

# SYSTEM REQUIREMENT IN VIEW OF USERS AND PROCESS FOR CONTENT MANAGEMENT AND ACADEMIC SUPPORT SYSTEM FOR COMPUTER LABORATORY (CASE STUDY: SOFTWARE LABORATORY CENTER BINUS UNIVERSITY)

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## ABSTRACT

*The system for Laboratory Information will take focus on determining the need for information systems related to the management, content development and academic management in the laboratory. These processes will focus on understanding the need and system requirement for a laboratory information system that focus on content management and the way to design a process to make sure the continuation of content creation can be done. With the design of the laboratory information system is expected to serve as a sample in the development of similar application for the course in general. The methodology to be used is to use the study of literature, design, and testing of laboratory information systems.*

**Keywords:** Information System, content management system, academic development

## ABSTRAK

*Sistem Informasi Laboratorium berfokus untuk menyusun kebutuhan akan sistem informasi terkait pengelolaan, pengembangan konten dan manajemen akademik pada laboratorium. Proses ini akan berfokus pada pemahaman kebutuhan dan persyaratan sistem untuk merancang sistem informasi laboratorium yang berfokus pada manajemen konten dan bagaimana cara merancang proses untuk memastikan kelanjutan dari pembuatan konten yang dapat dilakukan. Dengan adanya perancangan sistem informasi laboratorium diharapkan dapat dijadikan contoh atau sample dalam pengembangan aplikasi serupa untuk program studi secara umum. Metodologi yang akan digunakan adalah menggunakan studi literatur, perancangan, dan uji coba sistem informasi laboratorium.*

**Kata kunci:** Sistem Informasi, Sistem Pengelolaan Konten, Pengembangan Akademik

# INTRODUCTION

## Overview

Laboratory plays an important role in the academic progress and development of the content in university. Most of the improvement or the quality of the academic level is based on the research and the content development in the laboratory. The need for good management of Laboratory and focusing on developing a qualified and sustainable information system will ensure the long run of the lab and the university. Some laboratory sometimes traps with the focus on providing and maintain tools and assets of the lab which they assume as the main thing and the main investment of the lab itself. The focus in maintaining the tools is also to make sure that the teaching process of the lab will run well.

Despite the importance of maintaining tools, another important thing that should come into account is the management of the academic process of the lab session. Lab is the cycle of education, and have to ensure and responsible for knowledge creation and maintenance. The lab had to ensure the level of 'up-to-date' of the content and the 'relevancy' of the delivered knowledge to students. Many successful universities are proven to be supported by the strong level of laboratory to support the content as the basic for the research and development of the learning subject. To make sure the usefulness of laboratory and the role required to support the appropriate academic level, an academic information system that take control all the process and take the content management needed have to be build and well maintain for all laboratory.

This paper will focus on understanding the process that exist and have to be maintained in the view of academic for laboratory management. The process ranged from the assignment to create the lab material/case, subject evaluation, group discussion and research for subject creation or update, and also the process for collection, management and dissemination of the academic content and rule. The understanding also includes the forms, pattern or the step required for academic developments that are commonly used. The feedback from students can also be a part of process in improving the quality of content and process. Later on after the basic understanding of the processes have been done, the next step is developing the technical aspect and the technical design of the required system to make sure all the gathered process and data can be covered. The basic template of application will then be developed and implemented in Software Laboratory Center, BINUS University as the basic sample of requirement and implementation.

## Research Object

Software Laboratory Center (SLC) in BINUS University is a services center that serves the department in BINUS related to laboratory session using computer. From academic view this activity focus on preparing and teaching material related to programming, using software for business or other related things based on the designed curriculum. As the biggest laboratory in BINUS, SLC also function as the center for preparing the system and application to support the laboratory session in all laboratories in BINUS (14 laboratories in total). The huge line of services could become a valid sample in designing the appropriate system.

## Problem Identification

This paper is based on the core problem identification described below: (1) No reference standard for operational management in term of academic in university laboratory. (2) No reference for content management and maintaining the 'up-to-date' level for university laboratory that able to cover the industry requirement for a laboratory practice. (3) Requirement for knowledge management standard as integrated part of content management to ensure the quality of teaching and learning in laboratory.

## **Outcome and Benefit**

This paper will be a series that focus on creating and designing the standard for Laboratory in term of academic and content management. This is the first part that will focus on: (1) Understanding the academic aspect related to academic that need to be capture in a laboratory. (2) Understanding the factor related to academic that will be used as the basic of system requirement and design. This basic information will later on be used to design the detail system and build the prototype to be implemented.

## **METHOD**

Methodology will refer to standardize concept of SDLC – System Development Life Cycle. This part of paper will focus on understanding the basic process of the required system and the user requirement for the basic system. The basic understanding and design of the specific concept will refer to the principle from “Higher Education: Students at the Heart of the system (Secretary of State for Business, Innovation and Skills - Scotland, Wales and Northern Ireland), which consist of several view: (1) Sustainable and fair funding. (2) Well-informed students driving teaching excellence. (3) A better student experience and better-qualified graduates. (4) Adverse and responsive sector. (5) Improved social mobility through fairer access. (6) A new, fit-for-purpose regulatory framework

## **Principle of Process Requirement**

Satzinger et al. (2007), stated that the information system is a collection of interrelated components that collect, process, store, and provide output information needed to complete business tasks. Completing business tasks typically is a "problem" that has been discussed previously. Mcleod & Schell (2007) stated that management information system-MIS is defined as a computer-based system that make information available to users who have similar needs. The output information generated will be used by the parties to solve the problem (be it managers or professionals) to make decisions in order to solve the company's problems.

Management Information System is a collection of human and capital resources in an organization that is responsible for collecting and processing data to produce information that is useful for all levels of management in planning and controlling activities (Harianto, 2008; Paulsen, 2006; Looi, 2008). Academic Information System is an information system that was built and designed on an existing network at the university are used to assist in the administration and academic operations. In the current technological developments, technology is not only a system of information but the main medium of learning (Pradhana, 2012).

Menurut Kaplan-Leiserson, LCMS is a software application that allows actors to organize both academic and administrative processes of governance processes of academic content. Closely associated with the Content Management System (CMS). Choder (2011) describes about Laboratory Information System (LIS) Standard required to include some basic issue: (1) Flexibility – In a broader sense, the LIS needs to be able to accommodate a number of different laboratory types, institutional structure, interfaces for both instrumentation and electronic records. An off-the-shelf system is not designed for this, in most cases. (2) Scalability – Scalability refers to the ability for an LIS to adapt to a growing laboratory or to start with a single laboratory division or business unit and expand it into the entire laboratory or laboratory system, as well as to adapt to changes in technology. (3) Granularity – A one-size-fits-all LIS will have limited use by a typical laboratory or laboratory network because of the complexities of workflow and individual laboratory needs. If the system itself cannot be customized for its customers’ specific needs, it at least should provide individual modules for each

laboratory unit's general needs. (4) Interfaces – More effective laboratory information systems (LIS) can streamline workflow, integrate multiple laboratory specialties, including non-clinical laboratory components, and have the flexibility to grow with the technology for both the LIS and laboratory testing. In addition, these systems need to be customizable, be able to effectively and easily interface with both the institution's electronic record, the laboratory's instrumentation, and provide Web-based access.

Refer to standard described by Choder (2011), the requirement from the view of each user and the principle of requirement in the system is listed as follow: (1) Integrated – The system that will be developed should cover all laboratories in one single application. The system will let the management able to view and control all process and result in the laboratory. There will also integration between lab for area that could be centralize to cut repeated process into single centralize unit. (2) Single access of system – The application will be designed to cover all the process that have to be done by the staff and faculty member, so that all only have to access in one single application (portal). This will increase the level of utilization of the application and all the benefit will give greater impact. Users do not have to remember to many site or application and do not have the tendency to focus in using some/several application only. The integration also covers other related application like the operation area of laboratory or integrated into students or lecturer portal for other non laboratory academic. (3) Standardize – In creating the system and mechanism the system should consider about scalability, and resulting the need for standardization in Content and marking. In Laboratory will have several variations of teaching material, exam question, project question, and all these contents required to be standardize. The academic staff have a create a reference to all the assigned staff / teaching assistant the required or the level of difficulties to make sure everything is at the same level.

This standardization also required in marking standard. In allocating the marker for grading, we cannot always assign to one person for one kind of evaluation to make it standardize. Sometimes we are facing one item like exam was held at the same time, and required several staff to be assigned for marking. The academic staff must have a detail template and standard for marking to make sure all students will be graded at the same level. (1) Knowledge Management – The key successful in content development is the continuation of research and content. It will be easier in developing one content even if it was a totally new technology with a complete and detail reference as a sample content. The continuation of a subject will be maintain and kept up-to-date with a good knowledge management system. (2) Collaboration and Communication – The system should also make it possible for collaboration and communication. In preparing the teaching material, even an expert will need a reference and discussion with other expert about the content. The teaching assistant will need to know the subject matter expert and need to be able to keep in touch for discussion. The communication during the process like approval, idea generation, communicate the problem, communicate the unwritten standard, etc will guide to a much higher quality for the content.

The need for employee yellow pages and a mechanism for discussion like forum or other online system (like messaging) should be embedded. The system also need the automation mechanism for delivering the messages of evaluation of task like the comment or revising request regarding the project case or comment and revised regarding the marking should also be covered in the system. The communication will run as a living reference and knowledge later on.

## **RESULT AND DISCUSSION**

According to Paulsen (2006), Jigsaw model is a model to guide in indication the system requirement like Content Creation Tools, Learning Management System, Student Management System, and Accounting System to support academic system in academic institution (see figure 1).

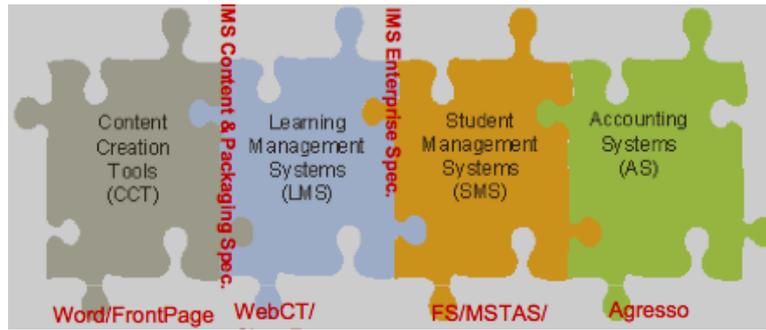


Figure 1 Jigsaw Model for Integrated Learning

As for further discussion for each component in the Jigsaw Model, Content Creation Tool is a system that used the Jigsaw model to help the governance of content creation course or the lecturer in charge. Content Creation Tool includes the manufacture of such learning materials to be delivered to students (presentation, documents, video, animation, simulation, etc.). Later Content Creation Tool will be divided by 2, Authoring Tools supporting tools focus more on the learning content creation and Assessment Tools more focus on students as a matter of academic assessment, multiple choice quizzes and exercises.

Learning Content Management System (Hall, 2005) is an environment where developers can create, store, make use again, organize, and deliver learning content. Educational institutions are expected to implement a Learning Content Management System, is an educational institution that has a lot of learning content with a variety of subjects and different formats. Learning Management System includes, among others, the management of learning, student data storage, storing catalogs of courses, academic data storage, and store data from students (grades and answers). The complete functionality of the LMS, including Authoring, Classroom Management, Competency management, Knowledge management, certification or compliance training and Personalization.

Student Management System is one of the most important component in the educational institutions. This system is used to regulate entities such as students, faculty, courses, application, administration, examination and student grades. Effectiveness of Student Management System will determine how performance rather than an educational institution. Accounting System is a system used in academic institutions to record transactions between the consumer and the supplier. In the academic context, the most important customers are students and faculty. The data in the Accounting System, which is very necessary to know the students who still do not pay tuition, online payment, online course registration and tuition payment. (Kaplan-Leiserson, 2000)

The basic information and system for every type of user in the system are collected and will be used as the basic for designing the system later on. The requirement will consider from the view of the users and from the view of the process. Here is the description from the view of the users.

## Students

Students would require: (1) Access to learning material like course outline, online resources, video tutorial, hands on lab, references, etc. (2) Access to laboratory standard (that they have to fulfill to pass the grade) like project question, assignment, marking system and standard. (3) Cover all the process regarding the academic like assignment collection, project submit, group project forming. (4) Access to Supporting material to cover teaching and learning process like software required, guidelines to install and calibrate for tools and software, standard rule and procedure, standard health and safety for laboratory session or other supporting document.

## **Teaching Assistant**

All the teaching assistants have the same access and requirement with the students in term of the need to access the learning material, laboratory standard and supporting material, but with the purpose of better preparation and better understanding to inform to all students. Some additional and differ in process are: (1) Cover all information regarding the academic for teaching assistant like: qualification in teaching (including qualification gap personally), teaching standard, reference material for teaching, teaching session management plan, template document for marking, reviewing and other information related to teaching guide. (2) The process regarding the teaching assistant like the report of teaching progress, see the assignment regarding material preparation, marking or project case, submit the task / assignment to students, collect the result from students, standard marking process, submit the task that was assigned like marking or case material for reviewing. (3) Get the progress or result of the teaching. The teaching assistant should get the progresses that have been done by the students, student marking result or some feedback and evaluation about the teaching method and process. This information will be used to adjust the teaching style in each class to ensure better understanding and also as a review for a better process in the future time.

## **Lecturers**

There will be two types of lecturers: (1) The lecturer that responsible in all teaching process. The teaching assistant will take role to support / help for technical things with the students and the lecturer will take all the teaching and learning process. In this case, the role of lecturers will be identical like the teaching assistant as was described above. (2) For many cases, the theory and the laboratory session is separated into different credit. The teaching assistant will take role in laboratory teaching and will take the system requirement function as mention above. In this case the role of the lecturers is to control and manage the function that have been created and run by teaching assistant. In system function basically the lecturer role will have the same requirement like teaching assistant but focusing on managing and controlling the delivery standard of teaching assistant and to understand the level of achievement of students, so the lecturers will be able to adjust the teaching level.

## **Academic Staff**

The main role of academic staff is to prepare all the material and standard to be used in teaching and learning process. The staff will have the access to all data that is mention above as a reference to evaluate and to prepare for the next with some additional and focus in creating (in process). (1) Access to data relating the projected class for the next semester as the basic to calculate the need and requirement for materials to be prepared. (2) Processes to guide in determining the material that need to be developed refer to database or current content in databank. This including the calculation number of course outline (new subject or update), online resources, video tutorial, hands-on lab, project case question, assignment.

The process continues to assignment of teaching assistant or subject matter expert to develop the material needed. The assignment could be done by the academic team or could be taken care by the operational team (based on the organization structure or the job description of the team). The system is expected also in the process of submission and communication to finalize the system, such as: (1) Process to discuss and get the approval of all content and standard from the department (or the lecturer) regarding the laboratory session. Department always have lecturers or subject specialist that was assigned to review and evaluate the content (sometimes the laboratory itself has a full time lecturer that take the quality control). (2) Process to allocate all the teaching material to be used in each classes and process to transfer (or upload) all the approved content to be used. (3) Process to guide for marking starting from assigning teaching assistant for marking process (use qualification standard as reference), creating and brief for marking standard and passing level and then monitor and control the process to make sure all the required standard is fulfilled.

## **Other Laboratory Staff (Operational staff, Database Administrator, Network Administrator, etc)**

Operational staff will need the information about the qualification of the subject and the list of teaching assistant that have fulfilled the qualification. Some case, there are an equaling level for certain subject that use the same technology (only the naming or the code is different). This information will be used to allocate the teaching assistant for teaching and marking in each class. Network administrator and technical support need to have access to requirement standard, software and tools that have to be prepared for the subject. They have to be aware and prepare the room to be allocated for certain subject has the required tools, equipment, software and other things. They need this information in detail like the version of software, certain tools (like mobile phone for IOS Class) or other specific information. This information will be provided by academic staff during the preparation of the subject. Database administrator will need to collect all the data to deliver all the information to external party. They will have to transfer the information like: marking and grading for each students, creating the report required for management, preparing the student result for each department for approval, etc.

## **Management**

The management will have certain required report for controlling and decision making. The reports and controlling that they required normally about the readiness of laboratory preparation and the outcome of the laboratory session, such as: (1) Up-to-date and real time status of all material preparation or creation. They will be able to see number of assigned task, the deadline and numbers that have been done and submit. (2) The student's achievement of the laboratory session to maintain weather it is still in line with the graduate competency level and in line with the target achievement of each students.

## **Process View of Requirement**

In replacing a legacy system in laboratory, some consideration should take into account: (1) Determination of new business rules. (2) Application and testing. (3) Mapping legacy data. (4) Performing data transfer. (5) Testing and validating transfer. (6) Publishing legacy data (Choder, 2011).

Choder (2011) also explain that Laboratories need information systems that are more powerful and sophisticated than the previous generation of Laboratory Information Systems (LIS). They need informatics solutions that provide flexible management capability—Laboratory Information Management Systems (LIMS). An effective LIMS can and should serve as the central nervous system of the lab, responsible for: (1) Sample Identification—barcode labeling, specimen attribute validation. (2) Work Scheduling—test initiation and assignment. (3) Data Acquisition—automated or manual entry of results generated by analytical instruments. (4) Data Analysis—calculations, reference ranges, statistical analysis, and QC. (5) Reporting—analytical test results, management summaries, ad hoc reporting, and data extracts. (6) Lab Management—Sample /job tracking, invoicing, SOP's, QA/QC, training, certification, and compliance. (7) Automation Support—data and process integration, bidirectional interfacing, electronic transport

The other view of understanding the system is from the view of process. In every process, actors will take different role and function. The process view will help in seeing the complete flow of an automation process and easier in mapping the data.

## **Preparation of Course Outline**

The department will maintain the overall curriculum to ensure the achievement of graduate competency. In every subject that was assigned there will be the theory / concept and the area for laboratory. The department will have a detail requirement and will assign a subject matter expert (SME) for each subject creating for Theory or for laboratory. The SME should communicate with the laboratory about the projected content in terms of: number of session, topics in every session, tools or equipment required for each session (can the laboratory provide it) and also the detail technology and skills required. The academic staff will use the course outline and the detail to determine the skill level for teaching assistant, and also the standard for teaching material.

The outcome is the detail course outline, which contain: (1) The teaching purposes – instructional design. (2) Number of lab session and the teaching subject for every session. (3) Tools and equipment to be used. (4) Technology and level of skills for every sessions. (5) Teaching qualification.

## **Qualification Management and Control**

Laboratory will have a recruitment system in which the minimum requirement of new recruiter is set from the academic view. After they are recruited, the process of training and developing will take part to ensure they could cover the qualification required in each subject they will teach. In this case the academic system will required a mechanism to ensure the management and control of the qualification. The system will contain: (1) Qualification catalog: group of skills and the detail skills that is created as reference in creating the qualification. There are possibility of some subject will refer to the same qualification standard, or some qualification is a general one that will be used by many subject. (2) Qualification for each subject (refer to qualification catalog). (3) Employee yellow pages that describes area (based on qualification catalog) that they have fulfilled. (4) Report on qualification gap. There must be a clear differentiation between one qualification that one teaching assistant cannot fulfill (permanently) and some that they not yet qualified (but possible to be qualified). (5) Projection report on number of minimum and average of required staff for each qualification and a report to determine the gap number so the preparation of training or certain certification for fulfilling the number could take consider.

## **Preparation of Teaching Material (Case, Problem Question, Project Question)**

The system required a mechanism to: (1) Get the projection number of class and the projection number of required teaching material. (2) Get the view of the qualified staff or teaching assistant to be assigned. (3) The allocation on teaching material development assignment. The system should also consider number of assignment to every person, the deadline, and the time frame to do the assignment. (4) Approval of the assigned task to subject coordinator or SME or the department. (5) Distribution (uploading) the approved contents.

## **Teaching and Learning process**

The system required the mechanism to control the teaching process. The system should ensure the teaching assistant reports all the teaching conducted session by session, task that have been given or control other process during teaching and learning.

## **Marking Process**

The system required a mechanism to: (1) Get the projection number of class and type of evaluation to be used as the data for allocating the grader. (2) Get the view of the qualified staff or teaching assistant to be assigned for marking. (3) The allocation on marking assignment. The system should also consider number of assignment, number of students in the class, difficulties level of

marking in the subject and the time frame to do the assignment. (4) Approval of the marking to subject coordinator or SME or the department. (5) Submit to Database administrator for further process.

### **Feedback and evaluation**

The system should cover the process of feedback and evaluation. This process can include students, teaching assistant, SME or even industry to see and review the content. The review is to maintain and keep all the content and process is still in line with the industry and with technology update. Things that need to be review and feedback like: (1) The course outline. (2) The hands on Lab, video tutorial or other supporting item. (3) Teaching methodology and teaching plan. (4) Quality of teaching assistant. (5) Software and other tools and equipment level. (6) Process and all the procedure.

## **CONCLUSION**

The requirement in creating the content management and academic support system will need a detail view from the users as the main player. The detail including the system needed in every step and activity that the users involved. This detail will give a very good view in the design of the portal for every single users to make sure a user friendly and maximum use of the system. The view of system in process will help to see the trigger of every process and the continuation of stepping in the process. This will be a good guide in developing the automation process for every step in the development of content and academic standard. The complete functionality of the LMS, including Authoring, Classroom Management, Competency management, Knowledge management, certification or compliance training and Personalization.

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