

**The Study of Written and Electronic Tutorial in the Department of Mathematics and
Science Education**
By Ucu Rahayu and Yumiati
(E-mail address: ucu@mail.ut.ac.id and yumi@mail.ut.ac.id)

Abstract

In distance education, tutorial is one of the alternative models of learner supports to enhance student's achievement. Face to face tutorial is one of the tutorial models which is offered most. However, this tutorial has limitations, such as the qualification of tutors in each region is not the same and can only be conducted in the cities, so students in remote area cannot involve in face to face tutorial. To overcome this problem, since 2002, the Department of Mathematics and Science Education (DMSE) – the Faculty of Teacher Training Education, Universitas Terbuka has been offering other kinds of tutorial models. They are, written and electronic tutorial. These tutorials were funded by Direktorat General of Higher Education (Dirjen Dikti).

The objectives of this study is (1) to get a general picture on written and electronic tutorial conducted by DMSE since 2002 to 2003 through students' responses, scores of tutorial tasks and students' perceptions., (2) to recommend the intitution to improve the system of written and electronic tutorial in the future. The paper was written based on a study done by team in the Department of Mathematics and Science Education.

The study shows that the outcome of written tutorial are (1) there was a decrease in the number of students responded each tutorial, (2) there was an increase in the ability to learn of the students from first tutorial to third tutorial, (3) all students were interested in joining written tutorial. On the other hand, the outcome of the electronic tutorial shows that (1) there was a decrease of students' responses in taking this tutorial from 2002 to 2003, (2) electronic tutorial helped students in understanding modules.

***Key words : Department of Mathematics and Science Education, Written Tutorial,
Electronic Tutorial***

BACKGROUND

Universitas Terbuka (UT) is the only university which implements open and distance learning system in Indonesia. UT is one of the mega universities in the world since its students is more than 200,000 which are from all of level society including civil servants, teachers, freshmen, etc. UT has an important role in mproving the quality of Indonesia's human resources since it has the capability of accomodating and enabling access to a large number of students.

Distance learning system demands their students to have an ability to do self study in order to complete their study. It means that students have a freedom in specifying their learning accelarations, places and resourses of their study. Three main components of the distance learning systems are materials provided, academic services and tests. These support learning process of students at distance.

Based on the Strategic Planning of UT, nowadays Faculty of Teacher Training Education (FKIP) focuses on three aspects of developments. They are, improvement in the academic quality, extended reachness, and improvement in the internal management. Tutorial is an effort to improve the academic quality. It answers student needs of learning process. Tutorial is an obsession of this institution to be continous improved. A good tutorial system is going to produce better quality alumni who are capable of their subjects and doing self study.

UT provides various models of tutorials. They are, (1) face to face tutorials, written tutorial by post, (2) broadcast tutorials include radio and television (TV) as media for tutorial communication, (3) recorded tutorials by Computer Assisted Instructional (CAI), (4) online tutorials by Internet, and (5) written tutorials. Basically, students have a freedom to choose a kind of tutorial which is suitable to themselves.

Face to face tutorial is one of tutorial models which is offered most. However, this tutorial has limitations, such as the qualification of tutors in each region is not the same and can only be conducted in the cities, so that students in remote area cannot be involved in face to face tutorial.

The Department of Mathematics and Science Education (DMSE), one of the departments of FKIP-UT offered electronic and written tutorial, besides face to face tutorials. In 2001, DMSE had already provided 29 courses supported by electronic tutorials, but students had responded this kind of tutorial only 4. In the same year, DMSE had provided a course supported by written tutorial and only 1 student had responded it.

By reflecting that experience, DMSE was funded by Direktorat General of Higher Education (Dirjen Dikti) conducted written and electronic tutorial for two years, since 2002 to 2003.

THE OBJECTIVE AND ADVANTAGES OF STUDY

The objective of this study is to get a general picture on written and electronic tutorial conducted by DMSE since 2002 to 2003 through students' responses, scores of tutorial tasks and students' perceptions. The findings are going to be used as a recommendation for decision makers in DMSE to conduct better written and electronic tutorials in the future.

CHARACTERISTICS OF THE DEPARTMENT OF MATHEMATICS AND SCIENCE EDUCATION

The Department of Mathematics and Science Education (DMSE) currently enrolls more than 8,000 students, who are in-service teachers in senior and junior high schools, learning at a distance from various parts of the country, without leaving their duties. This department has various study programs including Mathematics Education, Biology Education, Physics Education, Chemistry Education for sarjana degree (S1) and Science Education and Mathematics Education for Diploma degree (D3). In each registration period, more than 350 students registered their courses in each study programme. Table 1 illustrates the number of the students' registration during the past six semesters.

Table 1. Number of students registered in the past six semesters

Study Programmes	Number of students register						Average
	00.1	00.1	01.1	01.2	02.1	02.2	
S1 Mathematics Educ.	1589	1412	1122	1094	1016	1940	1362.17
S1 Biology Education	1096	1395	1287	1311	1125	1684	1316.33
S1 Physics Education	587	811	768	786	795	1175	820.33
S1 Chemistry Education	364	343	299	332	320	486	357.33
D3 Mathematics Educ	817	693	510	563	491	929	667.17
D3 Science Education	746	688	574	579	621	1097	717.5

The average number of graduated students per semester for the Department of Mathematics and Science Education are 575. The number of graduates per study programmes per semester is shown in Table 2.

Table 2. Number of graduate students per study programme per semester

Study Programmes	Number of graduate students						Average
	00.1	00.2	01.1	01.2	02.1	02.2	
S1 Mathematics Educ	279	193	126	324	128	153	200.5
S1 Biology Education	39	23	50	47	173	95	71.17
S1 Physics Education	33	14	15	50	33	55	33.33
S1 Chemistry Education	59	20	34	42	20	34	34.83
D3 Mathematics Educ.	187	198	59	130	147	24	124.17
D3 Science Education	248	112	89	111	68	37	110.83

LEARNER SUPPORT

Learner supports are all the activities beyond the production and delivery of course materials that assist in the progress of students in their studies (Simpson, 2000). Learner supports are categorized into academic support and non-academic support. Academic support is the university service for students to complete their studies. Tutorial is one form of the learner supports. Tutorial may involve students' activities in which students teach other students. This means that a distance he teaches either him/herself or others (Amos in Ehly & Larsen, 1980). Tutorial is a process where one helps and guides other people in studying (Cohen, Kirk & Dickson, 1972).

A student (tutee) who is treated by the tutorials has more ability to cope with learning materials than others since he learns something by process without memorizing it (Bentley in Ehly and Larsen, 1980). Other studies in the US, Canada and Britain showed that tutorial can

improve intellectual and psychomotor ability, develop behaviour of democracy, cooperation, and interaction among groups which support other abilities (PAU-UT, 1999). Tutorial has positive effect if the tutor has a role as facilitator. On the other hand, it has negative effect if the tutor has a role as a teacher.

DISTANCE LEARNING IN PRACTICE: EXPERIENCES OF THE DEPARTMENT OF MATHEMATICS AND SCIENCE EDUCATION, UNIVERSITAS TERBUKA

Instructional process at distance is not similar to that in face-to-face or campus-based education. UT students are spread out all over the country, either in urban areas or remote areas. A lot of students living in remote areas face constraints in their studies. UT has to provide learner supports, such as tutoring, practical work, academic and administrative counselling.

Tutorials

There are five tutorial models offered by the Department of Mathematics and Science Education. First, written tutorials by post. This tutorial system can reach virtually all of the students even those residing in remote areas. This tutorial system can be conducted at relatively low cost, and does not need special space. However, communication between tutor and students take time so that students' problems sometimes cannot be solved immediately. Tutors identify difficult and essential concepts that have to be further explained and delineated to their students. This tutorial system usually involve three phases of initiations. Each phase consists of description of difficult and essential concepts, practices and tasks. While the second part is sent to the students. Feed back for the first phase of students' responses are sent too to the students, and so are the third phase.

Second, broadcast tutorial includes radio and television (TV) as the media for tutorial communication. Like the written tutorials, these tutorials can reach most of the students, including those in remote areas. However, not all subject materials can be tutored using this model. Specific subjects like mathematics and physics, which explain formulas, are difficult to be delivered to students using radio and television tutorials. For this reason, tutor selects topics that are applicable to this tutorial model. Besides, this tutorial needs high cost to produce and deliver these subjects.

Third, recorded tutorial by Computer Assisted Instructional (CAI). This tutorial can reach students who have access to computer facilities, irrespective of where they live. However, not many of UT students are familiar with computer, or have easy access to computers, and there is limitation of software to use with the CAI programmes. Tutors need to select the most difficult topics of the subject matter. In this model, lecturers explain and describe the most difficult topics, including examples, exercises, and tasks that can be used in self- evaluation.

Fourth, online tutorial by Internet. Internet provides an opportunity for distance learning institutions, including UT, to design more communicative and interactive instructional system. Online tutorial is one of the most flexible models in tutorials, since students can access materials wherever and whenever they live, and tutors can up-date courses' materials and responds to students' enquiries in a flexible manner. However, not all students are familiar with computers, and for many UT students access to computers need relatively high cost. This model provides opportunity for interactive discussion (among students and tutor) and two-way discussion (between student and tutor). For UT, this model consists of eight initiations, including materials, exercises, tasks (evaluated by the tutor), and discussion.

Fifth, face to face tutorials are conducted in regional centres (*Unit Program Belajar Jarak Jauh-Universitas Terbuka* or *UPBJJ-UT*), when students need them. Face-to-face tutorials are and just in the cities where there is a state university available. This model

encourages interaction directly among students and tutor, so that students' problems can be solved right away. However, sometimes in certain places it is difficult to find qualified tutors that meet UT's criterias and suit to the different needs of the students.

Basically, initiation for all tutorials must be reviewed by other tutor who has the expertise in the same subject matter. Tutors have to submit instructional plans (*Rancangan Aktivitas Tutorial* or *RAT* and *Matrix Aktivitas Tutorial* or *MAT*) to the Department of Mathematics and Science Education in order to be validated. Tutors for face-to-face tutorials are selected based on specific criteria set by the University and Faculty of Education. Tutors are evaluated for their mastery of subject matter and classroom management. The result of this evaluation will be used as input to improve their performance.

METHODOLOGY

Population

The population of this study were the students of the Department of Mathematics and Science Education (DMSE) in 2002 and 2003

Sample

In 2002, maximum 60 students of DMSE per each course who had not been passed and registered yet for courses supported by written tutorials. Then in 2003, all students registered courses which supported by written tutorials were taken as sample of this study.

In 2002, 180 students who registered courses which were supported by electronic tutorials from 5 UPBJJs were taken as sample. Selection of UPBJJ based on the number of students who registered those courses. In 2003, the sample were all students who registered courses supported by electronic tutorials

In 2002, 12 courses from 6 study programs were both supported by written and electronic tutorials and in 2003, 12 courses were supported by written tutorials and 5 courses were supported by electronic tutorials. Courses which were supported by written and electronic tutorials were the courses which have a low rate of pass examination in four semesters (2000.1 to 2002.2). Selection of courses supported electronic tutorial based on the most number of students who responded electronic tutorial in 2002.

Instruments

Instruments of this study were tutorial tasks and questioners.

1. Tutorial tasks was a part of written tutorial scripts sent to the students. There were three tutorial taks that had to be worked by the students. Tutors gave a feedback of previous tutorial task to the students while he sent other tutorial'scripts.

In 2002, the scripts of written tutorials sent three times, however in 2003, the scripts were sent once.

2. Questioner was used to collect students' perception on the implemetation of written and electronic tutorials including constraints, strengths, weaknesses, and general impressions.

Questioner of written tutorials were sent together with the second tutorials scripts , while the questioner of electronic tutorials were sent both in the mid of semester and during the examinations.

FINDINGS

1. Written tutorials

a. Students' responses

In 2002, there were 126 of 240 students who responded written tutorials. The reasons why half students did not respond tutorial scripts because of busy, on leave, moved to new address, did not received the scripts, did not register the course. The

number of students responded written tutorials for each initiation in 2002 could be seen in diagram 1.

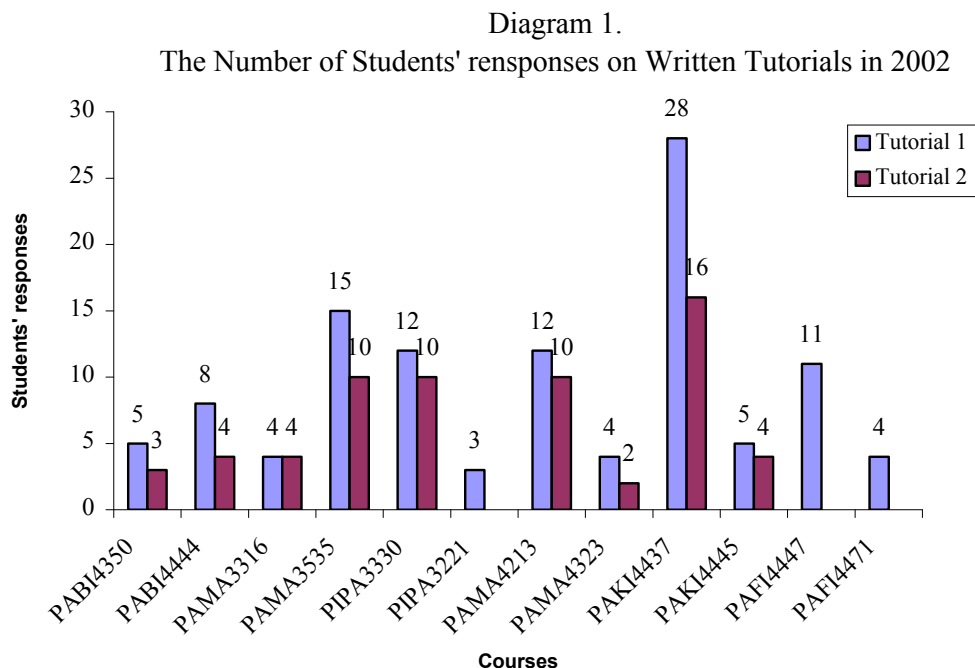


Diagram 1 shows that Physical Chemistry III (PAKI4437) was responded the most (by 28 students), and Calculus II was responded the least (by 4 students). Generally, students' responses from the first to the third tutorials were decreased. It occurred since the process of written tutorial took long time, started from sending tutorial scripts to the students until sending a feedback of the students' works. Moreover, some students received the third tutorial scripts during examination. Therefore, they did not have opportunity to learn the tutorial scripts and to send the third task.

Based on that experience, in the year of 2003, the tutorial scripts were sent to the students once. The number of students responded written tutorials were 382 out of 1400 students. The number of students responded written tutorials in 2003 for three initiations can be seen in diagram 2a and diagram 2b.

Diagram 2a.
The Number of Students' responses on Written Tutorials in 2003

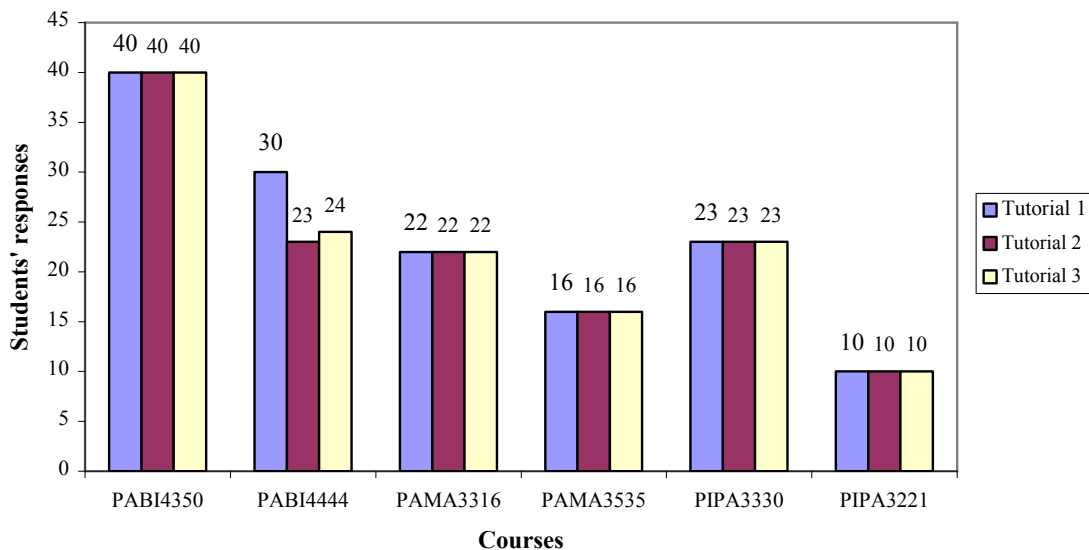
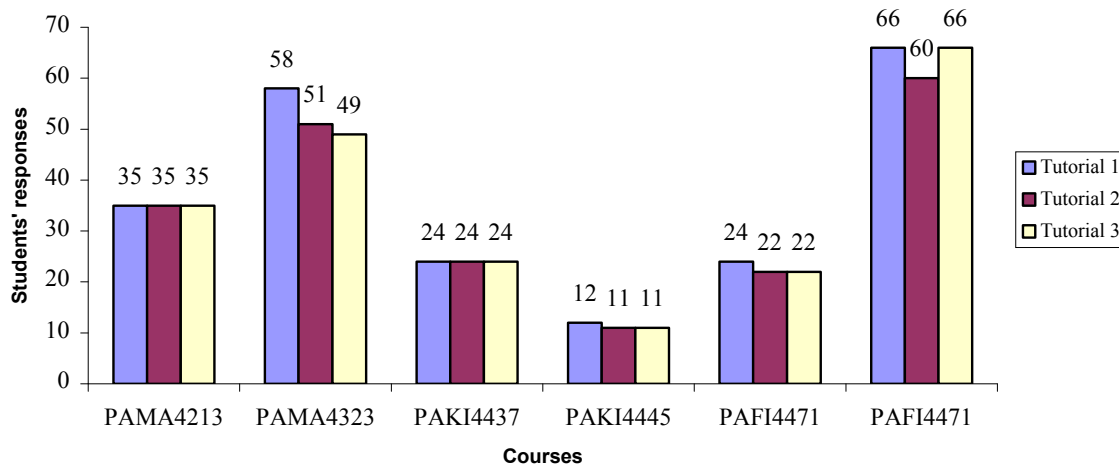


Diagram 2b.
The Number of Students' responses on Written Tutorials in 2003



Selected Topic of Physics was a course which was responded the most, but Mechanics was a course was responded the least. The number of students' responses to written tutorials were relative stable for majority courses. It meant that once script's delivery were able to stabilize the number of students' responses for each tutorial task.

b. Average scores

Average scores got the students for each course supported by written tutorials were vary. Some courses' were found increase but others were decreased. The whole information can be seen in diagram 3, diagram 4a. and diagram 4b.

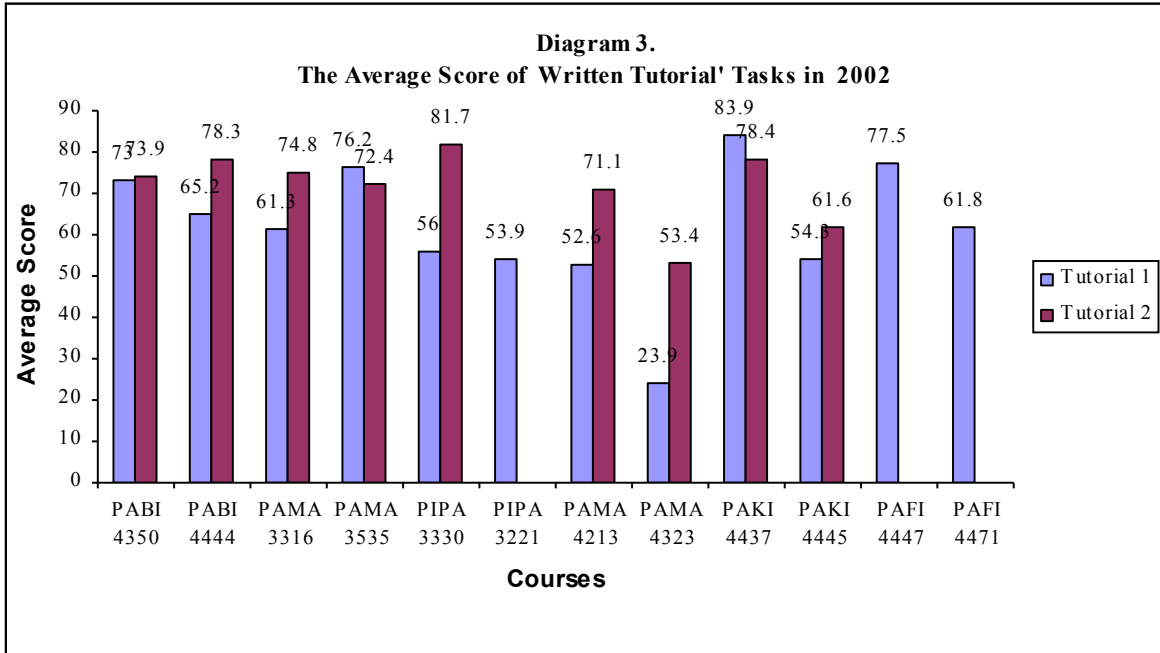


Diagram 4b. The Average Score of Written Tutorial' Tasks in 2003

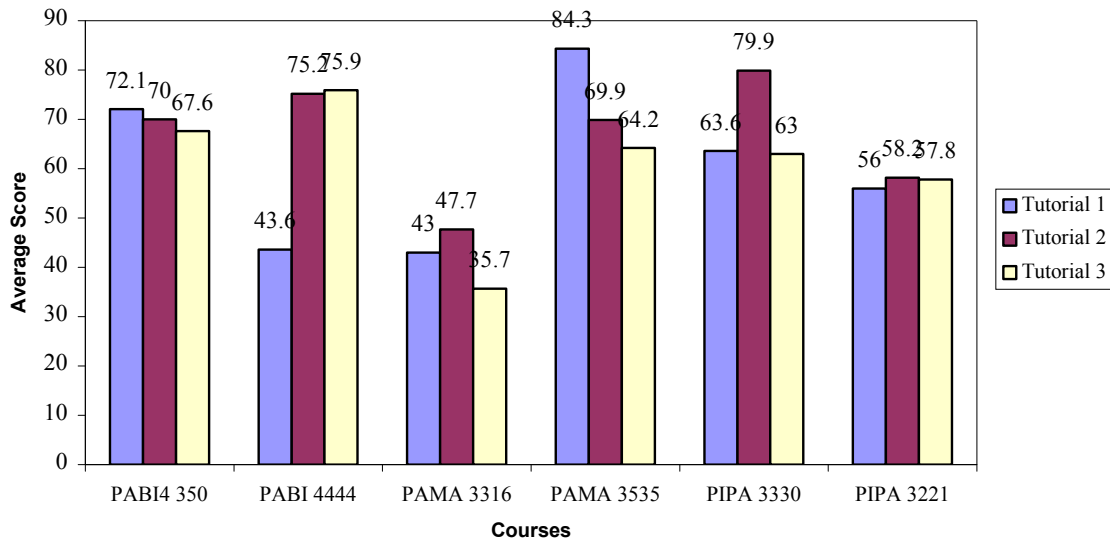
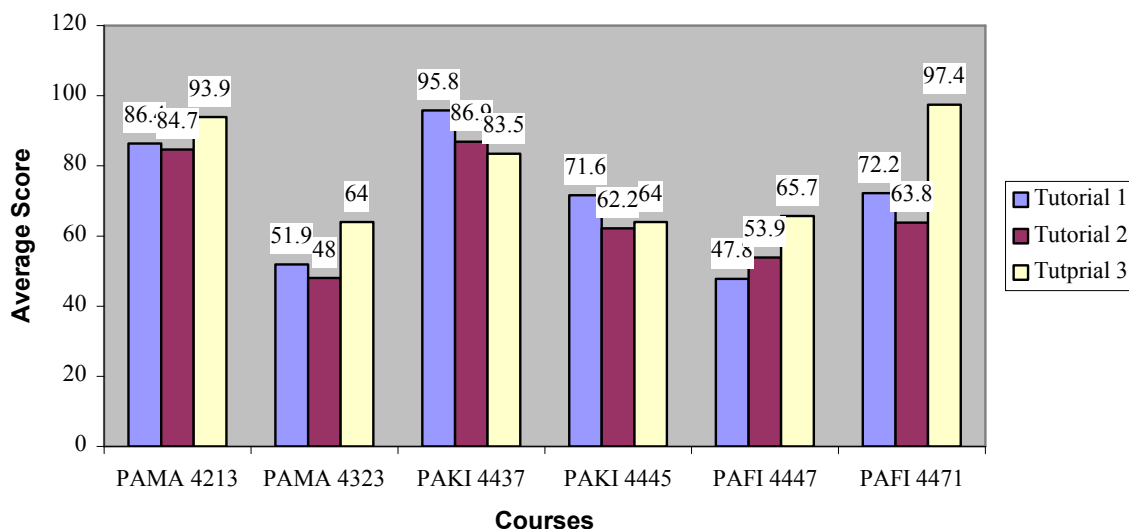


Diagram 4b. The Average Score of Written Tutorial' Tasks in 2003



c. Students' perceptions on written tutorials

There were some information from the questioners which were fulfilled by the students joining written tutorials.

- 1) By joining written tutorials, more than 80% students thought that written tutorial helped them to understand material of module. The rest of students thought that there was no relevancy between material of tutorial and modules.
- 2) More than 80% students had an opinion that the material of tutorial were presented sistematically, since it consisted of background, description and example, and task/test/evaluation. The rest of students thought that the material of tutorial was not sistematic and they suggested UT to add complete steps for the example tasks.
- 3) More than 90% students wanted to countinou written tutorials, and more than 70% students wanted all courses were supported by written tutorials. The rest of students who did not want to join written tutorials caused by their limitation of time in doing their tasks.
- 4) Ten percent of students refused to pay for written tutorials' cost since this tutorials did not contribute to the final score of students. However, around 90% students were agree to pay written tutorials' cost in a range Rp 7.000 to Rp 150.000 per course.
- 5) There were some constraints which faced by students:
 - a). students were too late to receive tutorial tasks, so they were so late to answer the tasks.
 - b). time for responding inisiation was too short.
 - c). questions in tutorial tasks were too many
 - d). tutorial tasks were so hard to do for students.
 - e). no place (people) for students to ask
- 6) Students' suggestions for the future:
 - a). Students expected tutors' giving responses as soon as possible
 - b). kinds of tutorial tasks should be more varrious
 - c). tutorial tasks should have a contribution to the students' final score
 - d). material of tutorial should include all the content of modules.

2. Electronic Tutorials

a. Students' responses

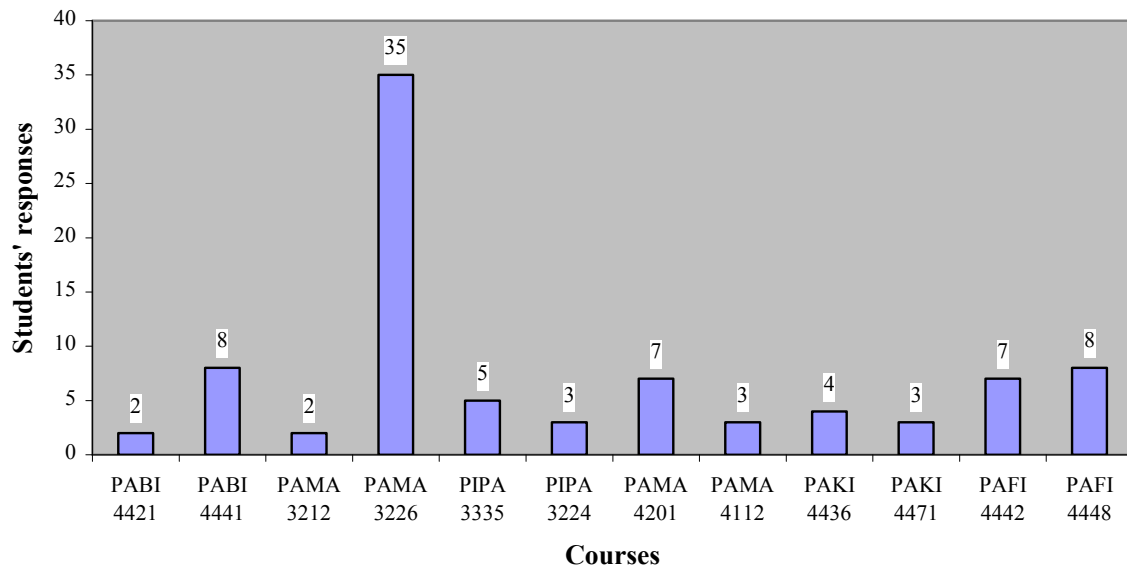
In 2002, the Department of Mathematics and Science Education (DMSE) socialized electronic tutorials for students took courses supported by this tutorials in 5 UPBJJs, those are, Jakarta, Bogor, Bandung, Palembang and Makasar. The number of students joined the training of this tutorials were 49 out of 180 students invited. The reasons of their absence were 1) the distance from their home to training place was so far e.g students needed 12 hours journey to a training place or should come by canoe, 2) there was a Regional Sport Event (PORDA) and other training in Makasar and Palembang ` DMSE's students.

Students who took training of electronic tutorials did not do well since the most never knew and operated computer before. However, they joined it enthusiastically and wanted to extend the training so they were more able to access the computers.

This tutorial was conducted eight times in a semester. Three out of eight tutorials provided tasks that consisted of objective and essay tests. Those tasks were given in the third, fifth, and seventh tutorials. Participation of students in joining electronic tutorials contributed 10% to the students final score.

The complete data of students responded to the electronic tutorials can be seen in diagram 5.

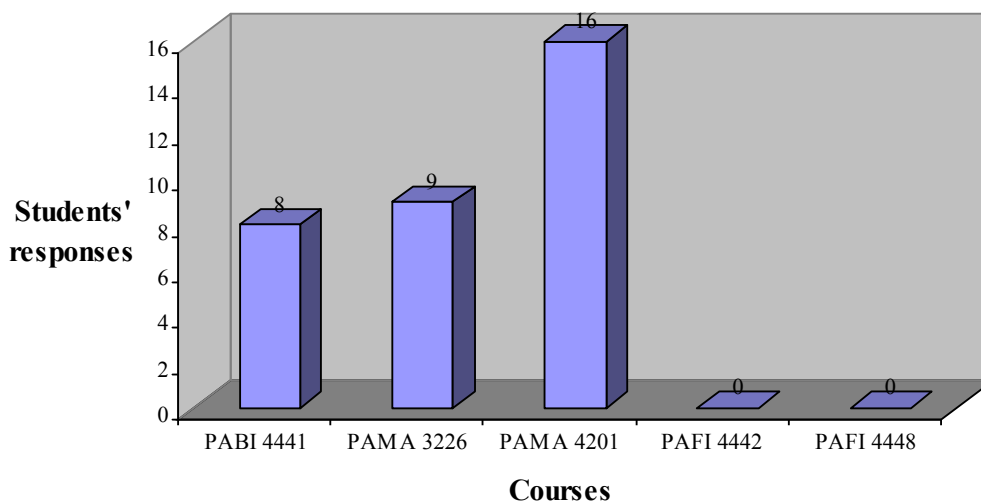
Diagram 5. The Number of Students' responses on Electronic Tutorials in 2002



The number of students' participation increased from 2001 to 2002. In 2001, only 4 students joined in 29 courses supported by electronic tutorials, then it increased to be 87 students responded for 12 courses. However, the average students only accessed 12 out of 24 times in 8 tutorials including log in, read a message and sent a message. It meant that we only reached 50% target. Besides that, most of students only read the message but not sent the message. Therefore we got difficulty to take the average score of courses supported by electronic tutorials in 2002.

In 2003, the DMSE continued the socialization of electronic tutorial by distributing leaflets to all students had not passed yet and registered the courses supported by this tutorials. The number of courses were offered to students decreased to be 5 courses. Selection of these courses based on the number of students joined this tutorial in 2002. The total number of students joined 5 courses supported by this tutorials were 34 students. The distribution of the students joined this tutorial are shown in Diagram 6.

Diagram 6. The Number of Students' responses on Electronic Tutorials in 2003



By looking at diagram 6, it was concluded that:

- 1) there was a course (Advanced Calculus) with the number of students' responses increased from 8 students in 2002 to 16 students in 2003.
- 2) There was a course (Biochemistry) with the number of students' responses was stable.
- 3) There was a course (Basic Statistics) with the number of students' responses decreased from 35 students in 2002 to 9 students in 2003.
- 4) Two courses had not been accessed by students (Digital Electronics and Introduction to Solid Physics).

In 2003, most students joined this tutorial did similar to students in 2002, only logged in and read the message. Therefore, we got difficulty to take the average score of courses supported by electronic tutorials in 2003.

b. Students' perception on Electronic Tutorials

There were some information from the questioners were fulfilled by the students participated in electronic tutorials.

- 1) Most of students (90%) were interested in joining electronic tutorials since
 - a) they got new knowledge and skill in using computer
 - b) they were able to discuss faster with the tutors eventhough they were in a distance.

The rest of students (10%) were not interested in joining this tutorials since they could not operated the computers.

- 2) The menu of electronic tutorials which was created by UT was sistematic, consisted of information, Description and Example, Classroom discussion, formatif test, tasks and other menus.
- 3) More than 90% students wanted to countinue this tutorial
- 4) Distance from students' home or school to internet kiosks was varried in range 500 m to 12 kms. The cost of computer' rent was in range Rp 4.000 to Rp 8.000 per hour.
- 5) Constraints faced b the students during this tutorials:
 - a) computer illiterate
 - b) less information about coueses supported by electronics tutorials
 - c) the distance from home to kiosk internet was far
 - d) responses' computer to internet was slow, it sometimes took 30 menit to be connected.
 - e) spent a lot of money
 - f) students did not know the way to answer and discuss tutorial tasks through UTs' website
 - g) tutor was late to respond
- 6) Recommendations for the future
 - a) most courses should be supported by electronic tutorials.
 - b) tutors should respond as soon as possible and gave appraisal of their correct answer.
 - c) socialization of electronic tutorials through regional centers had to be improved
 - d) Regional centers should provide an instructor to help students who had problems in joining electronic tutorials.
 - e) It was supposed to be networking or colaborating between UT and internet kiosks to decrease the cost of internet rent.

CONCLUSIONS and SUGGESTIONS

1. Gradual delivery tutorial scripts decreased students' responses to to written tutorials.
2. The average scores of written tutorial' tasks was varios for each course. Some average scores' coueses increased but others were decreased
3. Students' responses on electronic tutorials decreased from 2002 to 2003
4. Three tutorial scripts should be sent in the same time to the students registered for courses were supported by written tutorials.
5. There should be a course for each study programme obligating online tutorial, and
6. The socialisation has to be improved for these kinds of tutorials.

REFERENCES

Departeman Pendidikan Nasional, 2003, *Katalog Universitas Terbuka*. Jakarta: Universitas Terbuka.

Discenza, R., Howard, C., & Schenk, K., 2002, *The Design and Management of Effective Distance Learning Programs*. Herhey: Idea Group Publisng.

Ehli, S.W., Larsen, B.C. 1980, *Peer Tutoring for Individualized Instruction*. Boston: Allyn and Bacon Inc.

Richardson, J.T.E., 2000, *Researching Student Learning: Approaches to Studying in Campus-Based and Distance Education*. Bury St Edmunds, Suffolk: St. Edmundsbury Press.

Sadjati, I.M., dkk., 1999, *Program Akreditasi Tutor: Bahan Ajar*. Jakarta: PAU PPAI-UT.

Simonson, M., et al., 2003, *Teaching and Learning at a Distance: Foundations of Distance Education (second edition)*. New Jersey: Merrill Prentice Hall.

Simpson, O., 2000, *Supporting Students in Open and Distance Learning*. London: Kogan Page.

Tim Semique IV. 2002. Laporan Semique IV: *Peningkatan Kualitas Proses Pembelajaran Jurusan PMIPA FKIP-UT* (unpublish).

Tim Semique IV. 2003. Laporan Semique IV: *Peningkatan Kualitas Proses Pembelajaran Jurusan PMIPA FKIP-UT* (unpublish).