# Needs Analysis of Instructional Models in the course of Applied Physics at the Department of Mining Engineering

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Engineering students enrolled in universities have strong mathematics and physics background because engineering curriculum strongly depends on these two fundamental sciences. Many engineering core (main) courses offered are very intense in mathematics and fundamental physic sciences. Physics is a common course for all departments in engineering faculty, it has the same course content for all departments in which it is given. Nevertheless, those departments such as mining, civil, machine, and electrical engineering should have differences in the granting of material physics because of the awarding examples specification to the skills expected of graduates. However, while lecturing, the instructor could provide examples related to that field, and may pose questions and prepare activities which establish links between the field and Physics. Learning about analytical thinking starts with learning Physics. Those students should turn Physics into a way of thinking in order to find solutions to any kind of problems. Consequently, the needs of students to study Applied Physic subjects should be analyzed in order to create meaningful learning course. Student' needs analysis was conducted by distributing questionnaires and analyzing the answers given. Questionnaire contains the competence of lecturers, teaching materials, teaching and learning process, and student readiness. The results of this analysis are expected to produce instructional models for Applied Physics course.

Key words : *Need analysis, questionnaire, instructional models, meaningful learning.*

## A. Background

Curriculum used in Mining Engineering Department of Padang State University is Curriculum 2013 which is amenable with KKNI. The purpose of this curriculum is to help students experiencing every competency expected in every course. The demanded competence in Applied Physic course is: the students are able to solve the problem appropriately by applying Applied Physic concept in Mining Engineering field, especially in mining field and processing the diggings.

Applied Physic is the fundamental science course in Mining Engineering Department. Since the opening of this department (2001), this course has 3 credit semesters (2 credits for theory and 1 credit for practice). The expected learning outcomes of this course are (1) the students can apply Unit system concept, Vector, Mechanical Motion (Rectilinear Motion, Parabolic Motion, Circular Motion, Force, Equivalency, Effort,

Energy, Momentum), Fluids (Statistic and Dynamic), Thermo physic (temperature & heat, expansion), Elasticity, Wave (Wave Description, Mechanical Wave, Sound, Light, Optics) in mining field, (2) the students have contextual critical thinking as a graduate.

Based on the course material, the lecture should provide various teaching and learning model to ease the students to comprehend. Teaching is an activity to organize or to manage the surrounding optimally and links this atmosphere to the students to create the learning process (Nasution, 1986: 8). It means that: teaching is the lecturer's effort to manage the surrounding in order to create the appropriate atmosphere for students to study. The students learn by themselves through their own activity and the lecture is only as their facilitator. In this case, any supporting factors are used, such as books, models, any other resources.

The following table is the result of the fourth semester students learning outcomes which shows unsatisfying result.

**Table 1.**Students' Learning Result in Applied Physic course

| No. | Semester | Mark Percentage | | | | |
|---|---|---|---|---|---|---|
| | | A | B | C | D | E |
| 1 | Jan-Jun2013 | 4,45 | 2,65 | 40 | 16 | 17,8 |
| 2 | Jan-Jun2014 | 8,3 | 20,5 | 49,35 | 7,7 | 14,15 |
| 3 | Jan-Jun2015 | 3,1 | 41 | 46,5 | | 9,4 |
| 4 | Jul-Des2015 | 5 | 42,5 | 37,5 | | 15 |

*Source*: Taken from UNP students portal site

The clear explanation of the table above is described in graphic below.

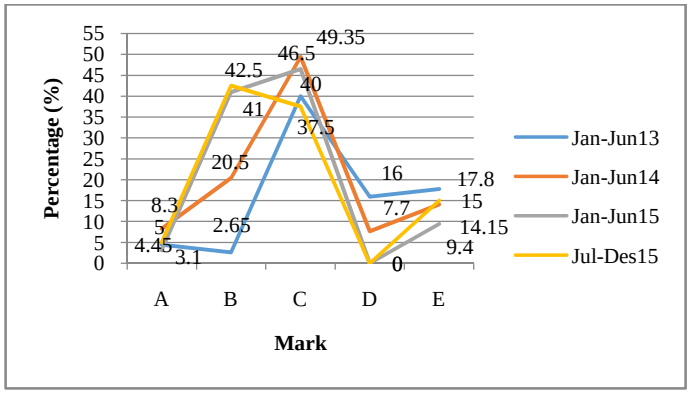



**Fig 1.** The mapping of Bachelor Degree students of Mining Engineering UNP

In relation with the lecturer's task in Applied Physic course, the appropriate instructional model of KKNI 2013 is ongoing. Nevertheless, it seems that the effort has not been effective towards the improvement of cognitive, affective and psychometric competence in Applied Physic course as expected. The students' learning result was unsatisfying, in which the students generally got C and E instead of A. This situation calls for attention.

## B. The Purpose of Survey

Based on the background above, the purpose of this study is to now the reasons of the low or unsatisfying students' learning result. The instrument used contains all aspects in teaching and learning process; lecturer, course material, implementation of teaching and learning and the students. It is expected that the result of the survey will give contribution to create such an instructional model which can improve the students' comprehension towards the material given.

## C. Population and Sample

The population of this study was all students of Mining Engineering Department who have enrolled Applied Physic course. Due to the limited time, the sample taken was 19 students. The sample was chosen randomly without considering the entrance year or learning result.

## D. Research Instrument

The instrument consists of 36 items using Rating Scale; Strongly Agree, Agree, Disagree, Strongly Disagree. The instrument of the study was:

1. There was 7 items about lecturer competence including; syllabi, learning method, media, task, expertise, ability to motivate students.
2. There was 6 items course material including: the need of Applied Physic, material implementation, learning process, test material, the appropriateness between material and syllabi.
3. There was 5 items about teaching and learning process including: situation of the learning, facility, communication and the practice.
4. There was 18 items about students' readiness to follow the course including: the links between materials, the application of task and practice, the ability to give opinion, creativity, consent, attending, responsibility, discipline, looking for information and getting project.

## E. Data Processing

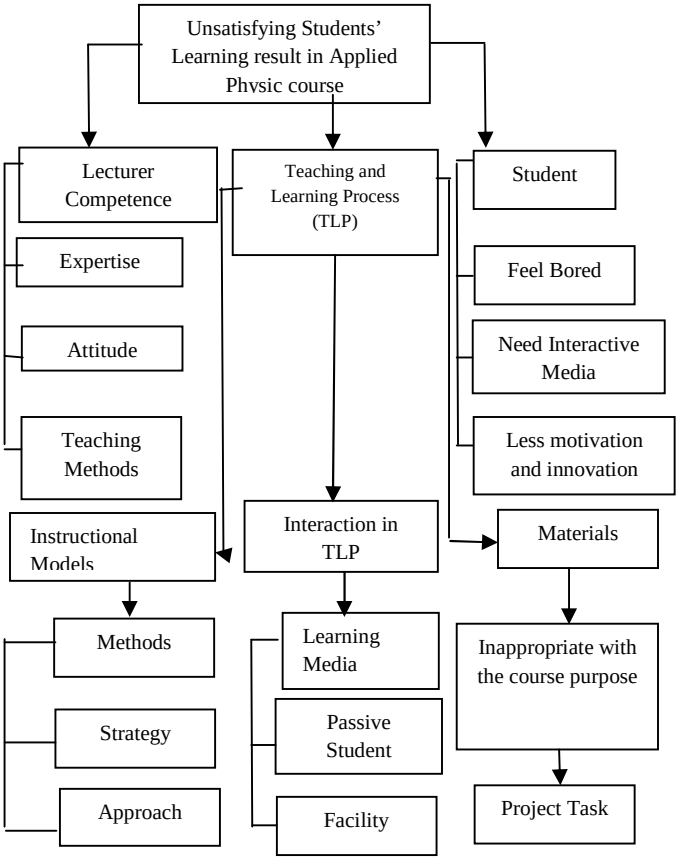
Table 2.

| No. | Observation | Result |
|---|---|---|
| 1. | Lecturer competence | 70% |
| 2. | Materials instructional | 69% |
| 3. | Teaching and learning process | 71% |
| 4. | Students do not understand the task instruction | 67% |
| 5. | Students are less confidence to give opinion | 67% |
| 6. | Students found obstacle during the practice | 60% |
| 7. | Students do not focus on the course | 70% |
| 8. | Students has lack interaction with lecturer and other students | 62% |
| 9. | Students want to get project | 84% |

## F. Data Analysis

Table 2 shows the result of survey in which the lecture competence, course material, teaching and learning process, the students labeled them in good category. Nevertheless, there were several items of students' readiness which calls for attention; they are the students do not understand the task, do not have self confidence, having difficulties in practice, do not focus during studying, having difficulties to interact, and want to get project.

The analysis technique used was Fault Tree Analysis (FTA). It is because FTA is step by step procedure to have logic identification, evaluation, and measuring the reasons of the problem (failure) in a system and to decide strategy to solve the problem.




The explanation mostly points to the fact that the Physics course given at universities was the continuation of the Physics education they received at high schools. The students saw the Physics instruction at university as a system based on memorization and problem solving which is similar to high school instruction. Physics is lectured as a theoretical class and lacked of practical work and physics instruction does not have a content related to their occupation (Zadeh & Satır, 2014)[1)].

Physics should be given more with the help of examples from everyday life besides mathematical data and theoretical lectures. Concepts of Physics should be supported with applied activities.

Engineering education should be based on a strong science and mathematics education. On the other hand, a well-trained engineer to issues outside their own discipline is often emphasized in familiarity. Engineering education should be designed according to this approach: equipped with basic knowledge and skills in the field, analysis, synthesis, design capability,and acquired the habit of lifelong learning to educate individuals ( İbrahim Güneş et al, 2015)[2.]

## G. Planning

Based on the problem and the FTA above, it can be seen that Applied Physic course needs such an instructional model which can improve students' motivation and creativity as well as interactive media.

Teaching model can be said as the instructional learning model. When the lecturer helps the students to gain information, opinion, skill and min-mapping, simultaneously the lecturer helps them to learn (Joyce, Weil, dan Calhoun , 2009:7). One of the instructional model mentioned above is Contextual Teaching Learning (CTL).

CTL, as an instructional model, needs a well-planned implementation including its concepts and principles. There are seven principle of CTL; constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. Applied Physic is main course for engineering science, so that there are several principles can be omitted. Questioning and inquiry can be amalgamated. Modeling is not necessary since this course does not demand the real model. Last, the reflection can be linked to every principle.

Contextual teaching and learning is a learning concept which establishes links between course material with the students real life situation. Besides, it stimulates the students to create links between their prior knowledge and its application in their real life as family and community member (Johnson . 2014:90).

Several researches about CTL in Physic subject had been conducted such as, utilizing the CTL learning sources (Nurdin, 2013), CTL approach based on lesson Study (Murtiani, et.al, 2012), Physic subject with CTL approach triugh empirical experience (especially for hyperbolic motion comprehension) (Mokhamad Areif FB, 2013) and the effectiveness of Physic subject using CTL model triugh predict, observe and explain methid towards high order thinking (M. Fayakun and P. Joko, 2015).

The planning and implementation of CTL method require the lesson plan for every Applied Physic course meeting. The lesson plan consists of appropriate method and materials to explain, whether it would be done trough lecturing, discussion, groupwork or interactive media.

Interactive media in Applied Physic course is demanded so that the students can repeat at home. Consequently, interactive media containing appropriate Applied Physic material for mining engineering is expected to be created.

## H. Conclusion

Applied Physic course should be straightened up in order the students can reach optimal learning result. CTL learning model is appropriate to create such meaningful learning since the students are motivated to be active and creative. The learning is student-centered and the lecturer is only as the facilitator. Instructing a project is expected at the end of the course to reflect the students' cognitive, affective and psychometric. Interactive media containing appropriate Applied Physic material for mining engineering is expected to be created.

## I. References

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