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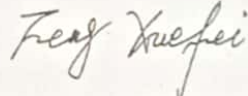
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**Managing Biological Experiments
at Universitas Terbuka, Indonesia:
A Study Case at UPBJJ Bogor**



Paper

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Managing Biological Experiments at Universitas Terbuka, Indonesia: A Study Case at UPBJJ Bogor

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Biology is a branch of Natural Science which studies living organisms and how they interact with their environment. Hence, biology is closely related to experimental activities. These experiments aim at strengthening students' understanding on the materials taught in tutorials by applying, analyzing, synthesizing, and evaluating the theories, both in laboratories and in the real world.

As an educational institution which provides distance learning programs, UT offers courses that involve experiments, such as biological experiment which is already integrated in the Bachelor Degree Program in Biology Science at the Faculty of Mathematic and Natural Sciences (known as FMIPA), and in Biology Education at the Faculty of Education (known as FKIP). While the Experiment Guide Book are developed by FMIPA and FKIP, the students of both study programs are recruited by UT's Regional Center (known as UPBJJ). UPBJJ, in addition, is also responsible for managing these experiment activities. Unfortunately, UPBJJ does not have its own laboratory facilities and instructors.

Therefore, the Biological experiments at UPBJJ Bogor (one of the 37 UT's Regional Centers) are conducted in collaboration with a partner institution, which is Universitas Pakuan (UNPAK). This collaboration offers some advantages for both side: UT would be able to carry out experiments without having to build new and costly laboratory facility; the partner institutions would enjoy some added values by interacting with more students; and the students would benefit from a richer learning experience.

So far, there is a difference in the way they collaborate with their partner. FMIPA cooperates directly with UNPAK, while FKIP collaborates indirectly with the same partner institution through UPBJJ Bogor. By evaluating and comparing the management of the two basis of the collaboration agreement, similarities and differences, in term of roles and responsibilities of the involved parties in the collaboration with the partner, were observed. Eventhough, some problems were found in the management such as a difficulty for UPBJJ to recruit a certain number of students which register same courses, or a difficulty for UNPAK to conduct certain experiment since the guide book is not designed for UNPAK facilities only, however in general, the biological experiments at UPBJJ Bogor, is able to be conducted/managed properly.



Managing Biological Experiments at Universitas Terbuka, Indonesia: A Study Case at UPBJJ Bogor

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Abstract

Biology is a branch of Natural Science which studies living organisms and how they interact with their environment. Hence, biology is closely related to experimental activities. These experiments aim at strengthening students' understanding on the materials taught in tutorials by applying, analyzing, synthesizing, and evaluating the theories, both in laboratories and in the real world.

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Universitas Terbuka (UT) is a state institution of higher education in Indonesia which uses a distance and open learning system. "Distance" means that the course

programs will not be conducted in a face-to-face manner, but rather by using media, both printed media (module) and non-printed media (audio/video, computer/internet, radio/TV). "Open" refers to the fact that the students are able to choose their own registration date, schedule of learning and examination, as well as the duration of their study. This is possible because there is no limitation in term of age, commencement date, duration of study, registration period, examination attendance, etc. The only limitation is that the students must have completed a high-school level of education. (*Katalog UT 2008:1*).

UT has four faculties, namely Faculty of Economics (FEKON), Social and Political Sciences (FISIP), Mathematics and Natural Sciences (FMIPA), and the biggest of all, Faculty of Education (FKIP). Each of the faculty offers a number of course programs. Few of these courses make it compulsory for the students to do laboratory experiments whose rules/guidance are specifically customized according to the course programs..

According to *Panduan Pelaksanaan Praktikum FKIP (2002:1)*, Laboratory is not limited to a room full of experiment tools. It can also be a repair shop, garden, forest, sea, etc, since Laboratory truly means a work place. **Romey** dalam **Sapriati, A. (2006:2)**, states that Laboratory does not only refer to the tools used in an activity, but it is actually the core of the learning process, the orientation place and center for learning. As such, experiment can be regarded as a student activity, which uses materials and tools, and which performs observation, testing, and improves the skill. This assumption is supported by **Zainuddin, M. (2005:2)**, who states that experiment is a learning strategy or a form of learning used in order to train *psychomotoric (skill)*, *cognitive (knowledge)*, and *affective (attitude)* components simultaneously in a labororium.

The labororium sessions can be either integrated inside an academic subject (*Matakuliah berpraktikum*) or a stand-alone subject by itself (*Matakuliah Praktikum*). "*Matakuliah berpraktikum*" is a subject whose final grade depends on not only the Labororium Experiments score, but also online tutorial score (if any) and Final Exam Score. Hence, the laboratory activity serves as an integrated part of the whole subject. These kinds of subjects are available in the Bachelor program's curriculum of *Communication in Farming* of FMIPA.

On the other hand, "*Matakuliah Praktikum*" is a subject whose study materials are nothing but Labororium Experiments materials. This subject is a stand-alone subject, separated from its counterpart (Theoretical Study). "*Matakuliah Praktikum*" will only be registered when the student has registered the theoretical subject which is closely related to the *Matakuliah Praktikum*. The final grade of *Matakuliah Praktikum* depends entirely on the Labororium experiments score. This final grade will not be affected by the score of the theoretical subject. In other words, Labororium Experiments score contributes 100% to the final grade of *Matakuliah Praktikum*.

Matakuliah Praktikum is compulsory for the students of Bachelor Degree Program of Biology in FMIPA and for the students of Bachelor Degree Program of Biology/Chemistry/Physics Education in FKIP. Generally, the learning process of *Matakuliah Praktikum* is different from the other subjects'. Beside its complex planning, execution and evaluation, running *Matakuliah Praktikum* definitely needs sophisticated facilities and huge expenses. Therefore, managing *Matakuliah Praktikum* is completely different from managing the other subjects. It should be managed using its own set of rules.

Suparman, A. (1996:114) reiterates that experiment is often a serious obstacle in distance education. The student has to conduct experiments at the instructional centers

or Laboratories. Even though it only takes a bit of his/her study time, the student who works would face a problem when he/she needs to perform the experiment outside his/her workplace. However, this method is not always possible to be done, since a more complex experiment would always require direct supervision from the supervisor. Another way is to have the experiment done at the normal universities. In this way, the student would be able to use the tools owned by distance education institutions itself or rented from other institutions for a certain period of time. This kind of experiment is different with the normal experiment because all the experiments for a year are concentrated into only a few days or a week.

As an education institution with distance learning system, UT has 37 region centers (*Unit Program Belajar Jarak Jauh* or shortened by UPBJJ) which spreads all over Indonesia, one of which is located in the city of Bogor. UPBJJ Bogor, in this case, is responsible for conducting laboratory sessions, beside its role as UT's information center in the Bogor area, registration counter, modules distributor, examination organizer, study group coordinator and other technical field. However, since UPBJJ-Bogor does not have its own Laboratory facilities and instructors, it has to look for partners and collaborate with other institutions which has Laboratory facilities and instructors. This partnership/collaboration offers few advantages: UT is able to conduct Laboratory experiments without having to build a new Laboratory facility which is costly; the partner institution can gain more by serving other students; the student can get a pleasant learning experience.

The collaborations that have been established so far are for Laboratory Sessions of Biology of FMIPA and for Biology/Chemistry/Physics Education of FKIP. The partner for both is the same, which is Universitas Pakuan (UNPAK), a private-owned university in Bogor. However, there is a difference in the basis of each partnership's agreement (Memorandum of Understanding or MoU). FMIPA collaborates directly with UNPAK, whereas FKIP is indirectly partnered with UNPAK through UPBJJ-Bogor.

The following is a result of a qualitative descriptive study about managing Biological experiments for students of FMIPA and FKIP in UT, especially in UPBJJ-Bogor. This study focuses on the aspect of management procedures (non-academic) and not on the academic materials aspect. It is aimed to satisfy the following questions:

1. What are the similarities/differences between managing Biological experiments in FMIPA with that in FKIP?
2. What are the obstacles/challenges in managing Biological Experiments in FMIPA and FKIP?

As such, the objective of this study is to observe the procedures/style in managing biological experiments in FMIPA and FKIP in UPBJJ-Bogor. To avoid misunderstanding, below are the explanations of few operational terms used in this study:

1. *Experiment Management*: all the activities done by the parties involved, from subject registration until the announcement of the exam result.
2. *Laboratory Instructor*: an academic practitioner who is competent to guide and to evaluate experiments' process. He/she, at least, is a Bachelor degree in relevant education background.
3. *Experiment Report*: a documentation/record of the experiment and its result, which should follow a certain format and adhere to the task requirements in main module or the guideline.

4. *Experiment Evaluation*: Final Grade of *Matakuliah Praktikum*, which is derived from Process Score and Report Score. Process Score refers to the student's performance in executing the experiment, while Report Score refers to the score given to the experiment report (a documentation/written record of the experiment and its result).
5. *Experiment Fee*: the total fee that the student has to bear. The fee includes:
 - a. Subject registration fee, based on the general guidelines stated in the catalogue
 - b. Experiment Cost. This is the amount used for tools rental, consumable materials, instructor's fee, Laboratorium rental fee, and UPBJJ administrative fee. More student means less money/cost

Literature Review

Biology (derived from the word "bios" which means life, and "logos" which means knowledge) is a branch of science which specifically studies about living beings. All lives in the universe is included as objects in the scope of biology. According to **Prawirohartono, S. (2004:37)**, a living organism studied in biology must have signs of life, such as body structure, adaptability skill, metabolism, nutrition, transport, movement, irritability, growing phase, genetic, and evolving. Living beings are very diverse, from the microscopic ones to the huge ones, from the simplest to the most complex organisms. Hence, the process in learning Biology is also varied. This learning process is closely related to Laboratorium activities, observation, research, and experiments.

Experiment has been regarded as an important component in learning Biology. It is a part of learning process which aims at testing/executing a theory in real life. In a more specific definition, experiment is a form of learning process which aims at strengthening student's understanding on a subject by applying, analyzing, synthesizing, and evaluating a theory in a Laboratory (in the form of observation and testing) and outside the Laboratorium (field survey). *Pedoman Pelaksanaan Praktikum Program Studi Biologi S-1 UT (2007:1)*

The term Experiment is generally linked to a set of procedures that needs to be done with specific tools. *Panduan Umum Praktek dan Praktikum (2003:2)* explains that experiment activity is usually performed inside a Laboratorium. Through experiments, the student is expected to understand better a certain procedure/concept in the corresponding subject.

Furthermore, in a book *Hakikat Pembelajaran MIPA dan Kiat Pembelajaran Biologi di Perguruan Tinggi. (2001:12-13)*, the writer explains that the learning method used in an experiment activity is implicitly a collaborative learning method (cooperative learning) by forming small groups of 3-5 students. Each group is asked to perform both direct and indirect observations on certain topics (complete with syllabus and schedule). This method is expected to motivate the students to learn actively, creatively, and innovatively. A compiled report from each group at the end of experiment can be used to evaluate students' understanding on the topic.

Learning biology with direct method can be done by directly observing the object of study. For example, observing the function and the structure of a cell using microscope or observing/measuring a process result such as measuring the CO₂ volume produced by a respiration process using CO₂ volumetric. Demonstration method can also be used in learning biology, i.e. using a preserves sample to discuss about the basic of cell reproduction.

Learning biology with indirect observation method is also needed to discuss certain topics, such as to use DNA modeling to discuss about chemical characteristics of Gene and to use documentary videos in the topic of Evolution.

The main objective (for students) of the experiment is stated in *Panduan Pelaksanaan Praktikum FKIP-UT (2002:1)*, which is to validate scientific/theoretical concepts. Beside that, experiment is also aimed at:

1. improving student's observation skill;
2. to trigger student's curiosity;
3. improving student's carefulness, objectivity, and honesty.

All of the objectives above would provide the student a meaningful learning experience, as has been said by *Adagium: "I listen and I forget, I observe and I remember, I do and I understand"*. This is in agreement with what **Christofi said in Sapriati, A (2006:2)** that the goal of an experiment is to develop problem solving skill and creative thinking, to widen the understanding of science (Biology) and scientific methodology, to increase scientific investigative and testing skill, to analyze the data and communicate the result, to train cooperative skill, to grow positive attitude and interest, and to build up the understanding and awareness for the environment.

Moreover, **Zainuddin, M. (2005:16)**, lists down the advantages of experiment in a learning process in details as follows:

1. Preparing the student with the necessary skills
2. Giving opportunity to the student to apply and integrate the knowledge and skill acquired earlier in the real life
3. Proving or inventing a new concept scientifically (scientific inquiry)
4. Appreciating his/her own knowledge and skill

Beside the instructional effect, Experiment will also bring other secondary positive effects, such as:

1. The student can gain an experience in team-work, especially on how to work and interact within a group
2. A student can have a stronger bond with the other student, which would result in a spirit of solidarity between students, as well as having good partnership with the lecturers/assistants.

As a system, managing experiment needs to be supported by the managerial concepts, such as planning, organization, execution, monitoring, and evaluation in a consistent and continuous manner. The procedures in managing experiment, as explained in *Pedoman Pengelolaan Praktikum (2004:10)*, refer to all activities done by the involved parties, from subject registration until the announcement of the exam result to the student. According to **Reksohadiprodjo, S. (2005:1.6)**, management involves processes in planning, organizing, directing, coordinating, and monitoring an activity in order to achieve the organization's goal effectively and efficiently. Since it can be considered as an art/knowledge/profession, management must have conceptual, humanly, and technical skills.

In managing UT's experiment activities, it is stated on MoU signed by FMIPA and UNPAK, (2003), and on MoU signed by FMIPA and UNPAK, (2003), that the role/responsibility of parties involved in the experiment management are:

1. UPBJJ : recruiting and grouping students;
2. FMIPA/FKIP : developing module and laboratory guidance;
3. UNPAK : conducting Biological experiments.

Methodology

This study is a qualitative descriptive study which is conducted in UT UPBJJ-Bogor for 6 months, from Augustus 2007 to January 2008. This duration was chosen to be able to observe the overall managing process, starting from subject registration to exam result announcement. The aspects observed were the procedures and the roles/responsibilities of the parties involved in the management of biological experiments of FMIPA and FKIP. The respondents include all the students registered for matakuliah praktikum of Biology in FMIPA and FKIP in semester 2, 2007. This is possible since the number of registered students for the subject is low (around 25 people). Furthermore, in order to further confirm the data from the students, the instructors and management people were also surveyed as respondents in this study. Data was collected through:

1. Research on the written documentation, i.e. subject module, management guidelines, and other relevant references.
2. Direct observation on the biological experiments of FMIPA and FKIP conducted at partner institution (UNPAK) and on the administration activities in UPBJJ-Bogor, Central UT, and UNPAK
3. Discussion with respondents regarding: personal details, experiment fee, experiment conduct and its challenges, administrations, and other related topics. Discussion with students was done during subject registration at UPBJJ Bogor, briefing on experiments, experiments execution/conduct, and during the exam result announcement. Discussion with the instructors was done directly face-to-face or by phone during the briefing about the experiment, experiment execution, and evaluation period. Discussion with the management people was done during preparation, publications, execution, and during result announcement.

The data collected from FMIPA and FKIP experiment management was then observed and compared. The indicator of success in managing biological experiments is whether or not all of the experiment activities are carried out. These activities start from planning, preparation, execution, evaluation, until result announcement.

The following points are the indicators of success in managing experiments:

Planning

1. Memorandum of Understanding (MoU) was signed

Preparation

2. Modules are available and easy to be implemented
3. Laboratory Experiment guideline are available
4. Socialization are done
5. Schedule is available
6. Registration Venue and fee are defined
7. Instructors meet the criteria
8. Venue for conducting experiment satisfies the criteria
9. Tools and consumables are available

Execution

10. Timing is according to the planned schedule
11. Frequencies of topics conducted are logic (don't make students tired)
12. Students and instructors' attendance is high
13. Monitoring is done
14. Instructor's skill in guiding the students is satisfy
15. Experiment's topics conducted are according to the guidelines

Evaluation

a. Reporting

16. Experiment report is received by UT Examination Centre ontime
b. Evaluation
 17. Student experiment is graded (process and report)
 18. The correct format is followed
 19. Evaluation skill is good
c. Score Management
 20. Report is according to the procedures
 21. Result Announcement is according to the Schedule (ontime)
 22. Instructor is capable

Results and Discussions

The results of the study can be shown in Table belows:

	ASPECTS	FMIPA	FKIP
Planning			
1	MoU	Was signed between FMIPA & UNPAK	Was signed between UPBJJ & UNPAK
Preparation			
2	Module	<ul style="list-style-type: none"> • Available • A small part, is difficult to be understood/implemented 	<ul style="list-style-type: none"> • Available (newly updated), • The number of experiment topics to be conducted is too many (need time)
3	Guidelines	<ul style="list-style-type: none"> • Available, created in 2007 	<ul style="list-style-type: none"> • Available, created in 2002 • Topic title, consumables are not fit to the content of module
4	Socialization	<ul style="list-style-type: none"> • Conducted at UPBJJ with FMIPA's initiative • It's about cost, schedule, and technical things • Attended by UPBJJ, FMIPA, UNPAK, 29 students 	<ul style="list-style-type: none"> • Conducted at UPBJJ with UPBJJ's initiative • It'a about cost, schedule, and technical things • Attended by UPBJJ, FKIP, UNPAK, 27 students
5	Schedule	<ul style="list-style-type: none"> • Arranged together by UPBJJ, FMIPA, UNPAK, students 	<ul style="list-style-type: none"> • Arranged together by UPBJJ, FKIP, UNPAK, students
6	Registration	<ul style="list-style-type: none"> • At UPBJJ • Rp. 20.000,- /Academic Unit • UPBJJ gets difficulty to fulfill a requirement on the number of students (minimum 8 people) 	<ul style="list-style-type: none"> • At UPBJJ • Rp.35.000,-/Acad. Unit • UPBJJ gets difficulty to fulfill a requirement on the number of students (10 people)
7	Instrutors' Criteria	Adhere to the guideline	Adhere to the guideline
8	Experiment's Venue	Satisfy the criteria	Satisfy the criteria
9	Tools and Consumables	<ul style="list-style-type: none"> • Available upon request • A small part is not available since the guideline is not drafted for UNPAK facilities 	Available upon request

		only	
Execution			
10	Experiment fee	• Rp.161.000,- - Rp.231.000,-	• Rp. 270.000,-
11	Timing	<ul style="list-style-type: none"> • According to schedule • Conducted not on work days (Sat/Sun/Holiday) 	<ul style="list-style-type: none"> • Some schedule amendments have been observed as there was a big occasion in the city • conducted not on work days.
12	Frequencies	<ul style="list-style-type: none"> • 3 full-days (each consist of 2 sessions) • 11 topics conducted 	<ul style="list-style-type: none"> • 4 full-days (each consist of 2 sessions) • 18 topics conducted
13	Students and instructors' attendance	<ul style="list-style-type: none"> • 100 % • Students are not only from UPBJJ Bogor, but also from UPBJJ Jakarta, and Serang 	<ul style="list-style-type: none"> • 100% • Students are from UPBJJ Bogor and Jakarta. They need information about places to sleep since their home are far from UNPAK
14	Monitoring	Done by UPBJJ and FMIPA	Done by UPBJJ only
15	Instuctor's skill	Satisfy	Satisfy
16	Experiment's Topics	<ul style="list-style-type: none"> • Consists of 5 kinds of biology courses e.g.: Taxonomy, Vertebrate etc. • 6 experiments each course • Certain experiment is difficult to be conducted as the tools are not available, but the experiment is still able to be done by <i>modificating its procedure</i> • There is field survey experiment • Some students need tutorial especially on the students who have no biological background 	<ul style="list-style-type: none"> • Consists of 1 kind of biology course • 18 experiments • The guideline cannot be implemented as the module content is not fit to the guideline. • There is not a field survey experiment.
Evaluation			
<i>a. Reporting</i>			
17	Experiment Report	Received by UT Examination Centre ontime	Received by UT Examination Centre in a little bit late
<i>b. Evaluation</i>			
18	Student experiment evaluation	Experiment process is evaluated by UNPAK's instructors, while experiment report is evaluated by FMIPA	Both process and report are evaluated by UNPAK
19	Report Format	Correct	Correct
20	Evaluation Skill	Good	Good
<i>c. Score Management</i>			
21	Result Announcement	Ontime or according to the procedures	A little bit late

22	Instructor	Capable	Capable
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Conclusions

Based on the study above, few conclusions can be drawn as follows:

1. There are two versions of Biological experiment management at UT UPBJJ-Bogor: the version for FMIPA students and the version for FKIP students;
2. In general, biological experiment at UT UPBJJ-Bogor in semester 2 of 2007, in both versions, is able to be conducted/managed properly, in terms of students grade/score can be announced in time. However, there are some aspects to be paid attention e.g.: FKIP experiment guideline that is not fit anymore to the module, FMIPA student education background that is not relevant to biology aspects, .the difficulty for UPBJJ to recruit a certain number of students who register the same course, the limitation of UNPAK to conduct all experiments required as in module,

Suggestions

Realize that it is not easy to manage biological experiment in a proper way, it is hoped that the proper management that is already exists at UT UPBJJ-Bogor is able to be maintained.

In order to increase the biological experiment management at UT UPBJJ- Bogor, it is also recommended for FKIP to update its experiment guideline in order to fit to its module. For FMIPA, it is logically to separate students who doesn't have enough biological background and give them some biology introduction. Moreover, For UPBJJ, it is needed to look for a creative way to recruit more students to fulfill the minimum requirement of the number of students who will join experiment activities. In addition, for better student services, UPBJJ should prepares information places to stay near UNPAK and its route/transportation. Then, it is hoped for UNPAK to create alternative experiment if the tools or consumables are limited, but still relevant with the module content. At last, students are hopefully having good motivation to join biological experiment and take its advantages from the activities.

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