results showed that all participants who implemented this activity went well.

After this seminar activity, it is necessary to carry out ongoing training and implementation activities to help students get used to processing and analyzing data using programs that continue to develop at this time. Topics related to data analysis techniques and the use of other applications, such as AMOS, Stata, and Lisrel, can also be further developed so that the benefits of Community Service activities can be felt continuously by activity participants.

ACKNOWLEDGMENTS

Thank you for the support of Partners, especially students as young researchers who have helped and participated in this activity very well. We hope that the material presented can enrich the knowledge of young researchers regarding data analysis techniques so that the quality and quantity of research will increase even more in the future.

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