

Code: P-44

**TRIGONOMETRY MODULE DEVELOPMENT APPROACH USING
APTITUDE TREATMENT AND INTERACTION (ATI) FOR EDUCATION
AND TEACHER TRAINING FACULTY STUDENTS AT MATHEMATICS
DEPARTMENT OF STATE ISLAMIC UNIVERSITY OF SUSKA UIN RIAU**

Risnawati¹, Zubaidah Amir², Defi³
UIN Suska Riau^{1,2,3}

rwati04@gmail.com¹, zubaidah_mz@yahoo.com², defi-pasha@gmail.com³

Abstract

This study aims to develop trigonometry module using the valid, practical and effective ATI approach. This research method used Research Development Approach. It is a development model of IDI (Instructional Development Institute). The study consisted of three stages: front-end analysis, prototype stage and assessment stage. Activities done in this front and analysis involved analyzing the measured material analyzing the math text books especially Trigonometry, reviewing literatures about modules learning, interviewing it math peers with in this sense were lecturers, and learning the characteristics of the students. According to the analysis finding of front and analysis has been obtained the prototype Trigonometry module which is then consulted by the experts. This prototype was further validated by five experts consisted of three instructional design experts and 2 content experts.

At the practices stage the module was tested to student the state semester. The testing has observed by two (2) observers from lecturers. The effectivity of module observation has done together with the practicalities. The effectivity observed has about student activity, motivation, and student learning achievement. The finding of this research showed that: (1) The designed Trigonometry module was valid (content, construct) from the instructional design experts and mathematics education expert, (2) The Trigonometry module can be used by students lecturers without any significant obstacles, in other words, it used practically based on the observers evaluation and the lecturers, and (3) trigonometry module effective with has shown by learning activities, motivation, and the high student learning achievement after following the learning teaching process.

Keywords: *Module, ATI, Trigonometry, Learning Activities, Learning motivation, Learning Achievement.*

INTRODUCTION

Conducted lectures on subjects Trigonometry students do not have adequate sources of lectures. In the lecture during this, the teaching materials used have not been effective because the number of references that few, even students still use basic math books and math high school trigonometry contained material. Of course this is forcing students to have handbooks such diverse. While no single practical teaching materials from professors as handle students in the lecture. Reality it is very difficult to achieve an effective learning process as expected.

The students had difficulty in using the media/book available for learning materials scattered in several different books. In addition to the language of the book is difficult for them to understand. The difficulty level of test material is also highly variable for their understanding, this is due to differences in the background of the origin of high school students. Instructional materials used have not been sufficient to support the learning process. The books used for this no attention to the diversity of the background of the school of origin, so that the student can not take full advantage of the book.

Trigonometry course has the topics consecutively each other and also linked to each other. Materials provided will be understood, if the supporting concepts are clearly understood. Subject supporting concept now would be much influenced by understanding of student to previous lecturing of supporting concepts. So to master the subjects well, students must complete a lot of testing materials, at least from textbook.

To assist student in learning, it is needed to develop a learning media. Learning media is one of source of learning applied to facilitate message that will be delivered by lecturers to the students. In this case, writer wants to develop media in the physical form. Learning media intended is a teaching material product assisting student in comprehending subjects with certain characteristics. Sahertian (2004) stated learning achievements are determined by a variety of factors that influence it, one of the factors that are outside the individual is the availability of teaching materials that make it easy for individuals to learn, resulting in better learning (p. 1). Teaching materials in question are special areas of Mathematics Trigonometry Module. This study answered the validity of the problem formulation, the practicalities and effectiveness of ATI-based module for Trigonometry.

To support the student understanding improvement, then the module was made with ATI approach. With modul, it's expected that the students can create new understanding based on early knowledge and learning experiences.

This research answered the problem formula about validity, practicality and effectiveness of ATI-based module for Trigonometry. Effectiveness is more focused on the activity, student motivation and learning outcomes. It aims to determine the extent of ATI-based module can improve the activity and student motivation. Because of all this it appears that activity, motivation, learning achievement for college students were still low in Trigonometry.

Study in College

Study process in high college differed from study process in school. According To Hisyam (2004: 4) expressed from any views, student have been assumed adult compared to high school student. In general, it can be told that the student has owned maturity in thinking and takes choice in process of study.

In process of study, students shall be treated as according to their adult characteristic. According To Hisyam (2002) told that the adult usually can manage her/himself, has various experience, ready to learn because of their self needs (p. 7). According to RH Knowles (1994) in Kemp based on intensive research had explained that, it has been known a number of spreads of adult and self adaptation in the process of education, that are: adult enters program with motivation and readiness of high learning, they like good structured program with clear elements (p. 67-68).

According To Erman (2004) expressed that every student is individual having potency for autodidact, either from written source, mass media or environment. Lecturer facilitates more and creates conducive learning climate, so that the potency can grow optimally (p. 2). On that account, in process of learning/college the lecturer is expected to create lecturing system enabling students learning from their own knowledge and experience.

Based on above description, it can be summarized that study process in college wish programmed and structured study process elegantly, that has clear purpose and step/ activity, systematic. The role of lecturer as instructor doesn't intervene, but only as facilitator. In process of study, students prefer to join actively in activity of their own learning.

ATI-Based Module

According To Sunardi (2002) explained that the attention to teaching will give the opportunity to individual to develop more". This mean that study gives an opportunity to individual to learn by its own way and based on individual different principle to develop more (p. 422). One of study based on principle is the study system with module.

Further according to Sunardi (2002) explained that study of module is a set of study program which can be studied by students self-supportingly with minimum assistance from lecturer (p. 422). By using module, study process is not lecturer centre, but student one. According To Suryosubroto (1983) explained that "Teaching system with module is a submission system selected for the agenda of developing education system which is more efficient, relevant, and effective (p. 9). So main principle from study system with module increased efficiency and study effectivity in the case of time usage, fund, facility and precise energy". So, study with module can give the opportunity to individual to learn by their own way and ability, beside this also aims to increase effectivity and efficiency in study.

According To Vembriarto (1981) expressed about Module: a standard or unit of measuring, that is a standard or measurement unit. Furthermore, he explained that a module is a study package that loads one concept unit from lesson material (p. 20). Teaching of the module is effort for the management of individual teaching enabling student to master one lesson material unit before he transfers to the next unit. According To James D Russel in Vembrianto (1974) affirmed that "the module is presented in the form of having the self-instructional character". This means that each student can set the speed and his own learning intensity (p. 2).

Module is compiled based on the concept emphasizing that student should master lesson material presented in module optimally. This principle contains consequence that student is not enable to follow the next program before he masters at least 75% from the material (Vembrianto, 1983: 19).

Important component of a module consisted of : (1) guidance written carefully, (2) a number of learning targets which must be finalized, (3) breakdown of a number of activities, (4) list source of learning, and (5) one tests or more accompanied with the answers so that student can check progress of their learning. Definition developed by Kemp in line with constraint about module developed by Agency For Education Development (Badan Pengembangan Pendidikan) Depdikbud in Vembrianto giving

constraint with module as follows: the concerned module is "one smallest learning program units detailedly marks: a) purpose of public instructional which will be supported by its attainment; b) Topic which will be made learning process jetty to teach; c) purpose of instruksional specially will be reached by student; d) matter fundamentals which will be studied and taught; e) Position and identity function (module) in unity of broader program; f) equipments and source which will be used; g) activities of learning that is must be done and involved by sequentially pupil; h) spread sheet which must be filled by children; i) Program evaluation which will be executed during implementation of study process".

Selection of independent learning through modules based on the assumption that students will learn better if they are done in a way that focused directly on his own mastery of the competencies and objectives to be achieved. Module can contain a wide range of learning activities, and can use a variety of media to further streamline the learning process. James D. Russell (1973) states that "through student module can control the speed of each, as well as advanced according to his ability". Through module can improve and develop the potential of students. Winkel (1987), adding that through the module "Students can follow the learning program in accordance with the rate of progress on their own and can appreciate the learning activities, either by getting learning assistance from lecturers and without guidance from the lecturers"(p. 275)

Module is the smallest learning program that students learn by themselves individually or taught by the students themselves as individuals or taught by the student himself (self instructional), after the student completes a unit, she stepped forward and study the next unit (Winkel, 1987). The module is based on the concept developed by emphasizing that students must master the material optimally lessons presented in modules (p. 274). This principle has the consequence that the student is not allowed to enter the next program before he mastered at least 75% of the material (Vembrianto, 1983: 19).

From the expert opinion it can be concluded that learning with a learning module that uses the principle is giving the opportunity to students to learn according to speed / abilities of their own. So the main principle of the learning system with modules is to increase the efficiency and effectiveness of learning in terms of the use of time, money, facilities and personnel as appropriate.

Approach of Aptitude Treatment Interaction (ATI)

Syafruddin Nurdin adopts a Cronbach idea that ATI Approach as a approach that try to look for and find suitable treatments with ability difference (aptitude) of student, that is treatment that is effective optimally applied for students with diferrent level of ability. Based on the understandings, the esensial meanings from ATI Approach are as follows.

Firstly, ATI Approach is a concept and model comprising a number of study strategies (treatment) that is effectively applied for certain student as according to ability difference. Second, As a theoritical framework of ATI Approach assumes that optimisation of academic achievement from learning will be created if such treatments in study is accomodated in such manner with student ability difference (aptitude). To each group is given treatment that is suitable with its characteristic.

From understanding formula and essential meaning which has been told by the expert, it can be seen that ATI Approach really aim to create and develop a study model that is really care and pay attention to interrelationship between someone's abilities (aptitude) with experience of learning or characteristically with study method (treatment).

Student Learning Activities

Activity is everything done by the students during the lectures. The students' learning activities can be physical or mental. Both of these activities are related to one another. Activities which are undertaken by the students during the lectures aim to gain knowledge. As explained in Sardiman Rousseau (2007) that all knowledge must be acquired with his own observations, experience itself, the investigation itself, the work itself, with its own facilities created, both spiritually and technically. This shows that every person must be active learning. Without activity, the learning process may not take place properly.

In addition, Silberman (1996) suggested when learning is passive, the learner comes to the encounter without curiosity, without questions, and without interest in the outcome (except, perhaps, in the grade he or she will receive). When learning is active, the learner is seeking something. He or she wants an answer to a question, needs information to solve a problem, or is searching for a way to do a job.

Many activities done by students in learning, are not enough to just listen and record it. Paul B. Diedrich in Sardiman (2007) suggested 8 kinds of activities that can occur in the study, namely: Visual activities, Oral activities, Listening activities, Writing activities, Drawing activities, motor activities, activities Mental, Emotional activities, of this opinion, it appears that a lot of activity which can be done by students in learning mathematics. According to Erman (2004) studied mathematics is not just learning to know, but should be improved include learning to do, learning to be, to learning to live together. In other words, in learning mathematics, students must work, doing, and if necessary in cooperation with other people.

Motivation

Crider (1983) explains the motivation can be defined as the desires, needs and interest that arouse or activate an organism and direct it toward a special goal, can lead to many different behaviors. Keller (1983) also argues motivation, by definition, Refers to the magnitude and direction of behavior. In other words, it Refers to the choices people make-as to what experiences or goals they will approach or avoid and degree of effort they will exert in the respect.

Jensen (1998) revealed five main strategies that can be done to improve student motivation lecturer in lectures, namely: (1) Eliminate the threat, (2) goal-setting (with some student choice) on a daily basis can provide a more focused attitude, (3) influence positively in every way you can, symbolically and concretely, student believe about Themselves and the learning, (4) manage student emotions through the productive use of ritual, drama, movement, and celebration, (5) feedback is one of the greatest sources of intrinsic motivation.

While Keller (1983) describes four categories of conditions that must be considered motivational lecturer in the business of making lectures interesting, meaningful and challenging for students, namely: (1) interest (interest), (2) relevance (relevance), (3) expectations (expectancy), and (4) satisfaction (satisfaction).

Learning Achievement

Learning achievements are intrinsically behavioral changes in a person (Sujana, 2001). Result of learning is a process of change has not been able to afford in the direction (W. S Winkel, 1998). It also presented the results of the research study is about the educational progress of students after learning activity (Djamarah, 1994). Of understanding the results of the above study it can be concluded that the learning outcomes are behaviors expressed by a score or figures obtained from a series of tests were carried out after learning the results of the learning process. Mathematics learning outcomes intended in this study is the change in behavior that is declared with the score obtained and a series of tests were carried out after the learning outcomes learning process using learning modules on deepening Trigonometry.

RESEARCH METHODS

In line with the model of development of IDI and opinions of Asim, the researchers drafted a development procedure consists of 3 stages, namely:

1. Analysis of face-to-rear (Front-end analysis).
2. Stage Prototype (Prototype)
3. Stage Assessment (Assessment).

In general it can follow the design as shown below:

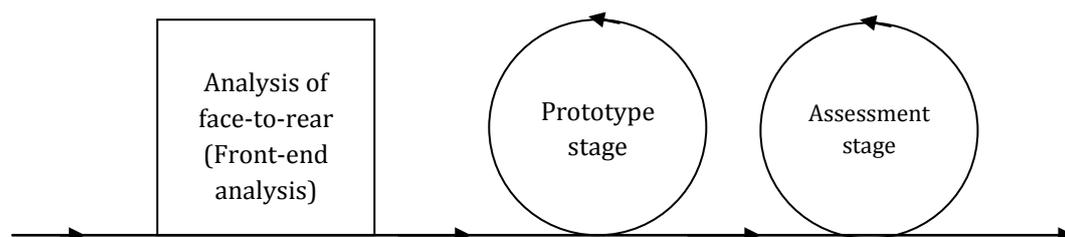


Figure 1. Research design (in Fauzan, 2002:63)

Note: The "loop" is used is to show cyclical processes.

The design in Figure 1 above will be described in the following phase of the research procedures.

1. Phase Analysis of Front-Rear (Front-end analysis)

This is done to get a picture of conditions in the field. This stage can be called as the requirement analysis phase (needs assessment). At this stage the following steps:

- a. Analysis of reference subjects/competences

Before developing learning modules, need to be analyzed back the materials included in the benchmark the competencies tested. The material there is a junior high school mathematics curriculum which is based on SBC. This reference will be used as a benchmark to look at the competencies mastered by students who have not subsequently be developed into teaching materials in the form of modules.

- b. Analysis of mathematics textbooks

Based on competencies that have been defined as the development of materials, it is necessary to analyze the textbooks of mathematics as a source of development. Textbooks are mandatory guidebook of money plus additional handbook.

- c. Reviewing the literature on learning modules.

The lecture which is the recognition of individual differences is the realization of the teaching module. Development of the module must be in accordance with the

principle, which is a unit of learning programs that students can learn on their own with minimal assistance from the teacher. That is, the resulting module must be easily understood by students. Developed module consists of the following elements: (1) general instructional goals / standards of competence which will be supported achievement, (2) The topic will be the base of the learning process, (3) instructional objectives or basic competences that will achieved by the student, (4) Principles of the material studied and taught, (5) The function unit (module) in the unity of the broader program, (6) The role of teachers in the learning process, (7) The tools and resources that will used, (8) learning activities / instructions to do and lived in consecutive student, (9) work sheets to be filled students, program evaluation will be conducted during the course of the learning process.

a. Interviews with colleagues.

Interview or interviews with peers, in this case subjects lecturer who administer conducted to determine problems or phenomena encountered in connection with the lecture class.

b. Study the characteristics of students

Student characteristics should be the basis in the development of the module. This is to facilitate compiled language level, and the difficulty matter.

2. Prototype Stage

Based on the results of the analysis behind the front-designed prototype instructional materials Competency Based Module on enrichment and remedial learning school mathematics. Prototyping is implemented through two stages, namely:

a. Validation Phase

A data or information can be said to be valid in accordance with our actual results. Activities begin with a preliminary analysis of the cyclical process and assessment experts (Expert Review). The validation process is accompanied by discussions or interviews with experts regarding improvements to be made on a prototype that is by design of Competency Based Module (MBK) consulted the expert or experts, then the design is judged by competent persons (validator) which has understand the principle of the development of the module, ie UIN lecturers and professors caregiver course. MBK validation have 2 kinds, namely: 1) Validate the contents of which are MBK which has been designed in accordance with the selection of material competence. 2) Construct Validity of the Conformity MBK components with elements of development that have been defined.

b. Phase practicalities

Practicalities of the prototype device is the level of applicability of learning by faculty and students, is to carry out experimental teaching using learning tools that have been revised based on the assessment by the validator or is the result of the first stage.

3. Assessment Stage

In the assessment phase, focused activities to evaluate whether the prototype (trial version) can be used in line with expectations and effectively to improve the quality of student learning and achievement. Aspects of effectiveness observed in the lecture that uses MBK trial class is activity, motivation and learning profile. Results also an aspect of the observed. Activity and profile observations recorded on the sheet provided.

Phases / stages	Quality of the study		
	Validity	practicalities	Effectiveness
The first stage prototyping	√		
The second phase		√	
Assessment			√

Table 1. Phase and Quality Aspects Examined In Software Development Based Learning Module ATI

RESULTS

Validity of ATI-Based Module

Validation of the validator results demonstrated that ATI-based modules developed for Trigonometry lectures are valid. It means that the module has been assessing what should be assessed in accordance with the competencies defined in the syllabus. Modules work in terms of content and construct validity.

Practicalities of ATI-Based Module

Results of experiments performed on the 3rd grade semester student of Mathematics Education Program FTK Suska UIN Riau showed ATI-based modules. This module obvious way to fill it, interesting and useful for students.

Effectiveness of ATI-Based Module

ATI-based module for Trig that has been created, tested with the type of cooperative learning strategies The Power Of Two. Based on the obtained activity data and student motivation.

Student Activity

To know the effectiveness of ATI-based module in the activities of students was done observation during Trigonometry class. Based on the observations of the students' activities during lecturing showed that ATI-based Module can appear positive activities of the students and reduce the appearance of negative activity of students. Positive activities that appear are filled with full modules, asking, answering friends questions, express opinions, compare answers with the answers themselves friends, and students to discuss with their partner. Activity most often and very successfully implemented in the classroom is to compare their own answers with the answers friends. In this activity each student to match their work.

Student Learning Motivation

To know the effectiveness of ATI-based module on student learning motivation, they were asked to complete a questionnaire motivation to learn. Questionnaire was completed at the end of the semester. The description of student motivation after using ATI-based module for Trigonometry :

1. Enthusiasm in learning and filling module

Student filled module given at home. But not all the problem that students can complete. They only fill module for the problems which were easy only. Other problem was done when discussion with his/her couple and class discussion. Student enthusiasm was still seen less for activity of asking/answering question and giving suggestion when group discussion. This thing was also seen when lecturing was done.

2. Relevance of module with lecturing topics

According to students, test materials of the module were always as according to subjects given during theoretical lectures. Module was also as according to requirement and student ability, so that testing materials at module was seldom not to be comprehended. Relevant module effect with lecturing matter, student seldom chat when discussion and presentation of group. If there was chatting student, student was sleepy student.

3. Student Wish and Satisfaction after Filling module

In general, student hope filled module is to obtain good score. To reach the good score they were serious and concentration in learning. By filling module, they understood more in lecturing subjects. Because students understood with lecturing subjects, they could make conclusion after filling module. Someone will be motivated if work was done successfully.

Learning Achievements in Trigonometry

Based on the test results, the data showed that of the 34 students taking the module obtained by the learning process with 14 people who get more out of 50. This means that 41.18% of students achieving mastery learning above 50%. while students who do not follow the learning module only 5 of 47 people who get a score above 50. If visits by grouping capabilities, the result that 1 person out of 13 low proficiency students scored more than 50. While the ability of the group were 5 students out of 10 people get more value 50, and for the high ability group there were 8 people from 11 students. In other words, the percentage of students who scored more than 50 for each of the low ability groups, medium, and high respectively is 7.69%, 50%, and 72.73%. Thus, learning to use the modules can be said to be effective in improving student learning outcomes.

CONCLUSION

This research is the development of Trigonometry module for students in Mathematics Education courses in UIN Suska Riau. From the discussion of the results of this study concluded the following: (1) The designed Trigonometry module was valid (content, construct) from the instructional design experts and mathematics education expert, (2) The Trigonometry module can be used by students lecturers without any significant obstacles, in other words, it used practically based on the observers evaluation and the lecturers, and (3) trigonometry module effective with has shown by learning activities, motivation, and the high student learning achievement after following the learning teaching process.

REFERENCES

- Djamarah. 1994. *Prestasi Belajar dan Kompetensi Guru*. Surabaya: Usaha Nasional.
- Dick. W, and Carey. L, 1990. *The Systematic Design of Instructonal Third Edition*. Florida: Harper Collins Publishers.
- Ngalim Purwanto. 2004. *Psikologi Pendidikan*. Bandung: Remaja Rosdakarya
- Erman Suherman, dkk. 2004. *Common Textbook Strategi Pembelajaran Matematika Kotemporer*. Bandung : JICA-Universitas Pendidikan Indonesia (UPI)
-2001. *Evaluasi Proses Dan Hasil Belajar Matematika*. Jakarta: UT. Depdiknas.
- Fauzan, Ahmad. 2002. "Applyng Realistic Mathematics education (RME) in Teaching Geometry in Indonesian Prymary Schools". *Thesis*, tidak diterbitkan. University of Twente. Enschede.

- Hisyam Zaini, dkk. 2002. *Desain Pembelajaran di Perguruan tinggi*. Yogyakarta: Center For Teching Staff Development (CTSD) IAIN Sunan Kalijaga.
- Joni, T.R, & Wardhani, I.G.A.k, 1984. *Pengembangan Paket Belajar*. Jakarta: Depdikbud, P2LPTK
- Kemp, Jerrol E. 1994. *Proses Perancangan Pengajaran*. Bandung : ITB Bandung
- Keller, Jhon M. 1993. Motivational design of Instruction. Dalam Reigulth, Charles M. (Ed.), *Instructional Design Theories and Model: An Overview of Their Current status*. London: Law Rence erldaum Associaties Publishers.
- Silbermen, Melvin L. 1996. *Active Leraning: 101 Strategies to teach any subject*. Boston: Allyn an Bacon.
- Nana Sudjana. 2000. *Dasar-dasar Proses belajar mengajar*. Bandung: Sinar Baru Algesindo.
- Nuridin, Syafruddin. 2005. *Model Pembelajaran yang Memperhatikan Keragaman Individu Siswa dalam Kurikulum Berbasis Kompetensi*. Ciputat: Quantum Teaching.
- Nana Syaodih Sukmadinata. 2007. *Metode Penelitian Pendidikan*. Bandung: Roda Karya.
- Ngalim Purwanto, 2004. *Psikologi Pendidikan*. Bandung: Remaja Rosdakarya
- Pupuh Faturrahman dan M. Sobry Sutikno.. 2007. *Strategi Belajar Mengajar melalui Penanaman Konsep Umum dan Konsep Islam*. Bandung: Aditama.
- Reigeluth,CM., 1983. *Instructional-Design Theories and Models: An Overview of Their Current Status*. Hillade,N.J: Lawrence Erlbaun Associates
- Riduwan, 2005. *Belajar Mudah Penelitian Untuk Guru, Karyawan dan Peneliti Pemula*. Bandung: Alfabeta.
- Rosjidan dkk. 2001. *Belajar dan Pembelajaran*. Malang: Universitas Negeri Malang.
- Sahertian CDW. 2004. "Pengaruh Penggunaan Bahan ajar dan Gaya Belajar terhadap Hasil Belajar". (www.pendidikan.net diakses 26 November 2007)
- Sardiman AM, 2007. *Interaksi dan Motivasi Belajar Mengajar*. Jakarta : PT. Raja Grafindo Persada
- Sudjana. 2001. *Penilaian Hasil Belajar Mengajar*. Bandung: PT. Remaja Rosda Karya universitas Negeri Malang
- Suparman, A.,1991. *Disain Instruksional*, Jakrta: Depdikbud,UT
- Suryosubroto. 1983. *Sistem Pengajaran dengan Modul*. Yoyakarta: Bina Aksar
- Uzer Usman. 2004. *Menjadi Guru Profesional*. Bandung: PT. Remaja Rosyda Karya.
- Vembrianto ST. 1981. *Pengajaran Modul*. Yogyakarta: Paramita.
- Wina Sanjaya. 2007. *Strategi Pembelajaran Berorientasi Standar proses Pendidikan*. Jakarta: Kencana Prenada Media Group.
- Winkel WS. 1998. *Psikologi Pengajaran*. Jakarta : PT. Grasindo.