UNIVERSITI PUTRA MALAYSIA

CONCEPTUALISING CHANGE ON THE WWW: CAPTURING THE CONSTRUCTIVIST APPROACH IN WEB-BASED LEARNING AMONG ENGINEERING LECTURERS

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By

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Thesis Submitted in Fulfilment of the Requirement for the Degree of Doctor of Philosophy in the Graduate School Universiti Putra Malaysia

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DEDICATION

This thesis is dedicated to the memory of my father, Guan Seng Yew.

"This moment has come ... Patience makes all hardships light."

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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MARCH 2003

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The Information and Communication technology such as the WWW presents itself as a medium for channelling creative and collaborative learning. The extraordinary growth of the WWW necessitates engineering educators to look into their pedagogic approach to capture the ever-expanding knowledge and technological advancement in their area of expertise.

This study attempts to look into the various factors related to the adoption of the WWW and the way the constructivist approach is related to the adoption of the WWW. The target population for this study are engineering lecturers from Polytechnics in Malaysia. Stratified sampling is applied to ensure that representative samples from the respective engineering departments are obtained in this study, namely the Civil Engineering, the Mechanical Engineering and the Electrical Engineering Department. The sampling size

for this study was 500 engineering lecturers and the selection was based on the table of random numbers. The researcher visited all Polytechnics in Malaysia to conduct the questionnaire research except Sabah and Sarawak. The response rate for this study was 75.6%.

The findings indicated that the four major factors namely organisational, technological, human, and training factors were significantly related with the adoption of the WWW. The human factor had the highest correlation coefficient value with the adoption model ($r = 0.560$, $p < 0.05$) whereas the organisation factor had the lowest correlation value with the adoption model ($r = 0.469$, $p < 0.05$) among the variables investigated. The other factors that had shown significant relationship with the adoption of the WWW were the technological factor ($r = 0.541$, $p < 0.05$) and training factor ($r = 0.511$, $p < 0.05$). Further multiple linear regression analysis showed that these four factors contributed about 50% of the explained variance of the adoption of the WWW.

The adoption of the WWW was also significantly related to the constructivist approach ($r = 0.591$, $p < 0.05$), and a correlation analysis indicated that it explained 35% variance of the dependent variable i.e. the constructivist approach. This study has resulted in the formulation of a multi-dimensional model of all the variables under this study linking the various factors influencing the adoption of the WWW in relation with the constructivist approach.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

MENGKONSEPSIKAN PERUBAHAN DALAM WWW: MENCAPAI PENDEKATAN KONSTRUKTIVIS DALAM PEMBELAJARAN BERDASARKAN WEB DIKALANGAN PENSYARAH-PENSYARAH KEJURUTERAAN

Oleh

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Teknologi Maklumat dan Komunikasi seperti WWW merupakan suatu media untuk menyalurkan pembelajaran kreatif dan kolaboratif. Pertumbuhan pesat WWW memerlukan pensyarah kejuruteraan untuk melihat ke dalam pendekatan pedagogi mereka dalam pencapaian ilmu pengetahuan yang sentiasa berkembang dan kemajuan teknikal dalam bidang kepakaran mereka.

Kajian ini cuba melihat beberapa faktor yang berkaitan dengan adopsi WWW and cara pendekatan konstruktivis itu berkait dengan adopsi WWW. Populasi sasaran untuk kajian ini ialah pensyarah kejuruteraan di Politeknik Malaysia. Kaedah persampelan berlapis digunakan untuk memastikan bahawa setiap persampelan dapat mewakili setiap jabatan kejuruteraan dalam kajian ini seperti Jabatan Kejuruteraan Awam, Jabatan

Kejuruteraan Mekanikal dan Jabatan Kejuruteraan Elektrik. Saiz persampelan untuk kajian ini ialah 500 pensyarah kejuruteraan and pemilihan adalah berdasarkan kepada Jadual Nombor Rawak. Pengkaji membuat lawatan ke semua Politeknik di Malaysia untuk melaksanakan kajian soal-selidik ini kecuali di Sabah dan Sarawak. Kadar respon untuk kajian ini ialah 75.6%

Dapatan menunjukkan bahawa empat faktor yang utama iaitu faktor organisasi, teknologi, kemanusiaan dan latihan mempunyai kaitan signifikan terhadap adopsi WWW. Faktor kemanusiaan mempunyai nilai korelasi yang paling tinggi dengan model adopsi ($\underline{r}$ = 0.560, $\underline{p}$ < 0.05) manakala faktor organisasi mempunyai nilai korelasi yang paling rendah dengan model adopsi ($\underline{r}$ = 0.469, $\underline{p}$ < 0.05) jika dibandingkan dengan faktor-faktor lain yang dikaji. Faktor-faktor lain yang menunjukkan korelasi signifikan dengan adopsi WWW ialah faktor teknologi ($\underline{r}$ = 0.541, $\underline{p}$ < 0.05) dan faktor latihan ($\underline{r}$ = 0.511, $\underline{p}$ < 0.05). Analisis regresi linear selanjutnya menunjukkan bahawa keempat-empat faktor ini menyumbangkan lebih kurang 50% daripada varian terhadap adopsi WWW.

Adopsi WWW juga berkait secara signifikan terhadap pendekatan konstruktivis ($\underline{r}$ = 0.591, $\underline{p}$ < 0.05), dan analisis korelasi menunjukkan bahawa ia menerangkan 35% varian pembolehubah bersandar iaitu pendekatan konstruktivis. Kajian ini juga menghasilkan suatu model pelbagai dimensi untuk semua pembolehubah di bawah kajian ini, yang mengaitkan semua faktor-faktor yang mempengaruhi adopsi WWW dan menghubunginya dengan pendekatan konstruktivis.

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CHAPTER I

INTRODUCTION

Background of the Study

The emergence of Information and Communication Technology (ICT) especially the Internet and World Wide Web-based learning has fundamentally changed the ways education are organised and managed. As a matter of fact, the undeniable constant in education in modern society is change. Today, the educational system is geared towards fulfilling the societal needs in information technology and production. In its drive to equip the schools with computer technology, the Ministry of Education of Malaysia is embarking on a smart school programme for 90 schools nationwide (Zoraini, 1998). These are the learning institutions that are equipped with modern tools and computers which will prepare the school children for the information age. The era of information explosion and revolution has necessitated the transformation of educational settings in schools into creating skills and knowledge necessary for the masses to use tools and computers for production and information access.

We need to capitalise the change evolving around us especially in the area of ICT . The modern world is so overwhelmed with information that effective education today mandates change. Fundamental changes in society restructure our lives and create new demands and expectations on the role of schools. Alluding to the fact that ICT is

available here, Malaysians are generally falling behind due to their inexperience because we are not thinking hard enough on the needs, demands and conditions needed to incorporate technology into our educational system (Chooi, 1999). All these demands and others compel the school to innovate and reform its programmes. Adopting the latest technology is seen as a prerequisite for the advancement and improvement of the society at large (Tengku Shahrom, 1996). Technology has gained its importance in extending human potential and cannot be left alone to develop by chance. On the contrary, schools are expected to play a major role in helping people to understand technology and cultivate the skills and knowledge needed. Before that mission can be accomplished, teachers are expected to be early technology adopters, to equip themselves with the information technology needed to be at par with the technological development.

The Information and Communication technology (ICT) especially with the introduction of internet has revolutionised the way lessons are being conducted by teachers. The World Wide Web usage in computer presents some phenomena that students can interact and learn through interactive method by investigation and query with the programme. The internet allows learners to experience a different mode of learning which is individualised and self-accessed, that demands learner's willingness to change (Jamalleah, 1996). Tengku Shahrom (1996) advocated that the use of technology can dramatically raise knowledge levels of students, help them to learn problem-solving techniques, develop skills required to manage massive amount of information and analyse concepts from different perspectives. In short, teachers who adopted this innovative teaching-learning approaches using ICT, enable their students acquired life-long learning

skills and productive employment. Already the education system is putting interactive ICT at the core of teaching-learning and management process. Smart schools are being set up where learning will be dynamic, lively and brimming with interaction through the use of multimedia technology and worldwide networking (Ministry of Education, 2000b). A high-tech infrastructure for information technology at the various universities is already providing access to strategic information, international databases and knowledge resources. Most of the universities around the country have a digital optic fibre backbone, and several of them have already incorporated distance learning programmes for professional and technical degrees. As Datuk Sri Mohd Najib, former Minister of Education aptly described;

> *Smart schools are being planned.... not only to meet the requirements of Multimedia Super Corridor (MSC), but also to create a new generation of Malaysians who are more creative and innovative in their thinking, adept with new technology, and able to access and manage completely the information technology* (Zoraini, 1998).

Coupled with the needs of the society at large for trained, skilled and knowledge workers in industrial sectors, smart schools in Malaysia are moving as preparatory sites for future knowledge workers (Zoraini, 1998). In the 80's, the needs of the society continued to change and exerted pressure on the schools to adopt changes within the realm of the society. Secondary schools in Malaysia must therefore understand change and school administrators must be prepared to adopt these changes in accordance with the societal demand. It is important to look carefully at how teachers learn to use technology, for they are quite clearly the change agent to transforming the teaching and learning in the

classroom. The changes have shifted the traditional industrial arts programme into technology education.

> *The pace of change today is measured by.... instantaneous transmission of data, including voice, graphics, and text, across the public telephone network. These kinds of technologies have become commonplace in the business community, but remain almost revolutionary in the world of education* (Ameritech, 1992, p.2).

In accordance with Ameritech's views, a market-sensitive education system is evolving here in Malaysia. Our schools and universities are taking up the challenge of globalisation by changing not only the content of curriculum and programmes but more importantly the delivery systems. ICT-enhanced teaching and learning are already making computers in schools, distance learning, video conferencing and internet link common place especially in tertiary education. We have to race ahead to achieve a significant transformation of our educational infrastructure in order to meet the next millennium as a technologically competent and scientifically adept society. We must break through the barrier between what is happening outside the classroom and inside the classroom. Schools need to give learners access to the internet technology that is driving the world and we need to plan for such change (Tengku Shahrom, 1996).

Our education structures need the necessary technological edge to enable the building of a pool of well-educated, highly skilled and strongly motivated professionals. The nation's human capital is its most important economic and development resource. Thus, a sense of

urgency is needed to establish Malaysia as a fully industrialised country in the 21st century.

According to Najib (1998), the government is facilitating change and seeking innovative approaches to expand the education base. Strategies for growth and development of education in the Seventh Malaysia Plan which include a Malaysia Inc. approach in education is making it possible for the private sector to meet the needs for tertiary education by offering degree, diploma and certificate level courses.

Technological literacy is the primary claim of adherents of technology education. All Polytechnic graduates ought to be technologically literate, meaning that they can understand the nature of technology, appropriately use techno-logical devices and processes, and participate in society's decisions on technology issues. To ensure the inculcation of technological literacy, a need was identified for educational programmes 'where learners become engaged in critical thinking'.

ICT Needs

The need to provide students with an evolved understanding and ability to think critically about both the old and new technological issues should be the driving force behind the introduction of new methodology and instruction. The ICT through the computer, then provides a valuable channel for teachers to present this form of learning (Berson, 1996). Through the use of ICT programmes, students engage in a greater amount of