

Integrating Evaluation into Development of Knowledge-Based System for Adaptive E-learning System

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Thesis submitted in fulfilment of the requirements for
the degree of

Doctor of Philosophy

under the supervision of Professor Ghassan Beydoun

University of Technology Sydney
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April 2020

CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Alva Hendi Muhammad declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Information System & Modelling at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

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Date: 14 April 2020

ACKNOWLEDGEMENT

I would like to express my sincere appreciation to my supervisor, Professor Ghassan Beydoun, for his academic guidance and personal support during my PhD journey. His continued support and patience have encouraged me to complete this thesis. I would also like to thank Professor Iwona Miliszewska from the University of Technology Sydney and Associate Professor Jun Shen from the University of Wollongong, for their support.

I would also express my sincere appreciation to my love, Wirdasari, for her constant and continued support and patience during my journey. My special thanks go to my girls Azkadina and Zivana who have always cheered me and restored my energy. Special thanks also to my boy Ghaza, who was born in Australia during my third year of PhD. I always pray that one day, you all can pursue your study in Australia. I am grateful to my sister, Ayu, for her continuous support. This thesis is dedicated to my beloved father and mother, who always prayed for me and supported me in my PhD journey.

I welcome this opportunity to thank my friends, neighbours and colleagues in Wollongong and Sydney, who have provided me so many memories to share together. In particular, I would like to thank LPDP families from the first generation to the fifth generation: Alfiah, Arya, Anggun, Sujadi, Adit, Mahmud, Giri; PPIA family: Dudi, Karfi, Zul, Wira; and also ICMI warriors: Widhi, Joe, Dhimas, Zulya, Aan.

My gratitude is also extended to the financial assistance provided by the Indonesian Endowment Fund for Education (LPDP), Ministry of Finance Indonesia and the University of Technology Sydney towards the completion of this thesis.

PUBLICATIONS

Muhammad, A., Zhou, Q., Beydoun, G., Xu, D. and Shen, J., 2016, May. Learning path adaptation in online learning systems. In *2016 IEEE 20th International Conference on Computer Supported Cooperative Work in Design (CSCWD)* (pp. 421-426). IEEE.

Muhammad, A., Shen, J., Beydoun, G. and Xu, D., 2016, July. SBAR: A framework to support learning path adaptation in mobile learning. In *International Conference on Frontier Computing* (pp. 655-665). Springer, Singapore.

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ABSTRACT

One of the main obstacles in knowledge-based systems, particularly in the field of evaluation, is to determine when the development of a knowledge base is complete with valid knowledge available to use. Ironically, this question is not easy to answer, since it involves many aspects in the lifecycle of knowledge-based systems. Some efforts have been introduced in literature, although none have been widely used or even agreed upon. In our investigation, we found that it is possible to provide a ready to use knowledge base without a separate testing phase. This thesis examines the way in which the testing phase could be integrated into the development phase through a statistical monitoring task during the knowledge acquisition process. This research tailored the dynamic evaluation framework and utilised the RDR technology as an incremental knowledge acquisition methodology, with additional statistical analysis to monitor the development of the knowledge base.

Using this framework, this thesis presents INCAES, an incremental adaptive e-learning system. The knowledge base was developed incrementally for suggesting learning contents to students. The recommendation was provided by analysing the learner model as a representation of the students in adaptive learning. However, a systematic understanding of attributes of learners is still lacking in the field of adaptive learning, since those attributes are regularly changed and updated. Thus, we keep track by investigating the potential learner's attributes that could be adapted to the adaptive system from a number of recent works.

The evaluation of the theoretical concept has been conducted using two real world case studies. The first case study was applied on the Web Programming subject, while the second case study was applied on the Networking Essentials subject. The test cases generated from learners' attributes and values were used to evaluate the knowledge base. Different scenarios were provided for the case study. The first scenario dealt with stopping the progress of the knowledge acquisition process at an early stage, while the

second scenario dealt with stopping it at a later stage. Following the knowledge base construction, two steps of testing were conducted to measure the performance of the initial knowledge base and the subsequent test set. The results have shown that the framework allows for the rapid development of a knowledge base with valid knowledge inside.