

**LEARNING OBJECTS IN ASSISTING NOVICE
PROGRAMMERS**

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**Master of Science Information Technology (IT)
UNIVERSITI UTARA MALAYSIA**

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**A thesis submitted to the Graduate School in partial fulfillment of the
requirement for the degree Master of Science (Information Technology),
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**By
Suriana Ismail**

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ABSTRAK

Mengajar subjek pengenalan pengaturcaraan komputer bagi semester satu dengan jaya adalah amat kritikal. Di MIIT-UNIKL, keputusan peperiksaan akhir bagi tahun 2005 jelas menunjukkan bahawa subjek pengenalan pengaturcaraan komputer (Fundamentals of Programming) mendapat markah purata yang paling rendah. Ianya juga turut menjadi subjek yang paling ramai gagal jika dibandingkan dengan subjek lain. Kajian ini bertujuan untuk membangunkan prototaip 'learning objects' sebagai alat bantuan bagi memudahkan pengaturcara baru memahami konsep pengaturcaraan dengan lebih cepat. Dua jenis prototaip 'learning objects' telah dibangunkan bagi kajian ini. Sekumpulan mahasiswa semester satu telah dipilih dan dibahagikan kepada dua kumpulan iaitu 'tested' dan 'control'. Hanya kumpulan 'tested' mencuba dan menggunakan 'learning objects' dan terlibat dalam sesi soal selidik. Kedua-dua kumpulan telah terlibat dalam sesi menjawab soalan kuiz. Hasil analisa secara keseluruhannya, mendapati kumpulan 'tested' telah mendapat keputusan yang lebih baik daripada kumpulan 'control'. Berdasarkan dapatan kajian ini, 'learning objects' sesuai digunakan dalam pengajaran dan pembelajaran untuk pengaturcara baru bagi meningkatkan lagi prestasi keputusan mereka

ABSTRACT

It is always a challenge to teach first year computer programming subject. At MIT-UNIKL, final exam result 2005 shows that introductory programming subject (Fundamentals of Programming) has the lowest average marks. It also contributes to the highest number of failure among other subjects. This study aims to develop learning objects prototype as an aided tools to help novice computer student in understanding programming concept better. Two learning objects prototype were developed. Semester one students were selected and divided into tested and control groups. The tested group evaluated the learning objects and involved in questionnaire session. Both groups involved in quiz session. The findings show that tested group has a higher passing rate as compared to the control group. Thus, it is believed that the learning objects can used as aided tools towards better performance of novice programmers.

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CHAPTER 1

INTRODUCTION

This chapter intention is to give a background to the project as well as stating the project objective. The first section describes the problems of learning programming at the early stage of programming study. The second section describes the difficulties face by novice programmers in understanding the concept of programming. Later, method to achieve all objectives and the findings are also discussed. Finally, a conclusion part is presented. In this project, the researcher seeks to build prototypes that help and guide novice programmers to understand programming concept better.

The contents of
the thesis is for
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REFERENCES

- Allison, I., Powell, H. & Paul, O. (2002). A Virtual Learning Environment for Introductory Programming. *Proceedings of 3rd Annual Conference of the Learning and Teaching Support Network for Information and Computing Science*, Loughborough, United Kingdom.
- Ásrún Matthíasdóttir (2004). Learning Objects in a Multimedia Interactive Environment. The Codewitz Project. *International Conference on Computer Systems and Technologies – CompSysTech*.
- Azinah Md Zain(2005). Problem Analysis for Novice Programmer. Unpublished Thesis: MSc (SE) Universiti Malaya
- Booch, G., Jacobson, I., & Rumbaugh, J. (2001). *The unified modeling language user guide*. Addison-Wesley: Boston.
- Bradley, C. & Boyle, T. (2004). Students' Use of Learning Objects. Retrieved May 15, 2006, from <http://imej.wfu.edu/articles/2004/2/01/index.asp>
- Carter, J. & Boyle, R. (2002). Teaching Delivery Issues- Lessons from Computer Science. *Journal of Information Technology Education*. Vol.1 No.2 Retrieved June 7,2006, from <http://jite.org/documents/Vol1/vln2p077-089.pdf>.
- Chalk, P., Boyle, T., Pickard, P., Bradley, C., Ray, J and Ken, F. (2003). Improving Pass Rates in Introductory Programming. *Proceedings of 4th Annual Conference of the Learning and Teaching Support Network for Information and Computing Science*, Galway, Ireland.
- CodeWitz (2004). <http://www.codewitz.net>

Cohen, E. B. & Nycz, M. (2006). Learning Objects and E-Learning: an Informing Science Perspective. *Interdisciplinary Journal of Knowledge and Learning Objects*. Vol. 2 No. 2, Retrieved June 7, 2006, from <http://ijklo.org/Volume2/v2p023-034Cohen32.pdf>.

Dave W. F. & Stubbs, G. (2003). Learning to Learn?- A Report on a Longitudinal Study of the Learning Styles of Computing Undergraduates. Retrieved September 16, 2006, from http://www.ics.ltsn.ac.uk/pub/conf2003/dave_farthing.htm

Jacobson, I., Booch, G., & Rumbaugh, J. (1999). *The Unified Software Development Process*, Reading, MA: Addison-Wesley, ACM Press.

Jenkins, T. (2002). On the Difficulty of Learning to Program. *3rd Annual Conference of the LTSN-ICS*, Loughborough, United Kingdom.

Jenkins, T. & Davy, J. (2001). Diversity and Motivation in Introductory Programming. Retrieved May 9, 2006, from <http://www.ics.ltsn.ac.uk/pub/italics/issue1/tjenkins/003.html>

Jones, R. (2006). Designing Adaptable Learning Resources with Learning Object Patterns. Retrieved May 9, 2006, from <http://jodi.tamu.edu/Articles/v06/i01/Jones>

Hodgins, H.W. (1994). The future of learning objects. In D.A. Wiley (Ed.). *The Instructional Use of Learning Objects*: <http://reusability.org/read/chapters/hodgins.doc>

Larkin, T. & Budny, D. (2005). Learning Styles in the Classroom: Approaches to Enhance Student Motivation and Learning. Information Technology Based Higher Education and Training. ITHET 6th Annual International Conference.

LOM (2006). Retrieved on May 9, 2006 from

http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf

London Metropolitan University (2002). <http://londonmet.edu.uk>

Malaspina University College (2006). Retrieved October 30, 2006, from

http://www.malaonline.ca/oldt/our_process.html

Polsani, P. (2003). Use and Abuse of Reusable Learning Objects. *Journal of Digital Information*. Vol. 3, No. 4, Article No. 164, <http://jodi.tamu.edu/Article/v03/i04/Polsani/>

Rohiza Ahmad, Shuib Basri, Asliza Sarlan and Haslinda Abu Hassan(2005). *First Programming Course: Perception and Performance of Students*. Unpublished Thesis : MSc(SE) Universiti Teknologi Petronas.

Sekaran, U. (2003). Research Methods For Business: A Skill Building Approach, John Wiley & Sons, Inc.

Universiti Kuala Lumpur – MIIT(2005). *Universiti Kuala Lumpur – MIIT(Final Examination Results)*. Kuala Lumpur, Malaysia.

Wiley, D.A. (2001). *Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy*. In D.A.Wiley (Ed). *The Instructional Use of Learning Objects*:<http://reusability.org/read/chapters/wiley.doc>

Wiley, D. A. (2002). Learning Objects. Retrieved May 9, 2006, from <http://wiley.ed.usu.edu/docs/encyc.pdf>

Wishart J. (2003). *A Comparison of Preferred Learning Styles, Approaches and Methods between Information Science and Computing Science Undergraduates*. Retrieved May 20, 2006, from <http://www.ics.headacademy.ac.uk/italics/Vol4-2/lspapaerwishartv2.htm>