Development of information technology assisted learning for improving the quality of learning in product design

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ABSTRACT: Information technology plays an important role in the global world. The information technology has an effect on almost every sector including in education sector. This paper presents an overview of learning method in product design that is currently performed in Manufacturing Engineering at University of Surabaya and discusses about the development of information technology assisted learning for improving the quality of learning in product design. In the information technology assisted learning, the learning method evolves from classical learning to problem-based learning using information technology e.g. Computer, LCD, Intranet, and Internet. By implementing information technology assisted learning, students are driven to learn mostly by themselves and lecturer is functioned only as a facilitator.

1 INTRODUCTION

Manufacturing is the transformation of raw materials into finished goods for sale. Manufacturing encompasses the design of the product, the selection of raw materials, and the sequence of processes through which the product will be manufactured (Kalpakjian, 2001). Instead of that definition, some industries, like semiconductor and steel manufacturer use the term 'fabrication' to define manufacturing. In the process, manufacturing engineers often create simulations of the operation of objects, as well as the manufacturing processes to be used, in order to optimize performance, cost effectiveness, and energy efficiencies, before settling on a particular design.

University of Surabaya is one that offers undergraduate programme in manufacturing engineering. The programme related with product design and development, beginning in idea, design concept, and realized into a product through manufacturing processes. The aim of the programme is to prepare professionals that give their contribution to manufacturing industries sector by providing its students with competencies in product design and development, manufacturing process design and optimization, and manufacturing system design and operation. The graduate students from Manufacturing Engineering at University of Surabaya can involve in product design and development, manufacturing processes design, improvement effort of productivity, quality control, or other related field of work. Some of them have already got a good careers in all walks of life particularly in manufacturing industry such as chief of work shop at jewelry industry, area manager at accessories of automobile industry, manager at spare part of

automobile industry, staff of production department at house ware industry, product designer at paper industry, etc.

There are two specific areas of expertise in Manufacturing Engineering at University of Surabaya, which are Product Design and Manufacturing Technology and Management. Product Design area is focused on how to design product based on concepts, function, aesthetic, usability and ergonomics. The main courses in Product Design area in curriculum 2005 are Engineering Mechanics, Engineering Drawings, Engineering Drawing Projects, Strength of Materials, Computer Aided Design, Ergonomics, Machine Elements I, Machine Elements II, Mechanism Design and Analysis, Product Design and Development, Manufactured Product Analysis, and Design Project. Except for last two courses, the courses are conducted in classical or lecture-based method. Meanwhile, the last two courses are conducted in form of project-based course.

Learning in design has its own characteristics, which are not the same as learning in other subjects because a certain level of various kinds of skills is required in designing a product. To be able in designing a product, there are some required skills, which are creativity and innovation development, analysis and problem solving, oral and written presentation, working in teamwork, and using design tools. These skills cannot be learned effectively by using classical methods, therefore there is a need to develop another method in product design learning.

2 EVALUATION OF CURRENT LEARNING PROCESS

The current method in conducting most design courses, which has been implemented since 2000, is classical method. In this classical method, lecturer is functioned as a source of information and student mostly learn from the lecturer. In this method, the learning is mostly performed in one direction and the initiative of students is minimum.

Based on the feedback from students, which are collected each semester, there is a drive from students to change the learning method in product design. The reasons, why the change in required, are limited number of relevant text book and other literatures in design topics, poor delivery method that is applied in design learning, lack of used visual aids, and poor relation between design theory and practice. The learning method, which is considered to be applied in product design, is problem-based learning using the aids of information technology. It is expected that by performing information technology assisted problem-based learning, the problems above will be eliminated and the quality of the learning will increase.

To develop the information technology assisted learning in product design, a certain analysis related to the current condition of Manufacturing Engineering at University of Surabaya is required. The used analysis in development of the information technology assisted product design learning is SWOT analysis. The results of the analysis can be seen in Figure 1 below.

Strength	Weakness
• Implemented curriculum is well defined and relevant to the industrial needs • Good availability of lecturers and laboratory technicians to help the students • Adequate student-lecturer ratio • Lecturer has high level of relevant knowledge • Sufficient physical facilities (office building, class room, laboratory) • Internet facilities are available • Computers with network system are available	• Limited number of computer for students • Low academic quality of students input • Low English capability of lecturer and student • Limited knowledge in information technology of lecturer • Limited experience in the use of IT base learning • Limited number of IT-based learning aids
Opportunity	**Threat**
• Development of IT- based design tools • Development of the application of IT in education	• Tendency to resist changes • Poor student's motivation

Figure 1. SWOT analysis results

The SWOT analysis describes about the strengths that are possessed, the weaknesses that have to be reduced, the opportunities, and the threats. Based on the analysis results, manufacturing engineering at University of Surabaya proposed some grants, which are aimed to support the development of the information technology assisted learning in product design. A few of the proposals had been accepted and the fund is used to perform some supporting activities.

3 INFORMATION TECHNOLOGY IN LEARNING

According to *Wilkipedia The free Encyclopedia, information technology (IT)* or information and communication technology (ICT) is the technology required for information processing. In particular the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information from anywhere, anytime.

There are some papers that present the use of information technology in learning. (Parikh, 2002) develops two fully operational education support systems based on the framework for courses, which require extensive and intermediate interactions among students and course instructor. (Short, 2002) presents how information technology is used in veterinary education. (Leung, 2002) presents how information technology is used to teach nurse and other health professional to deliver a quality care to their patients.

The use of information technology has some effects on the learning process. (Jeroen, 2004) concludes that the use of information and communication technology will be an added value for information problem solving in resource-based learning, for collaboration using external representations and tools, and for simulation in learning environments for competence based learning and discovery learning. Based on (Boone, 2001), the use of information technology has some positive effects on learning in

professional service organizations. Meanwhile, (Green, 2004) presents the effect on learner satisfaction of introducing a technology-enabled problem-based learning approach into a health informatics curriculum

4 DEVELOPMENT OF INFORMATION TECHNOLOGY ASSISTED LEARNING

Although some weaknesses and threats may hinder the effective use of information technology in design learning, there are some strengths and some potential opportunities can be used in manufacturing engineering at University of Surabaya. In the information technology assisted learning, the learning method evolves from classical learning to problem-based learning using information technology e.g. Computer, LCD, Intranet, and Internet. The example of activities in developed information technology assisted learning are the use of PowerPoint presentation to present the steps of design process, the use of Video Clips and Animation to show of the design process and its results, the design tutorial using interactive CD, and the virtual design analysis using CAD/CAM systems.

By implementing information technology assisted learning, the wide and open resources of study material are available so the students will not depend only on hard materials such as books. In addition, the delivery method of the course changes from classical to more interactive methods and the course is full of visual aids. Moreover, students are able to apply the design principles or theory to the design practice by using certain analysis and simulation softwares. At the end, students are driven to learn mostly by themselves and lecturer is functioned only as a facilitator.

Until now, the information technology assisted learning is developed and applied in one course, which is in Machine Elements course. The number of courses, which use the developed information technology assisted learning, will be increased step by step. By performing and evaluating the use of the information technology assisted learning step by step, it is expected that the implementation of this learning method will continuously improved.

In development of information technology assisted learning in Machine Elements course, PowerPoint presentation is used to present some commonly used of machine elements and how to analyse those machine elements. To show students about the application of those machine elements, a movie contains the application of machine elements in industry is made and then shown to students. Some animations about the effects of force to certain material are made and presented to students by using Computer Aided Engineering software. In addition, visual aids are built especially in power transmission. After that, Internet is used to find a newest technology in machine elements.

The developed information technology assisted learning in this course has not been completely evaluated. Based on the evaluation results, the developed information technology assisted learning will be analysed by using SWOT analysis and then the learning process will be improved.

5 CONCLUDING REMARKS

The information technology plays an important role in the global world. The information technology has an effect on almost every sector including in education sector. For that reason, students should be introduced to the use of information

technology. Manufacturing Engineering decides to develop and apply the information technology assisted learning in some of the design courses. It is expected that the quality of learning especially in design learning will improve and at the same time students will be prepared to adapt quickly to the use of information technology in their work environment.

In the future, students should not only be introduced to information technology but also be introduced to information and communication technology. Although at this moment, the security issue is still considered but in the future collaboration between or among students or engineer is a common way to work.

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PROCEEDINGS

6th AUAP General Conference

Higher Education Leadership:

Strategic Relevance for Asia-Pacific Communities

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PREFACE

On 4-8 September 2005, the University of Surabaya together with the Indonesian Rectors Forum hosted the 6th Association of Universities of Asia and the Pacific (AUAP) General Conference. The event took place in Surabaya and was organized in conjunction with the 10th AUAP Anniversary. The General Conference was held at the Sheraton Surabaya Hotel and Towers and the 10th AUAP Anniversary was celebrated at the Mandarin Hotel.

The AUAP General Conference is held bi-annually. The continuation of this AUAP tradition took the theme "Higher Education Leadership: Strategic Relevance for Asia-Pacific Communities." The rationale behind the theme selection is that diversity and uniqueness of the nature, value, and other characteristics of Asia-Pacific countries and communities should be explored and taken into account in creating strategies for higher education systems. Higher education institutions require a resilient leadership to define appropriate and tough strategies. Leadership becomes increasingly important as the competitiveness of the organization is mainly built on the competence of the leaders in properly creating and implementing the strategies. Building an excellent strategy requires mastermind so that larger groups of people with various inspiring ideas could be involved.

Growth of demand for higher education to provide high quality education should be proactively responded. In the midst of massive change due to globalization, Asia-Pacific universities should deliberately think about repositioning their existence. In many countries, the credibility and standing of universities are increasingly subject to question since all too often, the process and product of higher education lack of relevance to encounter the need of communities, particularly the diverse and unique Asia-Pacific.

In response to these challenges, AUAP and the University of Surabaya worked together to hold a program addressing the issues related to the strategic relevance for Asia-Pacific communities. This program was aimed at gaining various ideas and perspectives to better solve problems and improve the quality of the higher education systems. Furthermore, a medium for alliances and networking of institutions was established in this forum, so that institutions could hand-in-hand achieve the end-goal, the increase of prosperity of Asia-Pacific nations.

The forum presented three sub-themes: *developing regional needs-based curriculum*, *supporting communities through innovative learning processes*, and *enhancing the effectiveness of Asia-*

Pacific higher institutions networking. Each sub-theme produced numerous interesting discussions during the event, of which the full papers can be read in this proceedings. We wish for the proceedings to be fruitful and able to provide insights for the readers, particularly those interested in the central theme on leadership and strategic relevance for higher education institutions in Asia-Pacific.

Surabaya, September 2005

Eric Wibisono
Chair, Steering Committee
6th AUAP General Conference

Acknowledgments

We are truly indebted to our invited plenary speakers for their willingness to share their expertise and experience before the conference audience. It is partly from their contribution that this conference turns to big success. We would like in this opportunity to thank those people:

Di Yerbury

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Learning Center Manager, Nokia Asia Pacific

Ng Wun Jern

National University of Singapore, Singapore

Porntip Kanjananiyot

Fulbright Thailand, Thailand

Mohd. Salleh Mohd. Yasin

Universiti Kebangsaan Malaysia, Malaysia

Opening Speech

Wibisono Hardjopranoto

Rector, University of Surabaya

President, Indonesian Rectors Forum

President, Association of Universities of Asia and the Pacific (AUAP)

6th AUAP General Conference

Higher Education Leadership:

Strategic Relevance for Asia Pacific Communities

Distinguished Guests, Ladies and Gentlemen:

It is my great pleasure to welcome all of you to Surabaya and to the opening session of the 6th Association of Universities of Asia and the Pacific (AUAP) General Conference on the theme "Higher Education Leadership: Strategic Relevance for Asia Pacific Communities." It is also a great honour for the University of Surabaya to host this event in collaboration with the Indonesian Rectors Forum.

The purpose of the 6th AUAP General Conference is to gather various ideas and perspectives to respond the challenges and opportunities in order to build higher education leadership and its strategic relevance for Asia-Pacific communities.

Higher Education in Asia Pacific should reposition their existence as they have different characteristics and uniqueness as well as different needs and opportunities. To face this challenge, it is important to conduct a sharing forum in order to learn each other's capacity related to this issue. Therefore we are here now to fulfill this need and work hand-in-hand to be more creative in finding solution that is more relevant to us as Asia Pacific nations.

The important issues that need to be addressed in this forum are: *Developing Regional Needs-Based Curriculum*, *Supporting Communities through Innovative Learning Processes*, and *Enhancing the Effectiveness of Asia-Pacific Higher Institutions Networking*.

In similar vein, the Indonesian Rectors Forum also portrays the theme as an essential issue, where Higher Education in Indonesia must also be involved and give their thoughts and perspectives as part of the Asia-Pacific communities, to improve the quality of Higher Education system. Indonesian Rectors Forum as a forum of university's leaders believes by working together, the goal of taking higher education to have more competitive advantage in the global village could be achieved. Education is what will determine the future well-being of individuals and of nations. Therefore the advancement of a nation strongly relies on how well higher education performs and contributes to the benefits of the society.

Many scholars and practitioners from Asia-Pacific region today come to this conference. Moreover, experts outside Asia-Pacific region such as Europe, America and many others also come to this conference to share their ideas and perspectives. I deeply appreciate all thoughts and efforts contributed to the success of this conference.

International discussion allows us to make our contribution to the major world-wide issues related to the higher education as well as to establish our place among the nations of the world. The substance of the various session of this conference and the expertise of the presenters and other participants will provide us with excellent opportunities both to give and receive from the international dialogue. I believe by the end of our conference we will be able to identify benefits of our work together that will apply individually and collectively to educational systems of all countries participated in this conference. I wish for you to continue your endeavour during the conference.

Once again, let me welcome you to the 6th AUAP General Conference. I look forward to learning your discussion and deliberations. And I wish for you an enjoyable and productive stay in our beautiful capital city, Surabaya.

Thank you and best wishes.

Wibisono Hardjopranoto
Surabaya, 06 September 2005