Analysis of the lecture's teaching skills using structural equation modeling method

A Reski, R F Nikat and D K Sari
Department of Physics Education, Faculty of Teacher Training and Education, Universitas Musamus, Merauke, Indonesia.

E-mail: andireski2202@gmail.ac.id

Abstract. This research is an expo-facto study which aims to analyze and test the particular teaching skills model of beginner lecturers that applies basic physics courses I. Testing models aim to provide information and knowledge about the indicators that most influence lecturers' skills in teaching in the classroom. The population in this study were all students of the 2015 class and the 2016 class of the Physics Education Study Program of the University of Muhammadiyah Makassar with 224 people. The research sample was taken using Slavin techniques with a total of 145 students. The process of data collection was carried out by using an empirically tested questionnaire. The research data were analyzed using Structural Equation Modeling analysis method with Analysis of Moment Structures techniques. Through this model, it can be concluded that the skills of explaining basic physics material the most influential indicator of the teaching skills of beginner lecturers.

1. Introduction
The progress of science and technology has an impact on the rate of development in all fields. For this reason, improving the quality of human resources through the education sector is needed in this regard, higher education plays an important role in producing quality human resources capable of mastering science and technology. Higher Education (PT) as an organizer of Higher Education has a very large role in the national development framework. There are two main tasks carried out by Higher Education namely first, educating the sons and daughters of the nation to master science and technology and secondly, national and regional development policies including preparing candidates for leaders of high moral and democratic cultures [1]. Thus indeed, Universities function as the main producers of human resources for the needs of the community and to improve, disseminate and develop science and technology itself.

The role of universities to produce quality graduates who can adapt to the advancement of science and technology must be followed by improvements in the education system. Various thoughts and efforts to renew in the field of education must continue to be carried out, both comprehensive reforms and those that are limited to certain components of the education system. Educational components include educators (lecturers), students, facilities, and methods.

Lecturers as professionals must have competence. According to Law No. 14 of 2005 concerning Teachers and Lecturers, it is explained that competence is a set of knowledge, skills, and behaviors that must be owned, internalized, mastered, and realized by lecturers in carrying out their professional
duties [2]. One of the elements related to the competence of lecturers in carrying out their professional duties is teaching skills.

Teaching two basic abilities must be mastered by the first lecturer, mastering the material or teaching material taught (what to teach). This teaching material can create an environment and atmosphere that allows students to study [3]. Second, master the methodology or ways to teach it (how to teach). Teaching skills include in number 2, namely how to teach students. This is related to how to choose the right model, method, and strategy in teaching a material [4].

Professionals of educators can be seen from the teaching abilities of students. Teaching skills according to Helmiati are skills to open and close lessons, explain skills, ask skills, use variation skills, provide reinforcement skills, small group teaching skills, and individuals, manage classroom skills, and guide discussion skills [5].

2. Methods
The study was an ex-post-facto study that was analyzed using AMOS 22 with a 5% error rate or 95% confidence. The variables used in the study are teaching skills that are built with 6 (six) constituent indicators, namely the skills to open basic physics learning, skills in explaining basic physics material I, skills in conducting variations in basic physics teaching I, questioning skills in teaching basic physics I, skills to provide reinforcement in teaching basic physics I, and skills to close basic physics learning.

2.1. Research Model

![Figure 1. Research Model](image)

2.2. Data collection
The population in this study were all students of 2015 and the class of 2016 Physics Education Study Program FKIP Muhammadiyah University of Makassar. Determination of the sample using the Slovin technique and obtained 144 samples, but to avoid the shortage of samples in the study so the number of samples in the study was 145 people.

2.3. Research instrument
The instrument used in this study is a questionnaire arranged in the form of question items as many as 45 questions regarding students' perceptions of the teaching skills of lecturers of validated basic physics I subjects. The research instrument used must meet two conditions, namely valid and reliable. Therefore, in addition to being tested for validity, reliability testing was also carried out before the instrument was used. So that the instrument can be used to obtain the right and reliable data. Questionnaires used as observation tools with grading scale techniques One of the rating scales that
are often used is the Likert scale developed by Rensis Likert. The 5 (five) scales of choice that will be used in this study are (SS) means that it is very suitable, (S) means that it is appropriate, (KS) means that it is not appropriate, (TS) means it is not appropriate, (STS) means it is very inappropriate.

2.4. Data analysis
The path analysis technique for the data analysis process uses version 22.0 AMOS (Analysis of Moment Structure) program and uses estimation to obtain values from each parameter in the model. The estimator used is maximum likelihood (ML). Factor analysis is used to identify the right model to explain the relationship between indicators and measured variables. To test the influence of indicators with latent variables, a model must meet the Goodness of Fit requirements, namely an index used as a reference for a model that is said to be an acceptable fit. The indices that will be used are Chi-square, CMIN / df, GFI, AGFI, TLI, CFI, and RMSEA.

3. Results and discussion
The frequency distribution of the teaching skills variable is based on the categorization technique in Table (1) below.

| Interval  | Categorization |
|----------|----------------|
| 0 – 20   | Very low       |
| 21 – 40  | Low            |
| 41 – 60  | Is being       |
| 61 – 80  | High           |
| 81 – 100 | Very high      |

Source: [6]

Each item statement from the research data is analyzed to describe the state of the indicator. Table (2) shows the distribution of student perceptions of teaching skills of lecturers.

| Statement                                                                 | Items score | Percentage | Category     |
|--------------------------------------------------------------------------|-------------|------------|--------------|
| Deliver basic physics material I with simple or easy to understand the language | 582         | 80         | High         |
| Basic physics material I was delivered sequentially from simple to complex | 515         | 72         | High         |
| Explain by giving real examples/illustrations in everyday life            | 453         | 62         | High         |
| Using language that is difficult to understand when explaining basic physics concepts | 437         | 60         | Is being     |
| Providing information that focuses on the subject matter of basic physics I material that is being discussed | 454         | 62         | High         |
| Slows down the speed of speech when explaining basic physics formulas that are difficult or complex | 446         | 62         | High         |
| Using a friendly approach accompanied by variations in sound, body language, and visual contact to maintain student attention | 518         | 72         | High         |

Indicator X₁₁₂

Indicator X₁₁₅

High
Structural model testing is carried out to find out the influence model between variables arranged theoretically supported by the facts that exist in empirical data. Conformity tests between theoretical models and empirical data can be seen at the level of the Goodness of Fit Statistics. The calculation uses the procedure for estimating maximum likelihood. Model suitability decisions use Chi-square, CMIN/df, GFI, AGFI, and RMSEA indices [7].

Analysis of the teaching skills factors of lecturers using AMOS 22.0, factor analysis for lecturer teaching skills variables can be seen in Figure (2) below.

![Early model factors of lecturer teaching skills](image)

**Figure 2.** Early model factors of lecturer teaching skills

Based on the analysis of the initial factors of the lecturer teaching skills variable, the results obtained in Table (3) below.

**Table 3.** Results of the Early Factor Model for Lecturer Teaching Skills

| Index          | Score     | Cut off Value | Model Evaluation |
|----------------|-----------|---------------|------------------|
| Chi-Square     | 39.446    | Almost 0      | Not Fit          |
| CMIN/df        | 4.383     | ≤ 2.00        | Not Fit          |
| Probability    | 0.000     | > 0.05        | Not Fit          |
| GFI            | 0.914     | ≥ 0.90        | Fit              |
| AGFI           | 0.800     | ≥ 0.90        | Not Fit          |
| RMSEA          | 0.155     | ≤ 0.08        | Not Fit          |
The results of the analysis show that five indices have not been fit, so modifications are needed to increase the overall fit index of the model. The model modification results can be seen in Figure (3) below.

![Figure 3. Final factor model of lecturer teaching skills](image)

**Table 4. Results of the final factor model of lecturer teaching skills**

| Indeks     | Value | Cut off Value | Model Evaluation |
|------------|-------|---------------|------------------|
| Chi-Square | 0.813 | Almost 0      | Fit              |
| CMIN/df    | 0.271 | ≤ 2.00        | Fit              |
| Probabilitas | 0.846 | > 0.05        | Fit              |
| GFI        | 0.998 | ≥ 0.90        | Fit              |
| AGFI       | 0.987 | ≥ 0.90        | Fit              |
| RMSEA      | 0.000 | ≤ 0.08        | Fit              |

Source: [Raw data, processed with Amos 22.0]

The regression weight values obtained with the AMOS 22.0 program use criteria 0.001 in Table (5) to explain the covariance between latent variables and their indicators.

**Table 5. Weight of lecturer teaching skills regression**

|        | Estimate | S.E. | C.R. | P       | Label   |
|--------|----------|------|------|---------|---------|
| X1.6   | <--- X1  | 1.000|      |         |         |
| X1.5   | <--- X1  | 1.214| 0.111| 10.897  | 0.000   | par_1   |
| X1.4   | <--- X1  | 0.996| 0.106| 9.374   | 0.000   | par_2   |
| X1.3   | <--- X1  | 0.848| 0.109| 7.760   | 0.000   | par_3   |
| X1.2   | <--- X1  | 1.241| 0.117| 10.628  | 0.000   | par_4   |
| X1.1   | <--- X1  | 1.146| 0.102| 11.212  | 0.000   | par_5   |

Source: [Raw data, processed with Amos 22.0]

To find out whether there is an influence between latent variables and indicators (indicators are said to explain latent variables) seen from the probability value (P). The P-value in Table 5 shows the P-value of 0.000 which is far below 0.05. Because all P values are 0.000, it can be said that all indicators can explain the latent variables that exist.
In addition to probability values, the weight of standard regression (Standardized Regression Weights) can also show the influence of latent variables and indicators. The condition there is influence between latent variables and indicators is the factor loading value greater than 0.50 [8].

Table 6. Regression weight of lecturer teaching skills standards

| Estimate | X1.6 | X1.5 | X1.4 | X1.3 | X1.2 | X1.1 |
|----------|------|------|------|------|------|------|
|          | <--- | X1   | 0.807| X1   | 0.841| X1   |
|          | <--- | X1   | 0.830| X1   | 0.615| X1   |
|          | <--- | X1   | 0.897| X1   | 0.868|      |

Based on the estimated value in Table (6) it can be explained that the indicators of lecturer skills in explaining the material. Based on the results of data analysis obtained information that according to the perceptions of student lecturers who teach basic physics courses I use simple language so that it is easy to understand. The first basic teaching skills include skills in explaining the material. A teacher must be able to explain, explain and transfer knowledge to students in a language that is good and easy to understand [9].

4. Conclusion

Overall the teaching skills of lecturers in applying basic physics courses are already in the high category and the most important indicators of these skills are skilled in explaining basic physics material.

References
[1] Sofian E 2012 Metode Penelitian Survei (Jakarta: LP3ES)
[2] Departemen Pendidikan Nasional 2005 Undang-Undang Nomor 14 Tahun 2005, Tentang Guru dan Dosen (Jakarta: Depdiknas)
[3] Bahri, S., Arafah, K. & A M 2017 Pengembangan Bahan Ajar Fisika Dasar I Berbasis Komputer Seminar Nasional Pendidikan Fakultas Keguruan dan Ilmu Pendidikan pp 111–7
[4] Supriyadi S, Bahri S and Waremra R S 2018 Kemampuan Technological Pedagogical Content Knowledge (TPACK) Mahasiswa Pada Matakuliah Strategi Belajar Mengajar Fisika J. Inspirasi Pendidik. 8 1–9
[5] Helmiati 2013 Micro Teaching: Melatih Keterampilan Dasar Mengajar (Yogyakarta: Aswaja Pressindo)
[6] Riduan & Akdon 2008 Rumus dan Data dalam Analisis Statistik (Bandung: Alfabeta)
[7] Santoso S 2015 Amos untuk Struktur Equation Modeling (Jakarta: PT. Elex Media Komputindo)
[8] Santoso S 2015 Menguasai Statistik Parametrik : Konsep dan Aplikasi dengan SPSS (Jakarta: PT Elex Media Komputindo)
[9] Yenni Y 2017 Analisis Kemampuan Mahasiswa Dalam Menyiapkan Pembelajaran Yang Efektif Pada Mata Kuliah SBMM JPPM (Jurnal Penelit. dan Pembelajaran Mat. 10